МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ

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ИНОСТРАННЫЙ ЯЗЫК

АНГЛИЙСКИЙ ЯЗЫК

Рекомендовано Редсоветом университета
в качестве учебного пособия для студентов,
обучающихся по направлению подготовки 08.03.01 Строительство

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Пособие представляет собой систематический курс обучения английскому языку.

Ориентировано на совершенствование и дальнейшее самостоятельное развитие знаний, умений и навыков по английскому языку в различных видах коммуникации и чтение оригинальной литературы на английском языке. Структура пособия предусматривает преемственность аудиторной и самостоятельной работы студентов по иностранному языку.

Учебное пособие подготовлено на кафедре иностранных языков и предназначено для студентов направления подготовки 08.03.01 Строительство, при изучении дисциплины «Иностранный язык».

ПРЕДИСЛОВИЕ

Данное учебное пособие предназначено для студентов, обучающихся по направлению подготовки 08.03.01 Строительство по уровню бакалавриата.

Основной целью данного пособия является формирование общекультурных и общепрофессиональных компетенций студентов по английскому языку в различных видах речевой коммуникации, что даёт возможность:

1) з н а т ь английский язык на уровне профессионального общения и письменного перевода;

2) у м е т ь читать оригинальную литературу на английском языке в соответствующей отрасли знаний; оформлять извлечённую из англоязычных источников информацию в виде перевода и резюме;

3) в л а д е т ь коммуникацией на английском языке в устной и письменной формах для решения задач межличностного и межкультурного взаимодействия.

При работе над лексикой учитывается специфика лексических средств по направлению подготовки студента (бакалавра), многозначность служебных и общенаучных слов, механизмы словообразования (в том числе терминов и интернациональных слов), явления синонимии и омонимии.

ВВЕДЕНИЕ

Изучение иностранных языков является необходимой и неотъемлемой составной частью общеобразовательной профессиональной подготовки научных и научно-педагогических кадров. Это обусловлено интернационализацией научного общения, развитием сотрудничества специалистов и ученых на глобальном уровне и расширением сферы научного дискурса в современной коммуникации. Знание иностранного языка облегчает доступ к научной информации, использование ресурсов Интернета, помогает налаживанию международных научных контактов и расширяет возможности повышения профессионального уровня ученого.

В связи с процессами глобализации усиливаются интеграционные тенденции в науке, культуре и образовании, что повышает роль иностранного языка как посредника всех интеграционных процессов. Именно язык воплощает единство процессов общения, познания и становления личности. В этих условиях цели и задачи изучения языка сближаются с целями и задачами профессиональной подготовки и становления студента-бакалавра как будущего ученого, т.е. язык постигается одновременно и вместе с наукой как форма, в которую облекается научное знание в соответствии с условиями научного общения. Современное понимание науки как дискурсивной практики требует при изучении языка приоритетного знания структур и стратегий научного дискурса, форм и средств коммуникации, а также умения ими оперировать. Курс изучения иностранного языка носит, таким образом, профессионально-ориентированный и коммуникативный характер. Его целевая разработка обусловлена необходимостью модернизации отечественного образования и конкретизации его содержания на каждом уровне обучения иностранным языкам.

Целью данного пособия является обучение английскому языку как средству межкультурного, межличностного и профессионального общения в различных сферах научной деятельности.

В процессе достижения этой цели реализуются коммуникативные, когнитивные и развивающие задачи.

Коммуникативные задачи включают обучение следующим практическим умениям и навыкам:

- свободного чтения оригинальной литературы соответствующей отрасли знаний на иностранном языке;
- оформления извлеченной из иностранных источников информации в виде перевода, реферата, аннотации;
- устного общения в монологической и диалогической форме по специальности и общественно-политическим вопросам (доклад, сообщение,

презентация, беседа за круглым столом, дискуссия, подведение итогов и т.п.);

- письменного научного общения на темы, связанные с научной работой аспиранта (научная статья, тезисы, перевод, реферирование и аннотирование);
- различения видов и жанров справочной и научной литературы;
- использования этикетных форм научного общения.

Когнитивные (познавательные) задачи включают приобретение следующих знаний и навыков:

- развития рациональных способов мышления: умения производить различные логические операции (анализ, синтез, установление причинно-следственных связей, аргументирование, обобщение и вывод, комментирование);
- формулирования цели, планирования и достижения результатов в научной деятельности на иностранном языке.

Развивающие задачи включают:

- способность четко и ясно излагать свою точку зрения по проблеме на иностранном языке;
- способность понимать и ценить чужую точку зрения по научной проблеме, стремиться к сотрудничеству, достижению согласия, выработке общей позиции в условиях различия взглядов и убеждений;
- готовность к различным формам и видам международного сотрудничества (совместный проект, гранд, конференция, конгресс, симпозиум, семинар, совещание и др.), а также к освоению достижений науки в странах изучаемого языка;
- способность выявлять и сопоставлять социокультурные особенности подготовки студентов-бакалавров в стране и за рубежом, достижения и уровень исследований крупных научных центров по избранной специальности.

Формы контроля уровня знаний студентов-бакалавров включают:

1. Текущий контроль осуществляется на каждом занятии проверкой выполнения домашних заданий (чтение, перевод, аннотирование и реферирование текстов, выполнение заданий);

2. Промежуточный контроль включает доклады и презентации и проверку терминологических глоссариев;

3. Итоговый контроль состоит из двух этапов. Первый этап – подготовка письменного перевода текста по специальности в объеме 2000 п.з., второй этап – сдача экзамена.

Экзамен по иностранному языку включает в себя следующие три задания:

1. Письменный перевод научного текста по специальности. Объём текста – 2500–3000 печатных знаков. Время выполнения работы – 45–60 минут.

2. Беглое (просмотровое) чтение оригинального текста (газетной статьи) по специальности. Объём – 1000–1500 печатных знаков. Время выполнения – 2–3 минуты. Форма проверки – передача извлечённой информации на иностранном языке.

3. Беседа с экзаменаторами на иностранном языке по вопросам, связанным со специальностью и научной работой студента-бакалавра.

На экзамене студент-бакалавр должен продемонстрировать умение пользоваться иностранным языком как средством профессионального общения в научной сфере.

PART I

UNIT I
TOWN PLANNING AND TOWN DEVELOPMENT

1. *Give Russian equivalents to the following English words.*

Activity, master, individual, to absorb, distance, functional, central, part, traditional, social, industrial, topography, position, cultural, active, circulation, public, diagram, structure, communications, interest, to reconstruct, to adapt, control, natural, zone, to fix, organic, to modify

2. *Match words from A with their translations from B.*

A	B
1) description	a) полный
2) purpose	b) основной
3) freedom	c) свобода
4) development	d) изменять
5) to exist	e) движение
6) society	f) развитие; расширение
7) recent	g) окружать
8) needs	h) нужды
9) to accept	i) описание
10) to define	j) цель
11) to connect	k) определять
12) complete	l) создание
13) movement	m) осуществлять
14) to change	n) приспособляться
15) main	o) общество
16) to adapt	p) 16) соединять
17) creation	q) 17) принимать
18) to surround	r) 18) недавний

3. *Read and learn the following words.*

development застройка
design проектировать
environment окружающая среда, окрестность; зд. окружающая местность
dwelling жилой дом
forecast прогноз

pollution	загрязнение
master plan	генеральный план застройки
survey	обследование
flexible	гибкий
suburbs	пригород, окрестности; *зд.* районы
congestion	перенаселенность, скопление
housing	жилищное строительство
pattern	образец
recreation	отдых
define	определять

4. Read the text. Say in what paragraphs the definition of a master plan is given.

Town Planning

(1) That cities should have a plan is now admitted in our time of large-scale construction and plan-making has become an everyday activity. The purpose of a town plan is to give the greatest possible freedom to the individual. It does this by controlling development in such a way that it will, take place in the interests of the whole population.

(2) The new development absorbs or modifies an existing environment, and so before it can be designed it is necessary to find out about that environment. It is also necessary to do research of the trends of population growth, the distance from work to home, the preferences for different types of dwelling, the amount of sunshine in rooms, the degree of atmospheric pollution and so on. After the survey is complete a forecast of future development is made in the form of a map, or series of maps: the master plan or development plan. As no one can be certain when the development is to take place and since a society is an organic thing, with life and movement, the plan of a city must be flexible so that it may extend and renew its dwellings, reconstruct its working places, complete its communications and avoid congestion in every part.

(3) The plan is never a complete and fixed thing, but rather one that is continually being adapted to the changing needs of the community for whom it is designed. Until quite recent years town plans were always made as inflexible patterns, but history has shown that a plan of this description inevitably breaks down in time.(4) The flexible plan, preceded by a survey, is one of the most revolutionary ideas that man has ever had about the control of his environment.

(4) Most towns today have a characteristic functional pattern as follows: a central core containing the principal shopping centre, business zones, surrounded by suburbs of' houses. Most town planners accept the traditional town pattern. In the preparation of a master plan they are preoccupied with the

definition of the town centre, industrial areas, and the areas of housing; the creation of open space for recreation, the laying down of a pattern of main roads which run between: the built-up areas (thus leaving them free of through traffic) and connect them to each other.

(5) The master plan thus has to define the ultimate growth of the town, but though the master plan is a diagram, and even a flexible one, it is the structure upon which all future development is to take place.

COMPREHENSION

1. Say what sentences express the main idea of the text.

1. In the preparation of the master plan it is necessary to define the town zones. 2. All cities should have a plan. 3. Before a flexible plan is made it is necessary to find out about the existing environment. 4. The master plan also defines places for active and passive recreation.

2. Say what paragraph of the text these sentences can be headlines to. Arrange them according to the text.

1. Features of a traditional town pattern.
2. The purpose of a master plan.
3. The purpose of a town plan.
4. What main points should be included in a survey?

3. Complete the sentences with one of the options (a, b, c) according to the text.

1. The purpose of a town plan is...
a) to do research of the trends of population growth;
b) to give the greatest possible freedom to the individual;
c) to find out about the existing environment.
2. Before a town plan is designed, it is necessary...
a) to renew and extend the dwellings, reconstruct the working places;
b) to make a forecast of future development in the form of a map or a series of maps;
c) to find out about the existing environment.
3. History has shown that a town plan should be flexible, because...
a) it should continually be adapted to the changing needs of the community for whom it is designed;
b) it defines the position of schools, shopping centers and business centers;
c) it suggests the routes of public transport.
4. The master plan has to define the ultimate growth of the town and...
a) no one can be certain when the development is to take place;

b) a society is an organic thing with life and movement;

c) therefore it is the structure upon which all future development is to take place.

5. In the preparation of a master plan the planners are preoccupied with...

a) the idea that in our time plan-making has become an everyday activity;

b) the definition of the town pattern and the laying down of a pattern of main roads;

c) the necessity to determine the distance from work to home.

4. Make a plan of the text.

5. Find correct meanings of the words in bold and translate the word combinations according to the text.

1) **large-scale** construction (1) – шкала; масштаб; размер;
2) **everyday** activity (1) – ежедневный; повседневный; обычный;
3) in such a **way** (1) – дорога; средство; способ; путь;
4) **development** plan (2) – развитие; усовершенствование; застройка;
5) **master** plan (2) – главный; ведущий; руководящий; генеральный;
6) **most** towns (5) – больше всего; самый; наибольший; большинство;
7) **through** traffic (5) – через; из-за; сквозной; беспрепятственный;
8) town **pattern** (5) – образец; характер; тип; структура;
9) to **lay down** the pattern (5) уложить; составить; установить.

6. Say what Russian words have the same roots as the following English words and find their equivalents in the right column.

E x a m p l e : activity (активность) – деятельность

1) to absorb	a) схема
2) diagram	b) общественный
3) social	c) закреплять
4) to modify	d) расположение
5) industrial	e) промышленный
6) central	f) общественный
7) position	g) естественный
8) traditional	h) обычный
9) natural	i) предшествовать
10) public	j) поглощать
11) to fix	k) видоизменять
	l) гибкий
	m) главный

7. Translate the following words into Russian.

Business zone, town pattern, population growth, development plan, road system, plan-making, town planner, housing area, shopping centre, business centre, public transport, recreation area.

8. Translate the following sentences into Russian paying attention to the words in bold.

1. Cities should have a flexible **plan**. 2. **Plan**-making has become a much exercised activity. 3. People should **plan** the future development of the town. 4. Most town **planners** accept the traditional town pattern. 5. A town **designer** should not ignore the past. 6. **Designing** does not mean imitation of the past. 7. When making the **design** of a town we should bear in mind future development. 8. Before a town is **designed** it is necessary to find out about the environment.

9. Find in what sentences 'since' is translated as «так как».

1. Since a society is an organic thing, the plan of a city must be flexible. 2. The plan is continually being adapted since it is never a complete thing. 3. The town has changed greatly since I saw it last, that is since 1970. 4. Before a plan is designed it is necessary to find out about the existing environment since a plan absorbs or modifies it. 5. Since the master plan takes into consideration the existing topography, it indicates the areas for rest. 6. The master plan is very much like a diagram since it is never a complete and fixed thing.

10. Read the sentences where 'one' is used instead of a noun. Translate them into Russian.

1. The plan of a city must be flexible, as no one can be certain when the development will take place. 2. A plan is never a complete and fixed thing, but rather one that is continually being adapted to the changing needs of the society. 3. One should know that a good plan is the one that forecasts the future development. 4. One should use a new plan based on a survey, and not an old one. 5. A flexible plan, based on a survey, is one of the most revolutionary ideas. 6. The practice of making flexible plans is essentially a progressive one.

11 Translate the sentences into Russian paying attention to the meaning of the verb 'to be'.

1. The purpose of a town plan is to give the greatest possible freedom to the individual. 2. The master plan is the structure upon which all future development is to take place. 3. Another purpose of a town plan is to show the principal road

system connecting the various zones together. 4. We are to take into consideration all the advantages and disadvantages to decide what plan is the best. 5. This master plan is to be completed in the short period of two years. 6. Many new blocks of houses are to be built according to the new development plan. 7. The task of an architect is to make plans, whereas the task of an engineer is to build according to those plans.

12. Translate the text in written form.

13. Say which of the three sentences (a, b, c) is the answer to the question.

1. Why is it necessary to make a survey of the existing environment?
a) It is because no one is certain when the development is to take place.
b) It is because the new development absorbs or modifies the environment.
c) It is because growth is a law of life.
2. What does a survey consist in?
a) It consists in completing the town's communications.
b) It consists in finding out about the environment, in research into the trends of population growth and the types of dwellings; and into atmospheric pollution as well.
c) It consists in defining a place for recreation.

14. Disagree with the following statements according to the text.

E x a m p l e : Most town planners suggest quite new town patterns.
No, they don't. Most town planners do not suggest quite new town patterns. As the text says, most town planners accept the traditional town pattern.

1. The purpose of a plan is to limit the active life of its population.
2. The plan is a complete and fixed thing since the needs of the community do not change.
3. Growth is a law of life and town growth should not be controlled by any plan.

15. Draw a plan of a new district on the basis of the text . Comment on it in English.

16. Translate the text with a dictionary.

Far or Near

In choosing a location for the satellite towns now being planned in Russia preference is given to the southern and south-eastern slopes of hills with big green belts and reservoirs in the vicinity. A necessary condition in making the choice is the availability of convenient means of communication with the city best of all being an electrified railway line and a good automobile highway.

The distance of the satellite town from the city depends upon how well developed the electrified railway and the highway systems are. In the case of Moscow, which has highly ramified networks running in all directions, it is possible to locate the satellite cities within 50 to 100 km., whereas in the case of Kaluga, for example, the sensible thing apparently is to place them nearer.

It is taken into consideration that even when there are some enterprises and offices of its own in the satellite town, a certain portion of the population may still work in the city; thus architects are of the opinion that the town and city should not be more than an hour's commuting distance apart.

UNIT II
TOWN PLANNING

1. a) Remember what Russian words have the same roots as the following English words.

Standards, economy, to examine, scheme, details, scene, form, aesthetically, architect, historical, effect, tradition, visual, vandalism, texture, atmosphere, primitive, mechanical, expansion, to ignore, concentration, balance, natural, amorphous, imitation, problem, urban, date, adequate, position.

б) Find equivalents from the exercise above to the following Russian words.

Изучать, план (проект), сосредоточенность, равновесие, естественный, воздействие (влияние), расширение, подробности, зрительный (наглядный), нормы, экономичность.

2. Match words from A with their translation from B.

A	B
1) to design	a) предлагать
2) dwelling	b) расширение, застройка
3) building	c) проектировать
4) through	d) сквозь
5) to suggest	e) рассмотреть
6) development	f) жилой дом
7) to construct	g) возможный
8) growth	h) здание
9) environment	i) удовлетворяющий, приятный
10) to remember	j) окружающая среда
11) to consider	k) изучать
12) to examine	l) строить
13) possible	m) существовать

14) satisfying	n) помнить
15) population	o) рост
16) to exist	p) разрушать
17) to demolish	q) население
18) to site	r) соответствующий, должный
19) to provide	s) располагать
20) proper	t) обеспечивать

3. Read the text and define its main ideas.

Design of a Complete Town

(1) In considering the design of a town or city we must always remember that the town must be sited in a healthy position, free from dust, fogs, its layout must not encourage winds through urban spaces, and it must not pollute its own atmosphere. I t must provide proper standards of space and sunlight to its buildings and open spaces, and it must be possible to move about the town easily and without danger to life. Its parts must be so arranged that it is a convenient place for dwelling, working and playing.

(2) Connected with these and many other technical problems is the problem of economy. The problem must be thoroughly examined which does not suggest that the cheapest scheme may be the best.

(3) The town must work properly but it should also give pleasure to those who look at it. When we say that a town should be beautiful, we do not mean that it should have some fine parks and noble buildings, we mean that the whole of the environment, down to the most insignificant detail, should be beautiful.

(4) If we examine a typical urban scene we see all kinds of objects like buildings, lamp posts, paving, posters, and trees. It is all of them, together with all the other kinds of objects that are found in the town, that are called the raw materials of a town design. Each of them down to the least important should be aesthetically satisfying.

(5) Designing in terms of past time does not imply the imitation of the existing environment but respect of the form, color, texture, and general qualities of the existing development. That which is being constructed is for immediate use which is not to suggest that there must be an attempt to ignore the past and be ‘modern’.

(6) Future time must also be thought of in terms of the estimated life of the objects. Objects like buildings and lamp posts grow old and become out-of-date, and the designer must select those materials that are adequate for their life, no more and no less.

(7) Until comparatively recent times the growth of cities has been without purpose in any sense. Cities must grow, for growth is a law of life. But this natural overgrowth should have aroused action to restore balance. Mere size, as such, is no index of greatness.

(8) All overgrowth means overcrowding, which is loss of space, one of the vital needs of cities. The lesson that has to be learned is that natural growth, and all the other forms of growth have to be made subject to will and intelligence, or the city must be harmed. This is a certain lesson of history.

COMPREHENSION

1. Read the sentences which don't correspond to the content of the text.

1. When building a town we should be very careful not to spoil what exists already. 2. The streets and buildings of existing towns will serve many future generations. 3. When designing a town we should not forget that its citizens should be able to move about it without any danger to their life. 4. The economics of a town plan and the technical problems are closely connected. 5. Scientific forecast also includes progressive methods of planning. 6. The designer should select the best building materials for the objects of his planned town. **7.** Cities will grow but their growth must be controlled.

2. Arrange the following items of the plan in the sequence corresponding to the content of the text.

1. The whole town, and even its details, should be beautiful.
2. A town should be a nice place to live, to work and to rest in.
3. The town designer should remember that his raw materials will exist in the future.
4. All the objects in the town are called the raw materials of town design.
5. City growth should be controlled.

3. Complete the sentences according to the text.

1. Before a development plan is made, it is necessary... 2. The plan of a city has to be flexible because... 3. The traditional town pattern is as follows:..

UNIT III
RESIDENSIAL AND INDUSTRIAL BUILDINGS

1. Find Russian equivalents to the following English words.

Factor, to classify, functions, modern, technology, political, architect, proportion, concrete, techniques.

2. Read and learn the following words and word combinations.

building industry	строительная промышленность
managerial staff	управленческий аппарат

industrial construction	промышленное строительство
housing	жилищное строительство
technological advance	технический прогресс
off-.site prefabrication	фабричное изготовление
office buildings	служебные здания
storage facilities	складские помещения
site planning	планирование работ на строительной площадке
prefabricated structures	сборные конструкции
present-day design	современное проектирование
kitchen and sanitary fittings	санитарное оборудование
food-processing plant	пищекомбинат

3. Read the text. Say what paragraphs enclose the main idea of the text.

(1) In highly industrialized countries the building industry, comprising skilled and unskilled workers in many trades, building engineers and architects, managerial staff and designers, employs a considerable proportion of the available labor force.

(2) Construction industry including residential, public and industrial construction holds a considerable place in national economy and is being carried on a large scale. I t is the largest single industry in the country. The problems of construction have grown into major political issues in most countries.

(3) Housing is prominent among the factors affecting the level of living. The improvement of the housing represents a concrete and visible rise in the general level of living. In many countries residential construction has constituted at least 12 per cent and frequently more than 25 per cent of all capital formation. Since in the Russian Federation home building industry is the concern of the state the research and development in housing technology is carried out on a national scale and is being paid much attention to.

(4) The ever growing housing demands have brought to life new methods of construction with great emphasis upon standardization, new levels of technological advance utilizing such techniques as off-site prefabrication, precasting, use of reinforced concrete panels and large-scale site planning. At present, prefabricated structures and precast elements may be classified into two principal groups – for residential houses and industrial buildings.

(5) Present-day designs for residential construction envisage all modern amenities for a dwelling they advocate larger better built and better equipped flats and houses. There is a marked improvement in the heating and ventilating systems as well as in hot-water supply, kitchen and sanitary fittings. Many tenants now can afford better furnishings, refrigerators, washing machines, dishwashers etc. A house which is a physical environment where a family develops is acquiring a new and modern look.

(6) Industrial buildings comprise another significant type of construction. This type of construction involves factories, laboratories, food-processing plants, mines, office buildings, stores, garages, hangars and other storage facilities, exhibition halls etc.

(7) Each of these functions demands its own structural solution and techniques. But in general they may be divided into two classes according to whether the plan must give greater attention to the size and movement of machinery or of persons. The building techniques (by techniques we mean building materials and methods) depend upon the types of buildings.

(8) Modern industrial buildings have demonstrated the advantages of reinforced concrete arches, metal frames, glass walls and prefabricated standardized mass produced parts. Steel was gradually substituted for iron and permitted wider rooms and larger windows. Windows can be enlarged to the extent that they constitute a large fraction of the wall area.

COMPREHENSION

1. Find which sentences express the main idea of the text.

1. In Russia home building industry is the concern of the state. 2. The building industry comprises skilled and unskilled workers in many trades. 3. Building industry which Includes residential, public and industrial construction is being carried out on a large scale and it has brought into being new methods and techniques. 4. There is a marked improvement in the heating and ventilating systems as well as in hot-water supply.

2. Match the headlines with the paragraphs from the text. Arrange them according to the text.

1. The functions of industrial buildings.
2. New methods of housing.
3. Present-day design for residential construction.
4. The advantages of reinforced concrete for modern industrial buildings.
5. Building industry and national economy.

3. Say which of the given sentences describe residential buildings and which ones – industrial buildings.

1. In many countries residential construction has constituted at least 12 per cent of all capital formation. 2. The problem of housing has grown into a major political issue in most countries. 3. Industrial buildings comprise another significant type of construction. 4. Modern buildings have demonstrated the advantages of reinforced concrete arches, metal frames and glass walls. 5. The differing functions of industrial buildings require their own structural solutions

and techniques. 6. Present-day designs for housing envisage all modern conveniences and sanitary fittings. 7. Buildings may be divided into two classes according to whether the plan must give greater attention to the size and movement of machinery or persons. 8. Windows can be enlarged to the extent that they constitute a large fraction of the wall area. 9. A house which is a physical environment where a family develops is acquiring a new and modern look.

4. Choose a suitable option (a, b, c) according to the text.

1. Modern industrial buildings have demonstrated the advantages of...
a) hot-water supply and panel heating;
b) reinforced concrete arches, metal frames, glass walls and prefabricated parts;
c) all modern conveniences for a dwelling.
2. Industrial type of construction involves...
a) better built and better equipped flats and houses;
b) the atres, cinemas, museums, libraries, etc.;
c) factories, food-processing plants, mines, office buildings, stores, etc.
3. Present-day designs for residential construction envisage...
a) movement of machinery and persons;
b) application of metal frames and glass walls;
c) all modern conveniences including hot-water supply and panel heating.

5. Finish the following sentences with your own ideas.

1. Housing construction has grown into a political issue because... 2. In Russia the research and development in housing technology is carried out on a national scale since... 3. A house is acquiring a new and modern look for... 4. The building techniques depend upon the types of buildings because...

6. Find the subject and the predicate of each sentence. Translate the sentences into Russian.

1. In Russia much attention is being paid to research and development in housing technology. 2. Housing is prominent among the factors affecting the level of living. 3. The advantages of reinforced concrete arches have been demonstrated by modern industrial buildings. 4. Each of these functions demands its own structural solution. 5. At present prefabricated structures and precast elements may be classified into two principal groups.

7. Translate the following sentences into Russian paying attention to the subject of the English sentences.

1. House-building is being carried out on a large scale in Russia. 2. The level of living is very much affected by housing. 3. New methods of construction have

been brought into being by the ever growing housing demands. 4. The size and shape of building is greatly affected by the general plan for the framing of an industrial structure. 5. Some hundreds of systems of prefabrication have been devised and many of them have been tried, with greater or lesser success. 6. Medium life houses could be best produced by prefabrication methods. 7. In prefabricated construction the units should be based on a common dimension. 8. Mass production is encouraged by standard sizes and qualities of building units.

8. Choose a subject to each sentence from the list below.

1. Building materials ... by the type and the function of a building. 2. The techniques of construction ... not only by the availability of materials but also by the total technological development of society. 3. A number of factories ... to manufacture standardized factory-made elements. 4. The built-in space of an apartment ... as well. 5. Windows ... for the best possible lighting and ventilation. 6. Research and development in housing ... on a national scale. 7. Modern industrial buildings ... the advantages of prefabricated reinforced parts. 8. Reinforced-concrete elements ... in residential house construction.

1) have been designed; 2.) are governed; 3) are influenced; 4) are made use of; 5) are provided; 6) are carried out; 7) can be said to have demonstrated; 8) should be carefully thought of

9. Fill in the blanks with a suitable word.

1. Building industry … a considerable ... in the national economy. 2. Each of these ... its own structural solution. 3. Industrial ..... another significant type of construction.

place, holds, demands, functions, comprise, buildings

10. Group the words with the same root. Translate them into Russian.

Manager, consideration, availability, residence, industry, managerial, residential, available, considerable, political, physics, vision, technological, structure, politics, physical, visible, technology, structural, industrial.

11. Find a Russian word with the same root as an English one to each pair of words. Compare them.

О б р а з е ц : proportion – доля (пропорция)

1) techniques – (методы) (...). 2) modern – современный (...). 3) utilize– использовать (...). 4) residential – жилищный (...). 5) technology – техника (...).

12. Translate paragraphs 3, 4 and 5 of the text in written form.

13. Correct these sentences according to the text.

E x a m p l e : Housing does not affect the level of living.

This statement is incorrect. Housing affects the level of living. The improvement of housing shows a concrete and visible rise in the general level of living.

1. Not much attention is paid to the problems of construction. 2. Modern residential houses and industrial buildings are mostly built of bricks and timber. 3. Modern industrial buildings have demonstrated the advantages of plastics and ceramics.

14. Answer each question with not less than three sentences.

1. Why is a house acquiring a new and modern look?
2. What have ever growing housing demands brought into being?

15.Read Text A and Text B. Choose the problems which are discussed in the texts.

1. New building materials for earthquake-proof structures.
2. Methods of constructing of earthquake-proof structures.
3. The role of prediction of earthquake threats.
4. Methods of evacuating the inhabitants in case of an earthquake.
5. Some practical experience in constructing earth quakeproof structures.

A. In the 1970s a series of earthquakes occurred in the Central Asia the first of which was near Gazli virtually raising the town. Yet Tashkent, about 500 km from the epicenter of the earthquake which reached 7.3 on the Richter scale, suffered actually no damage at all. The reason was that Tashkent had been rebuilt following a devastating earthquake in 1966 to standards which would be able to withstand similar events in the future. Engineers predicted the recent earthquake and as a result the inhabitants of Gazli were evacuated saving many lives. Therefore the most effective response to earthquake threats at the moment seems to be prediction coupled with precautions.

B. Architects, planners, designers and builders of Kazakhstan work together at a specialized scientific research institute to perfect earthquake-proof buildings. One of the biggest cities of Kazakhstan Alma-Ata has suffered more than 4,000 earth tremors in the last century. Using a new kind of prefab ferroconcrete frame and new methods of fastening parts, and pretesting elements and structures for resistance builders have erected a number of buildings of late which can stand a magnitude of nine earthquakes.

UNIT IV
TYPES OF BUILDINGS

1. Find Russian equivalents to the following English words.

Variety, general, residential, techniques, factors, to classify, function, portion, exterior, texture, apartment, interior, thermal, tent, to stimulate, visually, evolution, total

2. Match words from column A with their equivalents from column B.

A	B
1) building materials	a) технический прогресс
2) techniques	b) современный
3) residential	c) обеспечивать
4) construction	d) теплоизоляция
5) technological changes	e) методы строительства
6) mechanized operations site	f) железобетонные блоки
7) reinforced concrete blocks	g) жилищное строительство
8) construction methods	h) методы
9) thermal insulation	i) строительные материалы
10) to provide	j) механизированные операции
11) contemporary	k) строительная площадка
12) technological advance	l) изменения в технологическом процессе

3. Match synonyms.

1) domestic	a) dining rooms
2) houses	b) modern
3) to influence	c) considerably
4) technological development	d) dwellings
5) factory-made elements	e) to affect
6) to lead to	f) to result in
7) to carefully think of	g) prefabricated units
8) contemporary	h) technological advance
9) dining areas	i) to consider
10) greatly	j) residential

4. Read the text. Define the main ideas of the text.

(1) Types of buildings depend upon social functions and may be classified according to the role in the community. The types of buildings may be domestic,

educational, office, industrial, recreational, etc. The common and necessary conditions are: (a) its suitability to use by human beings in general and its adaptability to particular human activities; (b) the stability and permanence of its construction.

(2) Speaking of residential construction we must say that the apartment houses are mostly built to suit urban conditions. Group housing provides home for many families and is at once public and private. The techniques of construction or the methods by which structures are formed from particular materials are influenced not only by the availability and character of materials but also by the total technological development of society.

(3) The evolution of techniques is conditioned by two factors: one is economic – the search for a maximum of stability and durability in building with a minimum of materials, labor and time; the other is expressive–the desire to produce meaningful form.

(4) Large housing program have tended to stimulate technological change in the building industry. Modular design (i.e. design in which the elements are dimensioned in combinations of a fixed unit) has led to standardization of elements, interchangeability of parts and increased possibilities for mass production, with resultant economies. Entire apartment assemblages are available and are being used to an increasing extent. These techniques aim at a higher output of better structures at lower cost.

(5) The high degree of mechanization and standardization is successfully achieved by reinforced concrete blocks and units. Reinforced concrete homes are produced by a variety of construction methods. Various methods of constructing reinforced concrete houses involve extensive use of large sections manufactured in heavily mechanized factories and erected at the site.

(6) The built-in space of an apartment should be carefully thought of as well. There is a considerable trend toward built-in furniture. Rooms should be both efficient and visually satisfying. The extent of built-in cabinets must be determined. Drawers and shelves can often be concealed behind walls, freeing valuable floor space.

COMPREHENSION

1. Say what paragraphs of the text these sentences could be headlines to.

1. The total technological development of society influences the techniques of residential construction.
2. The interior of a modern residential building.
3. Technological changes and new techniques in the building industry.

2. Say what sentence expresses the main idea of the text.

1. Great technological advances in plumbing and ventilating systems. 2. The types of walls of concrete structures. 3. The types of exterior concrete surface. 4. Classification of buildings according to their functions, building techniques; and factors affecting the latter.

3. Complete the sentences according to the text.

1.Types of buildings depend upon social factors because...
2. Large housing programs have tended to stimulate technological change in the building industry because...
3. Entire apartment assemblages are used to an increasing extent since...
4. There is a considerable trend toward built-in furniture because...

5. Choose a suitable option (a, b, c) according to the text.

1. Various methods of constructing reinforced concrete houses involve...
a) craft operations at the building site;
b) building materials, labor and time;
c) extensive use of large sections manufactured in heavily mechanized factories.
2. Types of buildings depend upon...
a) availability and character of materials;
b) increased possibilities for mass production;
c) social functions in the society.
3. The high degree of mechanization and standardization is successfully achieved by...
a) reinforced concrete blocks and units;
b) technological change in the building industry;
c) craft operations at the building site.

UNIT V
BUILDING MATERIALS, BUILDING TECHNIQUES AND BUILDER'S PLANT

1. Find Russian equivalents to the following English words.

Designer, to select, to adapt, material, construction, effective, result, civil, physical, uniform, microstructure, gypsum, cement, chemical, reaction, to accompany, evolution, to modify, variety, slag, structural, inert, fundamental, object, production, selection, accurate, method, variation

2. Read and learn the following words and word combinations.

lime	известь
mortar	раствор
masonry	каменная или кирпичная кладка
aggregate	заполнитель
high alumina cement	цемент с высоким содержанием глинозема
fine aggregate	мелкий заполнитель
high rate of strength	высокая прочность
moisture content	содержание влаги
resistance to	прочность на
workability	обрабатываемость (удобоукладываемость)
crushed stone	щебень
C compressive load	нагрузка на сжатие
gypsum	гипс

3. Read the text. Say what paragraphs disclose the headline of the text.

The Most Important and Widely Used Building Materials

(1) The designer must be able, to select and adapt such materials of construction that will give the most effective result by the most economical means. In this choice of materials for any work of construction, the civil engineer must consider many factors. These factors include availability, cost; physical properties of materials and others.

(2) Timber, steel and concrete all vary, sometimes over considerable ranges in the properties desired by the engineer. Even steel, uniform as it appears to be, varies considerably in its microstructure. Concrete is even less uniform than many other materials.

(3) Lime, gypsum and cement are the three materials most widely used in building construction for the purpose of binding together masonry units, such as stone, brick and as constituents of wall plaster. Cement is furthermore the most important component of concrete.

(4) Another important class of cement is high alumina cement. High alumina cement is a material containing alumina. It has an extremely high rate of strength increase which is, Owing to the violence of the chemical reaction, accompanied by a considerable evolution of heat. It is very resistant to chemical attack.

(5) It therefore follows that Portland cement like other materials can to some extent be modified to suit a particular application. The scope for such purpose-made cements has led to the development of an increasing variety such as high alumina cement, blast-furnace slag and pozzuolanas. Portland blast-furnace cement has greater resistance to some forms of chemicals.

(6)The most important building materials may now be considered to be structural steel and concrete. Concrete may be considered an artificial

conglomerate of crushed stone, gravel or similar inert material with a mortar. A mixture of sand, screenings or similar inert particles with cement and water which has the capacity of hardening into a rocklike mass is called mortar. The fundamental object in proportioning concrete or mortar mixes is the production of a durable material of requisite strength, water tightness and other essential properties at minimum cost. To attain this end careful attention must be given to the selection of cement, aggregate, and water.

(7)The most accurate method of measuring proportions is to weigh the required quantities of each material. It is widely used in large building construction, but in small building construction the less accurate method of measuring proportions by volumes is frequently used. The chief inaccuracies in volumetric measurement arise from the wide variation in the bulk of the fine aggregate due to small changes in its moisture content and faulty methods of filling measuring devices. Workability and strength tests are chief control tests made on concrete. To be able to undergo high compressive loads is a specific characteristic of this material.

COMPREHENSION

1. Say what paragraphs of the text these sentences could be headlines to. Arrange them according to the text.

1. Technology of concrete production.
2. Composition of cement.
3. Materials for binding masonry units.
4. The properties of major building materials.
5. The properties of Portland cement.

2.Group the sentences according to topics A, B and C.

A. The choice of materials for any work of construction.
B. The properties of high alumina cement.
C. The composition of concrete.

1. Another important class of cement is high alumina' cement. 2. Such a material may be considered an artificial conglomerate of crushed stone or gravel with a mortar. 3. The civil engineer must consider many factors when selecting the material for construction. 4. This kind of cement is very resistant to chemical attack. 5. The principal object in proportioning concrete is the production of a durable material of adequate strength and water tightness. 6. The factors that condition the selection of materials for construction include availability, cost and physical properties. 7. This material has an extremely high rate of strength increase. 8. Timber, steel and concrete vary over considerable ranges in the properties desired by the engineer and the latter should take them into

consideration in selecting the materials. 9. The most accurate method of measuring proportions for concrete is to weigh the required quantities of each material.

3. Choose what sentences describe cement and what sentences describe concrete?

1. This material is most widely used for the purpose of binding together masonry units such as stone and brick. 2. This material is also known to be the most important component of concrete. 3. This kind of material may be considered an artificial conglomerate of crushed stone, gravel or similar inert material with a mortar. 4. The material which contains alumina has an extremely high rate of strength increase. 5. The fundamental object in proportioning this material is the production of a durable material of requisite strength, water tightness and other essential properties. 6. The most accurate method of measuring proportions is to weigh the required quantities of each material.

4. Choose right answers to the questions.

1. What influences the choice of building materials?

a) The choice of building materials is governed by the type and the function of a building,

b) Availability, cost and physical properties are the main considerations for an engineer in selecting materials for construction,

c) The techniques and methods of construction are the main factors influencing the choice of building materials.

2. What are lime, gypsum and cement most widely used for?

a) These three materials are not widely used for the purpose of binding together masonry units;

b) They are used as components to produce concrete;

c) With the large-scale construction, lime, gypsum and cement may be considered to be the most important binding materials.

5.Complete the sentences.

1. Cement is the most widely used building material because...
2. High alumina cement is an important class of cement since...
3. Careful attention must be given to the selection of cement, aggregate and water in proportioning concrete because...
4. Timber, steel and concrete vary greatly for...

6. Translate the text with a dictionary in written form.

Faced with a frightening picture of widespread destruction as a result of World War II, the postwar USSR was forced to develop new techniques and methods for rapid building of desperately needed housing.

The years of emergency reconstruction following World War II (1945–1950) saw a turning to industrialized, so-called "speed-building" methods of housing. It was during this period that prefabrication and prefabricated housing made their grand entry into Soviet housing industry. Widespread acceptance of the idea came in the late 1950's and early 1960's. Ceramic sheets and tiles, gypsum blocks (ceramic tiles made of plastic), gypsum panels, prefabricated ceiling panels and sets of doors and window openings, and even built-in furniture were introduced during these years. Consequently, early postwar industrialized housing attempts turned to large-block construction, in which Soviet builders had had some pre-war experience. By enlarging the size of building elements, labor costs and time were decreased.

7. Insert than; so as; both ... and; not so ... as; as into the sentences.

1. Concrete ...a building material is more suitable ... timber. 2. ... workability ... strength tests are the chief control tests. 3. The designer selects such materials ... ... to give the most effective result. 4. Timber is ... ... durable ... concrete.

8. Find a border between the main and subordinate clauses. Translate the sentences into Russian.

1. Timber, steel and concrete the designers so often use vary sometimes over considerable ranges in the properties.
2. As for alumina cement we use for binding purposes it is very resistant to chemical attack.

9. Look through the text and make as many word combinations with the words 'concrete' and 'cement' as you can.

F o r e x a m p l e : production of concrete; concrete mix etc.

10. Fill in the blanks with the infinitives below.

1. Under certain conditions, concrete is exposed ... by chemicals. 2. The most important building materials may now be considered ... . 3. Walls and piers may ... with stone. 4. Enough water should be used ... a placeable mix. 5. It is very essential for a building engineer ... physical and mechanical properties of the building materials. 6. ... undergo mechanical treatment is a specific characteristic of some materials. 7. No masonry material is known ... which is permanent when subjected to sea water.

1) to be structural steel and concrete; 2) to be attacked; 3) to produce; 4) to be placed; 5) to know; 6) to have been developed; 7) to be able to.

11. Translate paragraphs 4, 5 and 6 of the text into Russian in written form.

12. Form verbs from the following words.

Selection, designer, considerable, addition, elaboration, development, appearance, desirable, mixture, resistant, application, production, suitable, measuring, construction, representative

13. Find a Russian word with the same root for each pair of words.

1) adapt – приспосабливать (...); 2) civil – гражданский (...); 3) accurate – точный (...); 4) plaster – штукатурка (...); 5) component – составная часть (...); 6) contain– содержать (...); 7) modify – изменять (...); 8) variety – разнообразие (...); 9) structural – строительный (...); 10) inert – нейтральный (...); 11) essential – существенный (...); 12) test – испытание (...)

14.Analyze the structure of the following words and word combinations. Translate them into Russian.

Rapid-hardening; high-early strength; high-alumina; purpose-made; blast-furnace; rocklike; water tightness; lightweight; large-size elements; semi-rigid

15.Prove if the statements are right or wrong with two or three sentences.

E x a m p l e : Steel and concrete are most widely used for binding together masonry units. This statement is incorrect. Lime, gypsum and cement are used in building construction for the purpose of binding masonry units.

1.The most important building materials may now be considered to be structural steel and concrete. 2. Lime, gypsum and cement are the three materials most widely used for making concrete. 3. Cement is the most important component of pricks.

16.Answer the following questions with not less than three sentences.

1. Why is concrete the most important building material?
2. What should for a designer know to select the most effective building materials?

17.Translate the text with a dictionary in written form.

Reinforced Concrete Elements Production

With the rapid growth in the employment of precast concrete products and particularly of wall panels, slabs, beams etc. to serve a multitude of building needs, this industry has to maintain and improve the quality of the products. A

vast amount of excellent work has already been done to raise the standards of this industry to their present level. Machinery and equipment designers have made important contributions by creating better machines and tools for the industry.

A great number of plants producing precast reinforced concrete elements is now in operation in our country and abroad. Before the decision is made to establish a precast concrete products plant in a given area, a number of purely economic considerations deserve particular attention. A careful appraisal of the potential requirements provides valuable information for determining the size of the plant which should be built. A well-designed plant must have sufficient capacity for the normal output plus a reasonable margin for a possible increase. The design should specifically and carefully anticipate the future installation of additional equipment for increased production without disrupting the original lay-out.

UNIT VI
CHOICE OF MATERIALS

1. Find Russian equivalents to the following English words.

Structural, technological, functions, zones, ordinary, effective, thermal, economical, plastics, synthetic, textile, physical, mechanical, polymer, organic, complex, components.

2. Learn the following words and word combinations.

mass production	массовое производство
volume weight	объемный вес
prefabricated concrete elements	сборные железобетонные элементы
thermal conductivity	теплопроводность
reinforced concrete elements	железобетонные элементы
rigid	жесткий
brittle	хрупкий
resin	смола
tensile stress	сжимающая нагрузка
bending loads	изгибающие нагрузки

3. Read the text. Define the main idea of the text.

(1) Which material can be used to the best advantage for a particular part of the building, depends as well on the kind of load to which it is subjected and on the shape of the part. That the development of the metallurgical and machine-building industry made possible mass production of prefabricated large-size

concrete and, reinforced-concrete structural elements is a well-known factor to influence the choice of materials.

(2) Reinforced concrete is a building material in which the joint functions of concrete and steel are advantageously utilized. Being brittle, concrete cannot, withstand tensile stresses, and it cannot therefore be used in structures subjected to tensile stresses under load. But if steel is introduced into concrete it changes the property of the monolith.

(3) There are two kinds of reinforced concrete: with ordinary reinforcement and concrete with pre-stressed reinforcement. To reinforce ordinary concrete structures is to introduce steel rods in stretched zones of concrete elements. Reinforced-concrete structures and elements are widely used both for residential houses and industrial buildings.

(4) In many cases bricks too are very satisfactory for use in the construction. Bricks generally present a pleasing appearance and can be obtained with various qualities, colors, and textures. Being of a high volume weight and high thermal conductivity, ordinary brick is not always satisfactory in building practice. There are other kinds of bricks which are ', more effective, they are light-weight building bricks, hollow or porous bricks. Light-weight building bricks differ from ordinary clay bricks in a lower volume weight and lower thermal conductivity, and are therefore more economical than ordinary bricks.

(5) One of the most significant facts about both industry and building has been research on synthetics and plastics. Plastics have appeared comparatively recently but, owing to their inherent valuable and diverse properties, have found a wide application in many industrial fields (machine-building, aviation, textile industry, etc.).

(6) In respect to physical and mechanical properties at a normal temperature of 20°C all plastics are divided into rigid, semi-rigid, soft and plastic. In respect to the number of constituents plastics may be classified as simple and complex.

(7) Plastics consisting of one polymer are referred to as simple. Thus, organic glass (Plexiglas) consists of one synthetic resin. But in the building field we usually deal with Complex plastics, e.g. plastics consisting of a polymer and other components.

COMPREHENSION

1. Match phrases from A with their equivalents from B.

A	B
1) успешно используются	a) diverse properties
2) растягивающее напряжение	b) tensile stress
3) свойства материалов	c) properties of the materials
4) прочность на сжатие	d) depending on application

5) в зависимости от применения	e) pleasing appearance
6) приятный внешний вид	f) mechanical properties
7) разнообразные свойства	g) wide application
8) широкое применение	h) compressive strength
9) простой кирпич	i) are advantageously utilized
	j) ordinary brick
	k) volume weight

2. Match the headlines with the paragraphs from the text.

1. The main characteristics of concrete.
2. The chief principles of plastics classification.
3. Factors that influence mass production of prefabricated large-size concrete and reinforced-concrete structural elements.
4. New tendencies in the choice of building materials.
5. The advantages of reinforced concrete.

3. Find what sentences describe concrete, brick and plastic.

1. There are some kinds of structural materials that have appeared comparatively recently, sometimes they consist of one polymer. But in building industry some complex materials consisting of a polymer and other components are used. 2. In many cases bricks too are very satisfactory for use in the construction. 3. There are some kinds of materials which are brittle and cannot withstand tensile stress. 4. If steel is introduced into some kind of material it changes its property. 5. Some building materials offer a good resistance to compressive loads. 6. In respect of physical and mechanical properties these materials are divided into rigid, semi-rigid and soft.

4. Choose a suitable option (a, b, or c) according to the text.

1. Using prefabricated or precast elements...
a) depends only on the kind of load to which it is subjected;
b) builders perform a considerable amount of building work not in situ but at a factory;
c) made possible mass production of large-size structural elements.
2. Reinforced concrete is a building material in which...
a) such properties as small volume weight and high thermal conductivity are combined;
b) physical and mechanical properties at a normal temperature of 20°C make it semi-rigid and soft;
c) the joint functions of concrete and steel are advantageously utilized.

3. Bricks generally present a pleasing appearance and...
a) they are light-weight building materials;
b) cannot be used in structures subjected to tensile stresses;
c) can be obtained with various qualities, colors and textures.

5. Answer the following questions according to the text.

1. For what types of construction are reinforced concrete structures and elements used? 2. What new materials have /income into use both in industry and building? 3. What made possible the mass production of prefabricated large-size concrete elements? 4. In what industrial fields are plastics used? 5.How does steel introduced into concrete change its properties?

UNIT VII
EARTH-MOVING MACHINERY

1. Find Russian equivalents to the following English words.

Million, excavator, planning, bulldozer, tractor, scraper, to absorb, canal, anatomically.

2. Learn the following English words.

Important, to start, to carry out, equipment, mechanized, site, advantage, to divide, soil, vehicle, to mount, surface, ground, source.

3. Read and learn the following new words by heart.

plant	механическое оборудование, парк *(машин)*
bucket	ковш
leveling	планировка, планировочные работы
wheel	ротор; колесо
site	строительная площадка
shovel	прямая лопата
excavation	земляные работы
to power	приводить в действие
to plane off	сострогивать, снимать слой
blade	отвал, нож
trenching	рытье траншей

4. Read the text. Define the main ideas of the text.

(l).The annual amount of mechanized earth digging operations in Russia comes up to thousands of millions of cubic meters. It requires the employment

of a great plant of powerful earth-moving machines, the excavators being the most important of them.

(2) It is not possible to start on a construction job without a good deal of preliminary leveling the site. To carry out this work one must employ the earth-moving equipment.

(3) Site preparation and excavation are the most fully mechanized of all the operations in building construction. Most excavating machinery is heavy and slow-moving and must be carried from site to site on special transporters. It is clear that the use of expensive mechanical plant requires careful planning and efficient site organization if full advantage is to be taken of its high rate of production.

(4) Plant for site preparation and excavation can be divided into four classes. First, machines which plane off a thin layer of soil and push it in front of them. Second, machines which plane off a thin layer of soil, at the same time picking it up and carrying it where required. Third, machines which dig out soil by some form of a bucket, and load it for transportation into separate vehicles. Forth, machines designed especially for trenching by means of a number of buckets mounted either on a continuous chain or on a wheel.

(5) In the first class are bulldozers of different types. A bulldozer represents by itself an earth-moving machine which carries out its work with the aid of a blade mounted on a tractor of either crawler or wheel type.

(6) A scraper, which belongs to the second class of earthmoving machines, is simply a large box with an open mouth, dragged along the surface of the ground until it is full. It has a cutting edge that digs. There is a considerable variety of the scrapers, from small units to huge ones made to accommodate 30 cubic yards of soil and to absorb the power of two tractors while at work.

(7) Revolving shovels, which belong to the third class of earth-moving machines, made their first appearance in 1835 in the form of a part-swing shovel mounted on railroad tracks. It was powered by steam, it was slow and clumsy, but it did the work. Into Great Britain they were introduced from America in 1887 to work on the Manchester Ship Canal. They" were a source of wonderment to the people of that part of the country and trips were organized to provide a view of the "American Devils" as they were popularly called.

COMPREHENSION

1. Find sentences which don't belong to the text.

1. On large construction sites where a considerable volume of concrete is required a central mixing plant is generally used. 2. A bulldozer is an earth-moving machine which planes off a thin layer of soil, picks it up, and carries it where required. 3. The tower cranes are employed for lifting materials 'and structural elements onto the buildings being erected. 4. The first revolving

shovels were mounted on railway tracks and powered by steam. 5. Site preparation and excavation are Operations which are usually carried out with manpower. A scraper is simply a large box fitted with a cutting edge that digs. 7. Since excavators are heavy and slow-moving machines, they are carried from site to site on special transporters.

2. Find a sentence in the text which is the answer to the question.

Are excavators fast-moving machines?

Site preparation and excavation are labor-consuming operations. At present they are the most fully mechanized of all the operations carried out in building construction. But earth-moving machines are heavy and slow-moving units, therefore they must be carried from site to site on special trailers. It is clear that such expensive mechanical plant as excavator must be made to carry out various classes of work.

3. Finish sentences from A with their ending in B.

A. 1. The best economy is achieved when an all-purpose earth-moving machine is designed... 2. A scraper is simply a box made of sheet steel with an open mouth... 3. Site preparation and leveling are... 4. It is not possible to start on a construction job... 5. The use of expensive mechanical plant requires...

B. 1. ...without a good deal of preliminary levelling the site. 2. ...the most fully mechanized of all the operations in building construction. 3. ...carefull planning and efficient site organization. 4. ...capable of being converted to suit any class of work. 5. ...which is dragged along the surface of the ground until it is full.

4. What sentences (a, b, c) do the following phrases belong to?

1) one must use earth-moving equipment.

a) As the years went on...

b) To carry out this work...

c) During the last fifty years...

2) can be divided into four classes.

a) Machines, which plane off a thin layer of soil...

b) The annual amount of digging operations...

c) Plant for site preparation and excavation...

3) an earth-moving machine, which carries out its work with the aid of a blade mounted on a tractor.

a) A scraper, which belongs to the second class of earth moving machines, is... b) A bulldozer is...

c) A revolving shovel, which belongs to the third class, is...

5. Make a plan of the text.

6. Translate the following sentences into Russian paying attention to the function of Past Participle.

1. The mechanical excavating plants dealt with in this chapter are multi-purpose excavators. 2. Properly applied the excavators carry out the work rapidly and at low cost. 3. The plant consists of a base frame mounted on crawler tracks, with a revolving platform positioned on top of the frame. 4. Many of the problems met in the design and discussed here are common in both forms of structures. 5. If fitted with different equipment the excavator can be adapted to carry out various digging operations. 6. Mounted on crawler tracks this excavator can be used under very adverse site conditions.

7. Translate the following sentences into Russian paying attention to Absolute participial constructions.

1. At present a great plant of powerful earth-moving machines is used, the excavators being the most important item. 2. The scrapers plane off a thin layer of soil, the latter being picked up and carried where required. 3. The multi-bucket excavators are designed especially for trenching, this being done by means of a number of buckets mounted either on a continuous chain, or on a wheel.

8. Form nouns from the following verbs with the help of suffices 'tion (-ion)', '-ment'.

Require, construct, excavate, employ, prepare, equip, transport, accommo-date, wonder, recognize, introduce, attach, complete

9. Combine the words from both columns to form terms.

earth-moving	tractor
excavating	shovel
site	equipment
continuous	plant
crawler	preparation
pneumatic	edge
cutting	tracks
revolving	machinery
railroad	chain
mechanical	tyre

10. Match words from A with their synonyms from B.

A	B
1) annual	a) to reach
2) amount	b) to fulfill
3) to come up to	c) work
4) to require	d) to have room for
5) job	e) yearly
6) preliminary	f) to demand
7) to carry out	g) not small
8) to excavate	h) quantity
9) continuous	i) to dig
10) considerable	j) preparatory
11) huge	k) enormous
12) accommodate	l) endless

11. Translate the text with a dictionary in written form.

Mobile Cranes

The function of a crane is to hoist or lower a load suspended from its jib. Various types of cranes are available, the type and size best suited for a specific operation being influenced by the following factors: the nature of the work on which it is to operate; the weight of load it has to handle.

Mobile cranes have a wide range of uses on building and civil engineering works of construction. Cranes of this type usually take the form of a frame carrying a jib, a winch, and other necessary hoisting and controlling equipment, the whole being mounted on a cast-iron bed plate fitted with road wheels of the pneumatic type. One may also have them mounted on caterpillar tracks or on a lorry chassis if desired.

At present rope-operated mobile cranes are being superseded by hydraulically operated ones, in which all working operations, but travelling, are performed with the help of hydraulic rams. The jib of the mobile crane can be of the solid or latticed type, the latter being preferred now because of its lower weight.

UNIT VIII
EXCAVATORS

1. Find Russian equivalents to the following English words.

Universal, dragline, conversion, to control, tendency, hydraulic, progressive, optimum, to select, stability, operation, telescopic, to separate, crane.

2. Match words from the first column with their translations from the second column.

1) ground	a) оборудовать
2) bucket	b) заменять
3) boom	c) колесо
4) to equip	d) грунт
5) comparatively	e) угол
6) to replace	f) ковш
7) angle	g) сравнительно
8) wheel	h) дополнительный
9) additional	i) траншея
10) levelling	j) направление
11) direction	k) стрела
12) trench	l) планировочные работы; выравнивание

3. Read and learn by heart the following words.

earth-moving machine	землеройная машина
backhoe	обратная лопата
attachments	сменное оборудование
grab, clamshell	грейфер
shovel	прямая лопата
outrigger arms	аутригеры
dragline	драглайн
guides	направляющие
dipper arm	рукоять ковша
track	гусеница
jack	домкрат
discharge	разгрузка
slope	уклон, скат, откос.

4. Read the text. Define the main idea of the text.

(1)The universal excavator is an earth-moving machine that can be equipped with different attachments known under the following names: shovel; dragline; backhoe; grab or clamshell; crane. Conversion from one type to another is a comparatively easy operation.

(2) Some decades ago only rope-controlled excavators were in use. Now there exists a tendency to replace the latter by more progressive hydraulically operated excavators. Especially widely used are now hydraulic backhoes.

(3) In hydraulically operated backhoes hydraulic rams are used in place of ropes and winches to operate the boom and the dipper arm. The hydraulic

system makes it possible to pivot the bucket on the dipper arm. This movement provided by an additional ram on the dipper arm gives the operator a means for selecting the proper angle of cutting for the bucket both at the start of the digging stroke and during the stroke to obtain optimum digging performance.

(4) With the wheeled excavator, which is considerably lighter than the crawler mounted one, means to provide additional stability are incorporated. Before starting digging operation outrigger arms are operated hydraulically. Independent movement of the outrigger arms provides for leveling the machine on sloping ground, so that trenches with vertical sides can be cut perpendicular to the direction of the slope. In some models the revolving superstructure of the machine can be moved transversely in special guides, so that a trench can be dug parallel and close to a wall or some other obstruction, this movement being carried out hydraulically too.

(5) A recent model incorporates a telescopic dipper arm: when extended it can dig deeper and has a greater discharge height and when retracted it produces its greatest digging force at the bucket.

(6) At present excavators are available in which all the digging motions as well as slewing are operated hydraulically. The crawler-mounted excavator has two other advantages over its rope-operated counterpart: with separate hydraulic motors for each track it is possible to put one track in reverse while other is driven forward, so that the machine can be turned within its own length, and the boom can be of the adjustable radius type, so that the reach, digging depth and discharge eight can be quickly varied to suit the job.

COMPREHENSION

1. Answer the following questions.

1. What attachments can be used to equip the universal excavator? 2. Why are the backhoes with telescopic booms very widely used now? 3. Can hydraulically operated excavators dig trenches with vertical sides on sloping ground? 4. Why **is** it profitable to change the angle of cutting in the process of digging? 5. Are hydraulically operated excavators more progressive than the rope-operated ones?

2. Match the beginnings of the sentences from A with their endings from B.

A. 1. In some hydraulically operated excavators the revolving super-structure... 2. With extended telescopic boom... 3.With separate hydraulic motors for each track...

B. 1. ...the machine can turn within its own length. 2. ...can moved perpendicularly to the longitudinal axis of the Machine in special guides. 3. ...the excavator can dig deeper 'trenches and discharge the spoil at greater heights.

3. Match words from A with words from B to form terms.

A	B
1) rope-controlled	a) of cutting
2) angle	b) superstructure
3) crawler	c) ram
4) revolving	d) excavator
5) telescopic	e) arm
6) hydraulic	f) mounted
7) dipper	g) boom

PART II

UNIT I
INTRODUCTION

Due to the increasingly globalized world of international business the demand for Business English today is great and it keeps on growing. As a result the learning of business English is playing an increasingly important role in business studies and every day corporate life. For students doing their MD their learning experience must reflect an understanding of business practices and reality. The aim of this textbook is to provide skills, strategies and vocabulary that will enable business English learners to improve basic and academic skills to develop essential business communication skills as efficiently as possible.

A task-based teaching approach enables students to work out techniques to tackle an assignment, introduces the core reading skills that are essential for processing text efficiently, which are then taken up and practiced. Each Unit begins with a business brief, giving the learner a purpose for reading, summarizing information from the reading texts, introducing the key points of the topic discussed in the Unit. This approach encourages learners to work individually and creatively. The follow-up discussion and analyses allowing discovering the most helpful techniques and realize why these ways are effective. This Business English course is based on topics of great interest to everyone involved in international business of the XXI century. It is designed to maintain and develop students' ability to communicate in English in a wide variety of business situations. It also enlarges students' knowledge of the business world.

The basic academic and communications skills, practiced in this course involve:

1. Reading. The reading focus is based on authentic articles from British and American newspapers and books on civil engineering. The emphasis is laid on developing the following techniques: skimming, scanning and follow-up detailed study, including vocabulary development.

2. Summarizing. These skills are aimed at developing students' ability to briefly state the main points of a written text, summarizing information of the reading texts, case studies and presentations.

3. Discussion. Discussion activities are based on issues raised in Business Briefs, articles, and related topics. The discussion focus is aimed at improving fluency and developing an ability to express opinions and exchange views, using an appropriate style. Proficiency in spoken English is developed using different interrelated stages which combine role-play and group discussions as well as problem-solving in case studies. A set of practical tasks encourages students to provide creative solutions to authentic business problems.

4. Making a presentation. This skill is aimed at developing essential business communication competence providing the basics the students will need to effectively operate in a business environment.

5. Vocabulary development. Mastering vocabulary and achieving fluency is an integral part and basis for improving academic and communication skills. The practiced vocabulary consists of compulsory items of basic and specialist vocabulary (terminology and business jargon). All compulsory materials (Business Briefs and articles) are supplemented by a list of active vocabulary. The words and phrases are practiced in the vocabulary exercised and the activities mentioned above.

The activities aimed at practicing the skills mentioned above comprise:

Reading

1. Skim-reading, i.e. getting an overall idea of what the article is about.
2. Scanning, i.e. extracting some specific information.
3. Further comprehension check by asking questions and paraphrasing some sentences, idioms, phrases, etc.
4. Follow-up activities: exchanging opinions/agreement or disagreement/; sharing experiences or additional information, discussing related issues.

Summarizing

1. Formulating a gist of the article.
2. Formulating the main idea of each paragraph.
3. Devising a plan of the summary with key-words in writing.
4. Presenting an article in summary orally or in writing.

Vocabulary development

1. Studying the highlighted Key Words in the business brief and the article, which are needed to understand and discuss the topic.
2. Supplying definitions, synonyms, opposites for basic and special vocabulary.
3. Learning the useful vocabulary/active vocabulary in a specific situation by heart.
4. Developing vocabulary in follow-up exercises, based on the Key Words.
5. Creating individual private vocabulary list devoted to the topic of the Unit.
6. Speaking or writing a paragraph on a related topic using Active Vocabulary.

Transfer activities

1. Summarizing the information from the texts in each Unit with the use of the active vocabulary.

2. Making a presentation. This activity frequently includes an opportunity to use ideas based on students' own studies, work and experience.

3. Follow-up activities: exchanging opinions, sharing additional information.

Recommendation 1 for students

Reading and vocabulary development

In the recommendations below we describe in more detail the above-mentioned skills and the techniques used to develop them.

Skimming and scanning are useful tools when reading any type of texts: articles, business briefs, business documents, letters, reports, etc. Learners all too frequently read a foreign language text with a painstaking dedication to deciphering every word in a linear fashion, frequently spending more time looking up words in a dictionary than reading the text. The result is either an imperfect translation or incomprehension. However, if the learners follow the techniques suggested and do not read in more detail then the instructions recommend, they should cope well with the tasks and texts. Each article in this textbook has a number of tasks or exercises with it. The tasks are based on reading techniques or vocabulary study. Follow the instructions carefully: do not read the text in more detail than the instructions tell you to. Use the dictionary only:

a) if you decide a word is especially important;

b) if you cannot guess its meaning from the context.

There is never enough time to read everything. Reading techniques will help you to read better. This does not mean simply reading more quickly. It means spending a minimum of time getting maximum understanding from what you read.

Input	Output
Reading time	Understanding
(minimum)	(maximum)

Skimming

When we have a text to read it is often helpful and time-saving to skim-read it first. Skimming is reading quickly without attention to detail, with no special attention to unknown words. The objective of skimming is to identify quickly the main points in each paragraph. It is often not necessary to understand everything in a paragraph to understand the main points. The aim is getting an overall idea of what the text is about. We advise the following procedure for skimming (allow 1–2 minutes for the task).

Step 1: Look at an article quickly and formulate in your own words what the article is about.

Step 2: Specify which parts of the text you have used to skim-read after checking the results.

Step 3: Read the title, read the lead and the bold introductory text, the headings or just the first lines of the paragraphs if the lead and the headings are missing.

This will help you to understand what is and what is not in the article. This is important because by understanding the title we can began to think about what information we will find in the text and where we will find it. You also learn what you will not find in the article. Look at the length and any pictures or graphic materials, e.g. diagrams, tables, figures etc. Then try to predict: 'What will the article tell me?' or 'What information is probably in the article?'. Skimming technique is time-saving and it enables to sort out documents, letters, etc.

Scanning

Most articles of the course are followed or preceded by tasks on scanning that is scanning for specific information, e.g. true-false statements or sentences which are missing from some paragraphs of the text, multiple choice or others. Note that these assignments should be done without a dictionary and new unfamiliar words must be either ignored or guessed. When you scan a page or an article, it is not necessary to read everything to find what is of special interest to you. Look for words, pictures, figures, etc., which indicate what you need to know. This is scanning. The aim is extracting specific relevant information. We advise the following procedure for scanning (allow 5-7 minutes for this activity):

Step 1. Find proof for or against the statements in the text or read the complete version of the paragraph.

Step 2. Tackle the task and find ways of doing it within a time-limit.

Step 3. After checking on the results analyze how you did the assignment and what you should have done to perform more effectively.

A follow-up technique for skimming and scanning is identification of the main points in a text. It is particularly important if you have long articles where you may see the words Introduction, Summary or Conclusion. One way of identifying the main points in a text is to read only the first one or two paragraphs and the last one or two. Read only the Introduction or the first paragraph carefully. Then read the final part of the text or the last two paragraphs. The beginning and the end of long texts often have the most important information.

After skimming and scanning the article, look at specific words or a particular phrase which can help you to predict what is coming next. They signal what is coming. Examples are phrases like ‘The first thing to do is...’, ‘Secondly…’, ‘The last step is…’ Recognizing and understanding signaling

words and phrases can help you to read more efficiently and to understand the structure of the text.

Detailed reading (with vocabulary development)

When reading a text, try first to predict the meaning of the unknown word from the context. Using a dictionary to find the meaning of every word you don't know reduces the efficiency of your reading. It is important first to attempt to guess the meaning of words you do not know. Usually the context/the rest of the text and especially words and sentences close to the unfamiliar words will help you to decide on a possible meaning for them. Only look up a word if you have no idea what it means and you are confident that it is necessary to understand the word to get the information you need. Tasks on detailed reading include: answering questions on the articles, analyzing small details and paying attention to highlighted vocabulary.

This textbook offers a number of follow-up exercises aimed at vocabulary development. The assignments in the exercises include:

- Finding the words which mean...
- Matching the words with their definitions
- Paraphrasing
- Finding a synonym/ an opposite for/of...
- Translating sentences into Russian

While working individually on your home assignment find definitions of the words in an English-English dictionary, learn the words in the specific context or sentences, sum up the topic, using the active vocabulary, prepare a presentation on a topic related to the issues of the article or the business brief.

Recommendation 2 for students

Summarizing

When you are referring to a book or other source, you can either quote directly from it, or summarize what it says. A summary is a brief restatement of the main idea and the most important supporting points of a written text, lecture or a presentation, etc. The ability to write a clear and accurate summary is a valuable skill, useful not only when referring to a text produced by someone else, but when you have to reduce the length of your own writing.

In order to communicate information effectively you have to develop the ability to present ideas in brief, in a logical form and in clear and simple terms. Your summary should be

1. Clear, i.e. presented in a logical form, in simple terms.
2. Concise, i.e. brief, free from unnecessary details and repetition.
3. Complete, i.e. covering all most important points which support the main idea.
4. Correct, i.e. free from mistakes and wrong information.

There are no specific rules about the length of a summary. An effective summary is just long enough to present the main ideas and too short to include any unnecessary details.

Overall, the recommended proportion of a close summary may be 1 to 3 of the original.

Here are some suggestions regarding the procedure of summarizing which could be useful in making a summary of an article or any other written text.

Task 1: Understanding the main idea of the article.

Procedure: read the article fairly quickly to get a general understanding of the topic and issues (ideas) it deals with.

Task 2: Highlight the important points and key words in the text.

Procedure: Read the article more carefully to get a better understanding of the points each paragraph deals with.

Read paragraph by paragraph and mark in the margin what is relevant information which develops the topic, i.e. important points and what is irrelevant information which illustrates or enlarges on the topic, i.e. unnecessary details, specific examples.

Go through the paragraphs again to understand how the main points are connected, highlighting essential phrases /key words/ related to the important points.

Task 3: Writing one sentence of each paragraph of the summary.

Procedure: Use your marks in the text and formulate the main idea of each paragraph in your own words, i.e. write in simple terms what you have learnt from each paragraph in one sentence. You may use some of the key-words from the text, if they are effective.

Task 4: Choosing the most important points from the notes.

Procedure: Look through the list of the main ideas or points you have made/ your notes. Mark the points which go together, i.e. related to the same issue.

Cross out the points which give unnecessary detail (repetitions, deviations, specific examples). Check with the original to make sure you have included all the important information.

Task 5: Organizing the most important points in a logical order.

Procedure:

a) Organize your notes.

b) Combine the points which go together and decide the best order to put the points in.

c) Make a plan of your summary to organize your most important points in a logical order.

For example:

1. Cause and results.
2. Advantages and disadvantages.
3. Keys to success.

The order of presenting the most important points may be different from the order in which they appear in the article.

Task: Writing a gist.

Procedure: Formulate the gist of the article, i.e. the main idea it deals with in writing in one sentence. You may start with: 'The article deals with/ reports on/ outlines, etc.

When you present an article in a summary try to follow the rules below:

1.State the title, the author's name, the source from which the article is taken.

2.Start with the gist covering the main idea of the article.

3.Present the most important points in a logical order (on the basis of your plan), in simple and clear terms.

Try to avoid typical mistakes:

Don't:

- make an introduction or a conclusion;
- express your personal opinion or attitude;
- give additional information to support the important points;
- include all the names, figures and some examples from the article;
- analyze the facts or opinions from the article;
- make it too general;
- retell from beginning to end.

The rule of thumb for summarizing: accurately state the main idea and the most important points of the original.

Recommendation 3 for students

Making a presentation

Presentation is a talk delivered to a group of people. Making a presentation is one of essential business skills. The aim of this activity is developing an ability to deliver a talk to a group of people within an accepted standard format (5 stages below) and learning to use effective techniques of communicating with the audience, i.e. structuring and signposting the talk in other words, making it clear and easy to understand.

What are the characteristics of a good presentation in terms of content and the way the speaker presents the information, that is, appearance and style? One of the key points is Planning and Preparation. Special attention should be paid to Organization, Visual support, Voice, Content, Physical aspects (appearance, gesture, eye contact, etc.) Preparation steps include the following:

Decide on the objectives − what you want the talk to achieve. What is the purpose of your presentation: informative, persuasive, educational, etc.? Find out about the audience: their technical level, interests, experience, age,

responsibilities, required knowledge, size of audience and what they want to know, their expectations.

Content. Collect a number of key ideas, not to overload the audience, sort out information and organize it.

Structure of the presentation. The information should be clearly presented and easy to follow.

Practice the presentation – memorize it by heart, visit the room where the presentation will take place, check the equipment.

The key questions that a presenter can ask himself while planning and preparing a presentation are:

a) Will your talk be formal or informal?

b) What are the audience's expectations in terms of technical detail, expertise, etc.?

c) What is your audience's probable level of specialist knowledge? Are they experts or non-experts?

d) How long will your talk be: five minutes, 20 minutes, half a day, or longer?

e) What is your policy on questions? Will the audience interrupt orwill they ask questions afterwards? Will there be any discussion?

f)How will you help the audience to remember what you tell them?

The main points to be considered while planning can be grouped as follows:

Audience – expectations, technical knowledge, size, questions and /or discussion.

Speakers' competence – knowledge, presentation technique.

Content – what to include, length/depth (technical detail), number of key ideas.

Structure – sequence: beginning, middle, end, repetition, summarizing.

Delivery – style: formal/informal, enthusiasm/confidence, voice: variety/speed, pauses, body language: eye contact, gesture/movement, posture.

Visual aids – Power Point, type/design/clarity, relevance.

Practice – PC, script or notes.

Room – size/seating, equipment (does it work?), sound quality.

Language – simple/ clear, spelling, sentence length, structure signals.

Any presentation requires a strategy to help you reach your objectives. The aim is to deliver a message that is worth hearing to an audience who want to hear it. It is important to use various signals to help hold the audience's attention and make the information clear. One type of a signal is to introduce the topic with special phrases, such as: 'I'd like to outline...', 'There are two things to consider...' etc. Another signaling technique is to give a link between parts of a presentation. Say where one part finishes and another starts. Useful phrases are: 'That's all I have to say about...' or 'Let's move on to...' etc.

Next comes sequencing of the information, e.g.: the background, present situation and the future. Useful words are: first, next, then, later, finally.

Another technique which helps to emphasize key points is careful repetition, e.g. ‘As I have already said’, ‘I’d like to emphasize...’

The final point concerns timing and quantity of information. Every speaker needs to think about exactly how much information of a particular type a specific audience is likely to absorb, usually not more than three things in a five-minute speech.

Needless to say, that a successful presentation should be well-structured. Your presentation should have a clear, coherent structure and cover the points you wish to make in a logical order.

First of all, special attention should be paid to the beginning of a presentation, because in any presentation it is crucial. You should get the full attention of your audience during the first stage of your talk that is during the first moments that can make or break the presentation. Most presentations start with a brief introduction and end with a brief conclusion. Use the introduction to welcome your audience, introduce your topic/subject, outline the structure of your talk and provide guidelines on questions. Use the conclusion to summarize the main points of your presentation, thank the audience for their attention and invite questions. A good rule of thumb is 'to tell your audience what you are going to say, say it, then tell the audience what you have said'.

Now a few words about visual aids. Visual aids can make a presentation more interesting and easier to understand, but make sure they are appropriate and clear. Do not try to put too much information on each one, allow your audience time to absorb information.

Next goes voice quality and language. You must be clearly audible at all times. If you vary your intonation, your voice will be more interesting to listen to and you will be able to make your points more effectively. Pay attention to simplicity of the language. You must be sure that your audience understands you. Try to use simple constructions.

Conclusion

The recommendations given above are broad and general in nature. Depending on the level of your overall knowledge of English and your communication skills some activities may need to be practiced more often than others. Ask your instructor for more recommendations on the development of the specific skills that you need to improve.

UNIT II
CIVIL ENGINEERING

Civil engineering is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works like roads, bridges, canals, dams, and buildings. Civil engineering is the oldest engineering discipline after military engineering, and it was defined to distinguish non-military engineering from military engineering. It is traditionally broken into several sub-disciplines including environmental engineering, geotechnical engineering, structural engineering, transportation engineering, municipal or urban engineering, water resources engineering, materials engineering, coastal engineering, surveying, and construction engineering. Civil engineering takes place on all levels: in the public sector from municipal through to national governments, and in the private sector from individual homeowners through to international companies.

1.1. History of the civil engineering profession

Engineering has been an aspect of life since the beginnings of human existence. The earliest practice of civil engineering may have commenced between 4000 and 2000 BC in Ancient Egypt and Mesopotamia (Ancient Iraq) when humans started to abandon a nomadic existence, creating a need for the construction of shelter. During this time, transportation became increasingly important leading to the development of the wheel and sailing.

Until modern times there was no clear distinction between civil engineering and architecture, and the term engineer and architect were mainly geographical variations referring to the same person, often used interchangeably. The construction of Pyramids in Egypt (circa 2700–2500 BC) might be considered the first instances of large structure constructions. Other ancient historic civil engineering constructions include the Qanat water management system (older than 3000 years and longer than 71 km,) the Parthenon by Iktinos in Ancient Greece (447–438 BC), the Appian Way by Roman engineers (312 BC), the Great Wall of China (220 BC) and the stupas constructed in ancient Sri Lanka like the Jetavanaramaya and the extensive irrigation works in Anuradhapura. The Romans developed civil structures throughout their empire, including especially aqueducts, insular, harbors, bridges, dams and roads.

In the 18th century, the term civil engineering was coined to incorporate all things civilian as opposed to military engineering. The first self-proclaimed civil engineer was John Smeaton who constructed the Eddy stone lighthouse. In 1771 Smeaton and some of his colleagues formed the Smeatonian Society of Civil Engineers, a group of leaders of the profession who met informally over dinner. Though there was evidence of some technical meetings, it was little more than a social society.

In 1818 the Institution of Civil Engineers was founded in London, and in 1820 the eminent engineer Thomas Telford became its first president. The institution received a Royal Charter in 1828, formally recognizing civil engineering as a profession. Its charter defined civil engineering as the art of directing the great sources of power in nature for the use and convenience of man, as the means of production and of traffic in states, both for external and internal trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation and docks for internal intercourse and exchange, and in the construction of ports, harbors, moles, breakwaters and lighthouses, and in the art of navigation by artificial power for the purposes of commerce, and in the construction and application of machinery, and in the drainage of cities and towns.

The first private college to teach Civil Engineering in the United States was Norwich University founded in 1819 by Captain Alden Partridge. The first degree in Civil Engineering in the United States was awarded by Rensselaer Polytechnic Institute in 1835. The first such degree to be awarded to a woman was granted by Cornell University to Nora Stanton Blatch in 1905.

1.2. History of civil engineering

Civil engineering is the application of physical and scientific principles, and its history is intricately linked to advances in understanding of physics and mathematics throughout history. Because civil engineering is a wide ranging profession, including several separate specialized sub-disciplines, its history is linked to knowledge of structures, materials science, geography, geology, soils, hydrology, environment, mechanics and other fields.

Throughout ancient and medieval history most architectural design and construction was carried out by artisans, such as stonemasons and carpenters, rising to the role of master builder. Knowledge was retained in guilds and seldom supplanted by advances. Structures, roads and infrastructure that existed were repetitive, and increases in scale were incremental.

One of the earliest examples of a scientific approach to physical and mathematical problems applicable to civil engineering is the work of Archimedes in the 3rd century BC, including Archimedes Principle, which underpins our understanding of buoyancy, and practical solutions such as Archimedes' screw. Brahmagupta, an Indian mathematician, used arithmetic in the 7th century AD, based on Hindu-Arabic numerals, for excavation (volume) computations.

1.3. The civil engineer

Civil engineers typically possess an academic degree with a major in civil engineering. The length of study for such a degree is usually three to five years and the completed degree is usually designated as a Bachelor of Engineering, though some universities designate the degree as a Bachelor of Science. The degree generally includes units covering physics, mathematics, project

management, design and specific topics in civil engineering. Initially such topics cover most, if not all, of the sub-disciplines of civil engineering. Students then choose to specialize in one or more sub-disciplines towards the end of the degree. While an Undergraduate (BEng / BSc) Degree will normally provide successful students with industry accredited qualification, some universities offer postgraduate engineering awards (MEng / MSc) which allow students to further specialize in their particular area of interest within engineering.

In most countries, a Bachelor's degree in engineering represents the first step towards professional certification and the degree program itself is certified by a professional body. After completing a certified degree program the engineer must satisfy a range of requirements (including work experience and exam requirements) before being certified. Once certified, the engineer is designated the title of Professional Engineer (in the United States, Canada and South Africa), Chartered Engineer (in most Commonwealth countries), Chartered Professional Engineer (in Australia and New Zealand), or European Engineer (in much of the European Union). There are international engineering agreements between relevant professional bodies which are designed to allow engineers to practice across international borders.

The advantages of certification vary depending upon location. For example, in the United States and Canada only a licensed engineer may prepare, sign and seal, and submit engineering plans and drawings to a public authority for approval, or seal engineering work for public and private clients. This requirement is enforced by state and provincial legislation such as Quebec's Engineers Act. In other countries, no such legislation exists. In Australia, state licensing of engineers is limited to the state of Queensland. Practically all certifying bodies maintain a code of ethics that they expect all members to abide by or risk expulsion. In this way, these organizations play an important role in maintaining ethical standards for the profession. Even in jurisdictions where certification has little or no legal bearing on work, engineers are subject to contract law. In cases where an engineer's work fails he or she may be subject to the tort of negligence and, in extreme cases, the charge of criminal negligence. An engineer's work must also comply with numerous other rules and regulations such as building codes and legislation pertaining to environmental law.

1.4. Careers

There is no one typical career path for civil engineers. Most people who graduate with civil engineering degrees start with jobs that require a low level of responsibility, and as the new engineers prove their competence, they are trusted with tasks that have larger consequences and require a higher level of responsibility. However, within each branch of civil engineering career path options vary. In some fields and firms, entry-level engineers are put to work primarily monitoring construction in the field, serving as the "eyes and ears" of senior design engineers; while in other areas, entry-level engineers perform the

more routine tasks of analysis or design and interpretation. Experienced engineers generally do more complex analysis or design work, or management of more complex design projects, or management of other engineers, or into specialized consulting, including forensic engineering.

1.5. Sub-disciplines

In general, civil engineering is concerned with the overall interface of human created fixed projects with the greater world. General civil engineers work closely with surveyors and specialized civil engineers to fit and serve fixed projects within their given site, community and terrain by designing grading, drainage, pavement, water supply, sewer service, electric and communications supply, and land divisions. General engineers spend much of their time visiting project sites, developing community consensus, and preparing construction plans. General civil engineering is also referred to as site engineering, a branch of civil engineering that primarily focuses on converting a tract of land from one usage to another. Civil engineers typically apply the principles of geotechnical engineering, structural engineering, environmental engineering, transportation engineering and construction engineering to residential, commercial, industrial, and public works projects of all sizes and levels of construction.

1.6. Coastal engineering

Coastal engineering is concerned with managing coastal areas. In some jurisdictions the terms sea defense and coastal protection are used to mean, respectively, defense against flooding and erosion. The term coastal defense is the more traditional term, but coastal management has become more popular as the field has expanded to include techniques that allow erosion to claim land.

1.7. Construction engineering

Construction engineering involves planning and execution of the designs from transportation, site development, hydraulic, environmental, structural and geotechnical engineers. As construction firms tend to have higher business risk than other types of civil engineering firms, many construction engineers tend to take on a role that is more business-like in nature: drafting and reviewing contracts, evaluating logistical operations, and closely monitoring prices of necessary supplies.

1.8. Earthquake engineering

Earthquake engineering covers ability of various structures to withstand hazardous earthquake exposures at the sites of their particular location.

Earthquake engineering is a sub discipline of the broader category of structural engineering. The main objectives of earthquake engineering are:

Understand interaction of structures with the shaky ground.

Foresee the consequences of possible earthquakes.

Design, construct and maintain structures to perform at earthquake exposure up to the expectations and in compliance with building codes.

1.9. Environmental engineering

Environmental engineering deals with the treatment of chemical, biological, and/or thermal waste, the purification of water and air, and the remediation of contaminated sites, due to prior waste disposal or accidental contamination. Among the topics covered by environmental engineering are pollutant transport, water purification, waste water treatment, air pollution, solid waste treatment and hazardous waste management. Environmental engineers can be involved with pollution reduction, green engineering, and industrial ecology. Environmental engineering also deals with the gathering of information on the environmental consequences of proposed actions and the assessment of effects of proposed actions for the purpose of assisting society and policy makers in the decision making process.

Environmental engineering is the contemporary term for sanitary engineering, though sanitary engineering traditionally had not included much of the hazardous waste management and environmental remediation work covered by the term environmental engineering. Some other terms in use are public health engineering and environmental health engineering.

1.10. Geotechnical engineering

Geotechnical engineering is an area of civil engineering concerned with the rock and soil that civil engineering systems are supported by. Knowledge from the fields of geology, material science and testing, mechanics, and hydraulics are applied by geotechnical engineers to safely and economically design foundations, retaining walls, and similar structures. Environmental concerns in relation to groundwater and waste disposal have spawned a new area of study called geo environmental engineering where biology and chemistry are important.

Some of the unique difficulties of geotechnical engineering are the result of the variability and properties of soil. Boundary conditions are often well defined in other branches of civil engineering, but with soil, clearly defining these conditions can be impossible. The material properties and behavior of soil are also difficult to predict due to the variability of soil and limited investigation. This contrasts with the relatively well defined material properties of steel and concrete used in other areas of civil engineering. Soil mechanics, which describes the behavior of soil, is also complicated because soils exhibit nonlinear (stress-dependent) strength, stiffness, and dilatancy (volume change associated with application of shear stress).

1.11. Water resources engineering

Water resources engineering is concerned with the collection and management of water (as a natural resource). As a discipline it therefore combines hydrology, environmental science, meteorology, geology, conservation, and resource management. This area of civil engineering relates to

the prediction and management of both the quality and the quantity of water in both underground (aquifers) and above ground (lakes, rivers, and streams) resources. Water resource engineers analyze and model very small to very large areas of the earth to predict the amount and content of water as it flows into, through, or out of a facility. Although the actual design of the facility may be left to other engineers. Hydraulic engineering is concerned with the flow and conveyance of fluids, principally water. This area of civil engineering is intimately related to the design of pipelines, water supply network, drainage facilities (including bridges, dams, channels, culverts, levees, storm sewers), and canals. Hydraulic engineers design these facilities using the concepts of fluid pressure, fluid statics, fluid dynamics, and hydraulics, among others.

1.12. Materials engineering

Another aspect of civil engineering is materials science. Material engineering deals with ceramics such as concrete, mix asphalt concrete, metals Focus around increased strength, metals such as aluminum and steel, and polymers such as polymethylmethacrylate (PMMA) and carbon fibers.

Materials engineering also consists of protection and prevention like paints and finishes. Alloying is another aspect of material engineering, combining two different types of metals to produce a stronger metal.

1.13. Structural engineering

Structural engineering is concerned with the structural design and structural analysis of buildings, bridges, towers, flyovers, tunnels, off shore structures like oil and gas fields in the sea, and other structures. This involves identifying the loads which act upon a structure and the forces and stresses which arise within that structure due to those loads, and then designing the structure to successfully support and resist those loads. The loads can be self weight of the structures, other dead load, live loads, moving (wheel) load, wind load, earthquake load, load from temperature change etc. The structural engineer must design structures to be safe for their users and to successfully fulfill the function they are designed for (to be serviceable). Due to the nature of some loading conditions, sub-disciplines within structural engineering have emerged, including wind engineering and earthquake engineering.

Design considerations will include strength, stiffness, and stability of the structure when subjected to loads which may be static, such as furniture or self-weight, or dynamic, such as wind, seismic, crowd or vehicle loads, or transitory, such as temporary construction loads or impact. Other considerations include cost, constructability, safety, aesthetics and sustainability.

1.14. Surveying

Surveying is the process by which a surveyor measures certain dimensions that generally occur on the surface of the Earth. Surveying equipment, such as levels and theodolites, are used for accurate measurement of angular deviation,

horizontal, vertical and slope distances. With computerization, electronic distance measurement (EDM), total stations, GPS surveying and laser scanning have supplemented (and to a large extent supplanted) the traditional optical instruments. This information is crucial to convert the data into a graphical representation of the Earth's surface, in the form of a map. This information is then used by civil engineers, contractors and even realtors to design from, build on, and trade, respectively. Elements of a building or structure must be correctly sized and positioned in relation to each other and to site boundaries and adjacent structures. Although surveying is a distinct profession with separate qualifications and licensing arrangements, civil engineers are trained in the basics of surveying and mapping, as well as geographic information systems. Surveyors may also lay out the routes of railways, tramway tracks, highways, roads, pipelines and streets as well as position other infrastructures, such as harbors, before construction.

1.14.1. Land surveying

In the United States, Canada, the United Kingdom and most Commonwealth countries land surveying is considered to be a distinct profession. Land surveyors are not considered to be engineers, and have their own professional associations and licensing requirements. The services of a licensed land surveyor are generally required for boundary surveys (to establish the boundaries of a parcel using its legal description) and subdivision plans (a plot or map based on a survey of a parcel of land, with boundary lines drawn inside the larger parcel to indicate the creation of new boundary lines and roads), both of which are generally referred to as cadastral surveying.

1.14.2. Construction surveying

Construction surveying is generally performed by specialized technicians. Unlike land surveyors, the resulting plan does not have legal status. Construction surveyors perform the following tasks:

Survey existing conditions of the future work site, including topography, existing buildings and infrastructure, and even including underground infra-structure whenever possible;

Construction surveying (otherwise ‘lay-out’ or ‘setting-out’): to stake out reference points and markers that will guide the construction of new structures such as roads or buildings for subsequent construction;

Verify the location of structures during construction;

As-Built surveying: a survey conducted at the end of the construction project to verify that the work authorized was completed to the specifications set on plans.

1.15. Transportation engineering

Transportation engineering is concerned with moving people and goods efficiently, safely, and in a manner conducive to a vibrant community. This

involves specifying, designing, constructing, and maintaining transportation infrastructure which includes streets, canals, highways, rail systems, airports, ports, and mass transit. It includes areas such as transportation design, transportation planning, traffic engineering, and some aspects of urban engineering, queuing theory, pavement engineering, Intelligent Transportation System (ITS), and infrastructure management.

1.16. Municipal or urban engineering

Municipal engineering is concerned with municipal infrastructure. This involves specifying, designing, constructing, and maintaining streets, sidewalks, water supply networks, sewers, street lighting, municipal solid waste management and disposal, storage depots for various bulk materials used for maintenance and public works (salt, sand, etc.), public parks and bicycle paths. In the case of underground utility networks, it may also include the civil portion (conduits and access chambers) of the local distribution networks of electrical and telecommunications services. It can also include the optimizing of waste collection and bus service networks. Some of these disciplines overlap with other civil engineering specialties, however municipal engineering focuses on the coordination of these infrastructure networks and services, as they are often built simultaneously, and managed by the same municipal authority.

COMPREHENSION

1. Read the text; as your read, note the topic dealt with in each paragraph, underline the topic sentence, key words, and important facts as your go along.

2. Analyze how the facts are connected, how the topic of a paragraph is connected with that of a preceding paragraph.

3. Make a list of all points you are going to mention in your précis .Write them down using the necessary key terms. These notes must contain all the essential facts.

4. Write a précis of the text.

5. Sum up the main points presented in the text. Write the plan of the text in the form of statements.

6. Develop your plan into summary.

7. Make your summary coherent by a sparing use of connectors.

8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.

9. Prepare and deliver a 10-minute presentation about civil engineering.

UNIT III
CIVIL ENGINEER

While all civil engineers tend to spend at least some time working "on site", much of the modern civil engineering work is done in offices, working with plans or computers.

A civil engineer is a person who practices civil engineering; the application of planning, designing, constructing, maintaining, and operating infrastructures while protecting the public and environmental health, as well as improving existing infrastructures that have been neglected.

Originally, a civil engineer worked on public works projects and was contrasted with the military engineer, who worked on armaments and defenses. Over time, various branches of engineering have become recognized as distinct from civil engineering, including chemical engineering, mechanical engineering, and electrical engineering, while much of military engineering has been absorbed by civil engineering.

In some places, a civil engineer may perform land surveying; in others, surveying is limited to construction surveying, unless an additional qualification is obtained. On some U.S. military bases, the personnel responsible for building and grounds maintenance, such as grass mowing, are called civil engineers and are not required to meet any minimum educational requirements

2.1. Specialization

Civil engineers usually practice in a particular specialty, such as construction engineering, geotechnical engineering, structural engineering, land development, transportation engineering, hydraulic engineering, and environmental engineering.

Some civil engineers, particularly those working for government agencies, may practice across multiple specializations, particularly when involved in critical infrastructure development or maintenance.

2.2. Education and licensing

In most countries, a civil engineer will have graduated from a post-secondary school with a degree in civil engineering, which requires a strong background in mathematics and the physical sciences; this degree is typically a bachelor's degree, though many civil engineers study further to obtain masters, engineer, doctoral and post doctoral degrees. In many countries, civil engineers are subject to licensure. In jurisdictions with mandatory licensing, people who do not obtain a license may not call themselves civil engineers.

In Belgium, a civil engineer is a legally protected title applicable to graduates of the five-year engineering course of one of the six universities and the Royal Military Academy. Their specialty can be all fields of engineering: civil, structural, electrical, mechanical, chemical, physics and even computer science. This use of the title may cause confusion to the English speaker as the

Belgian civil engineer can have a specialty other than civil engineering. In fact, Belgians use the adjective civil as an opposition to military engineers.

The formation of the civil engineer has a strong mathematical and scientific base and is more theoretical in approach than the practical oriented industrial engineer educated in a five-year program at a polytechnic. Traditionally, students were required to pass an entrance exam on mathematics to start civil engineering studies. This exam was abolished in 2004 for the Flemish Community, but is still organized in the French Community.

In Scandinavian countries, civil engineer is a first professional degree, approximately equivalent to Master of Science in Engineering, and a protected title granted to students by selected institutes of technology. As in English the word has its origin in the distinction between civilian and military engineers, as in before the start of the 19th century only military engineers existed and the prefix civil was a way to separate those who had studied engineering in a regular University from their military counterparts. Today the degree spans over all fields within engineering, like civil engineering, computer science, electronics engineering, etc.

There is generally a slight difference between a Master of Science in Engineering degree and the Scandinavian civil engineer degree, the latter's program having closer ties with the industry's demands. A civil engineer is more well-known of the two; still the area of expertise remains obfuscated for most of the public. A noteworthy difference is the mandatory courses in mathematics and physics, regardless of the equivalent master degree, e.g. computer science.

Although a college engineer is roughly equivalent to a Bachelor of Science in Scandinavia, to become a civil engineer one often has had to do up to one extra year of overlapping studies compared to attaining a BSc / MSc combination. This is because the higher educational system is not fully adapted to the international standard graduation system, since it is treated as a professional degree. Today this is starting to change due to the Bologna process.

A Scandinavian civil engineer will in international contexts commonly call himself Master of Science in Engineering and will occasionally wear an engineering class ring. At the Norwegian Institute of Technology (now the Norwegian University of Science and Technology), the tradition with a NTH Ring goes back to 1914, before the Canadian iron ring.

In Norway the title ‘Sivilingeniør’ will no longer be issued after 2007, and have been replaced with ‘Master i teknologi’. In the English translation of the diploma, the title will be ‘Master of Science’, since ‘Master of Technology’ is not an established title in the English-speaking world. The extra overlapping year of studies has also been abolished with this change to make Norwegian degrees more equal to their international counterparts.

In Spain, a civil engineering degree can be obtained after four years of study in the various branches of mathematics, physics, mechanics, etc. The earned

degree is called Grado en Ingeniería Civil. Further studies at a Graduate school include Master's and doctoral degrees.

Before the current situation, that is, before the implementation of Bologna Process in 2010, a Civil Engineering degree in Spain could be obtained after three or five years of study. In the first case, the earned degree was called Ingeniero Técnico de Obras Públicas (ITOP), literally translated as 'Public Works Engineer'; at the second case, the academic earned degree was called Ingeniero de Caminos, Canales y Puertos (often shortened to Ingeniero de Caminos or ICCP), that literally means 'Roads, Canals and Harbors Engineer', though civil engineers in Spain practice in the same fields as civil engineers do elsewhere.

The first Spanish Civil Engineering School was the Escuela Especial de Ingenieros de Caminos y Canales (now called Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos), established in 1802 in Madrid, followed by the Escuela Especial de Ayudantes de Obras Públicas (now called Escuela Universitaria de Ingeniería Técnica de Obras Públicas de la Universidad Politécnica de Madrid), founded in 1854 in Madrid. Both schools now belong to the Technical University of Madrid.

In Spain, a Civil Engineer has the technical and legal ability to design projects of any branch, so any Spanish Civil Engineer can oversee projects about structures, buildings (except residential structures which are reserved for architects), foundations, hydraulics, the environment, transportation, urbanism, etc.

In Spain, Mechanical and Electrical engineering tasks are included under the Industrial engineering degree.

In the United Kingdom a chartered civil engineer (known as certified or professional engineer in other countries) is a member of the Institution of Civil Engineers, and has also passed charter ship exams. However a non-chartered civil engineer may be a member of the Institution of Civil Engineers or the Institution of Civil Engineering Surveyors. The description 'Civil Engineer' is not restricted to members of any particular professional organization although 'Chartered Civil Engineer' is.

In the United States, civil engineers are typically employed by municipalities, construction firms, consulting engineering firms, architect/engineer firms, state governments, and the federal government. Each State requires engineers who offer their services to the public to be licensed by the State. Licensure is obtained by meeting specified education, examination, and work experience requirements. Specific requirements vary by State. Typically licensed engineers must graduate from an ABET-accredited University or College engineering program, pass the Fundamentals of Engineering exam, obtain several years of engineering experience under the supervision of a licensed engineer, then pass the Principles and Practice of

Engineering Exam. After completing these steps and the granting of licensure by a State Board, engineers may use the title ‘Professional Engineer’ or PE in advertising and documents.

2.3. Professional associations

The ASCE (American Society of Civil Engineers) represents more than 140,000 members of the civil engineering profession worldwide. Official members of the ASCE must hold a bachelor's degree from an accredited civil engineering program and be a licensed professional engineer or have five years responsible charge of engineering experience. Most civil engineers join this organization to be updated of current news, projects, and methods (such as sustainability) related to civil engineering; as well as contribute their expertise and knowledge to other civil engineers and students obtaining their civil engineering degree.

The ICE (Institution of Civil Engineers) founded in 1818, represents more than 80,000 members of the civil engineering profession worldwide. Its commercial arm, Thomas Telford Ltd, provides training, recruitment, publishing and contract services.

COMPREHENSION

1. Read the text; as your read, note the topic dealt with in each paragraph, underline the topic sentence, key words, and important facts as your go along.
2. Analyze how the facts are connected, how the topic of a paragraph is connected with that of a preceding paragraph.
3. Make a list of all points you are going to mention in your précis .Write them down using the necessary key terms. These notes must contain all the essential facts.
4. Write a précis of the text.
5. Sum up the main points presented in the text. Write the plan of the text in the form of statements.
6. Develop your plan into summary.
7. Make your summary coherent by a sparing use of connectors.
8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.
9. Prepare and deliver a 10-minute presentation about civil engineers in different countries.

UNIT IV
BUILDING MATERIALS

A building material is any material which is used for a construction purpose. Many naturally occurring substances, such as clay, sand, wood and rocks, even

twigs and leaves have been used to construct buildings. Apart from naturally occurring materials, many man-made products are in use, some more and some less synthetic. The manufacture of building materials is an established industry in many countries and the use of these materials is typically segmented into specific specialty trades, such as carpentry, plumbing, roofing and insulation work. They provide the make-up of habitats and structures including homes.

The tent is the home of choice among nomadic groups all over the world. Two well known types include the conical teepee and the circular yurt. It has been revived as a major construction technique with the development of tensile architecture and synthetic fabrics. Modern buildings can be made of flexible material such as fabric membranes, and supported by a system of steel cables; rigid or internal (air pressure).

3.1. Mud and clay

The amount of each material used leads to different styles of buildings. The deciding factor is usually connected with the quality of the soil being used. Larger amounts of clay usually mean using the cob/adobe style, while low clay soil is usually associated with sod building. The other main ingredients include more or less sand/gravel and straw/grasses. Rammed earth is both an old and newer take on creating walls, once made by compacting clay soils between planks by hand; now forms and mechanical pneumatic compressors are used.

Soil and especially clay is good thermal mass; it is very good at keeping temperatures at a constant level. Homes built with earth tend to be naturally cool in the summer heat and warm in cold weather. Clay holds heat or cold, releasing it over a period of time like stone. Earthen walls change temperature slowly, so artificially raising or lowering the temperature can use more resources than in say a wood built house, but the heat/coolness stays longer.

Peoples building with mostly dirt and clay, such as cob, sod, and adobe, resulted in homes that have been built for centuries in western and northern Europe as well as the rest of the world, and continue to be built, though on a smaller scale. Some of these buildings have remained habitable for hundreds of years.

3.2. Wood

A natural material for building dwellings for thousands of years, wood was also used to make Churches in the past. The main problems with wood structures are fire risk and durability. Wood is an aesthetically pleasing material that never goes out of trend completely, though the current popularity of plastic is taking its place in many construction sites.

3.3. Rock

Rock structures have existed for as long as history can recall. It is the longest lasting building material available, and is usually readily available. There are many types of rock throughout the world all with differing attributes that make them better or worse for particular uses. Rock is a very dense material

so it gives a lot of protection too, its main draw-back as a material is its weight and awkwardness. Its energy density is also considered a big draw-back, as stone is hard to keep warm without using large amounts of heating resources.

Dry stone walls have been built for as long as humans have put one stone on top of another. Eventually different forms of mortar were used to hold the stones together, cement being the most commonplace now.

The granite-strewn uplands of Dart moor National Park, United Kingdom, for example, provided ample resources for early settlers. Circular huts were constructed from loose granite rocks throughout the Neolithic and early Bronze Age, and the remains of an estimated 5,000 can still be seen today. Granite continued to be used throughout the medieval period (see Dart moor longhouse) and into modern times. Slate is another stone type, commonly used as roofing material in the United Kingdom and other parts of the world where it is found.

Mostly stone buildings can be seen in most major cities, some civilizations built entirely with stone such as the Pyramids in Egypt, the Aztec pyramids and the remains of the Inca civilization.

3.4. Thatch

Thatch is one of the oldest of building materials known; grass is a good insulator and easily harvested. Many African tribes have lived in homes made completely of grasses year round. In Europe, thatch roofs on homes were once prevalent but the material fell out of favor as industrialization and improved transport increased the availability of other materials. Today, though, the practice is undergoing a revival. In the Netherlands, for instance, many new buildings have thatched roofs with special ridge tiles on top.

3.5. Brush

Brush structures are built entirely from plant parts and are generally found in tropical and sub-tropical areas, such as rainforests, where very large leaves can be used in the building. Native Americans use them for resting and living in, too. These are built mostly with branches, twigs and leaves, and bark, similar to a beaver's lodge. These were variously named wiki ups, lean tos, and so forth.

3.6. Ice

Ice was used by the Inuit for igloos, but has also been used for ice hotels as a tourist attraction in northern areas that might not otherwise see many winter tourists.

3.7. Sand

Sand is used with cement and sometimes lime to make mortar for masonry work and plaster. Sand is used as a part of the concrete mix.

3.8. Concrete

Concrete is a composite building material made from the combination of aggregate and a binder such as cement. The most common form of concrete is Portland cement concrete, which consists of mineral aggregate (generally gravel and sand), Portland cement and water. After mixing, the cement hydrates and

eventually hardens into a stone-like material. When used in the generic sense, this is the material referred to by the term concrete.

For a concrete construction of any size, as concrete has a rather low tensile strength, it is generally strengthened using steel rods or bars (known as rebar). This strengthened concrete is then referred to as reinforced concrete. In order to minimize any air bubbles that would weaken the structure, a vibrator is used to eliminate any air that has been entrained when the liquid concrete mix is poured around the ironwork. Concrete has been the predominant building material in this modern age due to its longevity, formability, and ease of transport. Recent advancements, such as Insulating concrete forms, combine the concrete forming and other construction steps (installation of insulation). All materials must be taken in required proportions as described in standards.

3.9. Metal

Metal is used as structural framework for larger buildings such as skyscrapers, or as an external surface covering. There are many types of metals used for building. Steel is a metal alloy whose major component is iron, and is the usual choice for metal structural building materials. It is strong, flexible, and if refined well and/or treated lasts a long time. Corrosion is metal's prime enemy when it comes to longevity.

The lower density and better corrosion resistance of aluminum alloys and tin sometimes overcome their greater cost. Brass was more common in the past, but is usually restricted to specific uses or specialty items today.

Metal figures quite prominently in prefabricated structures such as the Quonset hut, and can be seen used in most cosmopolitan cities. It requires a great deal of human labor to produce metal, especially in the large amounts needed for the building industries.

Other metals used include titanium, chrome, gold, and silver. Titanium can be used for structural purposes, but it is much more expensive than steel. Chrome, gold, and silver are used as decoration, because these materials are expensive and lack structural qualities such as tensile strength or hardness.

3.10. Glass

Glassmaking is considered an art form as well as an industrial process or material.

Clear windows have been used since the invention of glass to cover small openings in a building. They provided humans with the ability to both let light into rooms while at the same time keeping inclement weather outside. Glass is generally made from mixtures of sand and silicate, in a very hot fire stove called a kiln and is very brittle. Very often additives are added to the mixture when making to produce glass with shades of colors or various characteristics (such as bulletproof glass, or light emittance).

The use of glass in architectural buildings has become very popular in the modern culture. Glass ‘curtain walls’ can be used to cover the entire facade of a

building. They can also be used to span over a wide roof structure in a ‘space frame’. These uses though require some sort of frame to hold sections of glass together, as glass by itself is too brittle and would require an overly large kiln to be used to span such large areas.

3.11. Plastic

The term ‘plastics’ covers a range of synthetic or semi-synthetic organic condensation or polymerization products that can be molded or extruded into objects or films or fibers. Their name is derived from the fact that in their semi-liquid state they are malleable, or have the property of plasticity. Plastics vary immensely in heat tolerance, hardness, and resiliency. Combined with this adaptability, the general uniformity of composition and lightness of plastics ensures their use in almost all industrial applications today.

3.12. Foam

More recently synthetic polystyrene or polyurethane foam has been used in combination with structural materials, such as concrete. It is light weight, easily shaped and an excellent insulator. It is usually used as part of a structural insulated panel where the foam is sandwiched between wood and cement or insulating concrete forms, where concrete is sandwiched between two layers of foam.

3.13. Cement composites

Cement bonded composites are made of hydrated cement paste that binds wood or alike particles or fibers to make pre-cast building components. Various fibrous materials including paper and fiberglass have been used as binders.

Wood and natural fibers are composed of various soluble organic compounds like carbohydrates, glycosides and phenolics. These compounds are known to retard cement setting. Therefore, before using a wood in making cement boned composites, its compatibility with cement is assessed.

Wood-cement compatibility is the ratio of a parameter related to the property of a wood-cement composite to that of a neat cement paste. The compatibility is often expressed as a percentage value. To determine wood-cement compatibility, methods based on different properties are used, such as, hydration characteristics, strength, interfacial bond and morphology. Various methods are used by researchers such as the measurement of hydration characteristics of a cement aggregate mix; the comparison of the mechanical properties of cement aggregate mixes and the visual assessment of micro structural properties of the wood cement mixes. It has been found that the hydration test by measuring the change in hydration temperature with time is the most convenient method. Recently, Karade et al have reviewed these methods of compatibility assessment and suggested a method based on the ‘maturity concept’ i.e. taking in consideration both time and temperature of cement hydration reaction.

3.14. Modern industry

Modern building is a multibillion dollar industry, and the production and harvesting of raw materials for building purposes is on a world wide scale. Often being a primary governmental and trade key point between nations. Environmental concerns are also becoming a major world topic concerning the availability and sustainability of certain materials, and the extraction of such large quantities needed for the human habitat.

3.15. Building products

In the market place the term building products often refers to the ready-made particles/sections, made from various materials that are fitted in architectural hardware and decorative hardware parts of a building. The list of building products exclusively exclude the building materials, which are used to construct the building architecture and supporting fixtures like windows, doors, cabinets, etc. Building products do not make any part of a bajingo rather they support and make them working in a modular fashion.

It also can refer to items used to put such hardware together such as glues, caulking, paint, and anything else bought for the purpose of constructing a building.

COMPREHENSION

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6. Develop your plan into summary.
7. Make your summary coherent by a sparing use of connectors.
8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.
9. Prepare and deliver a 10-minute presentation about various types of building materials.

UNIT V
AUTOMATIVE ENGINEERING

Modern automotive engineering, along with aerospace engineering and marine engineering, is a branch of vehicle engineering, incorporating elements of mechanical, electrical, electronic, software and safety engineering as applied to the design, manufacture and operation of motorcycles, automobiles, buses and trucks and their respective engineering subsystems.

4.1. Product Engineering.

Some of the engineering attributes/disciplines that are of importance to the automotive engineer:

Safety Engineering: Safety Engineering is the assessment of various crash scenarios and their impact on the vehicle occupants. These are tested against very stringent governmental regulations. Some of these requirements include: Seat belt and air bag functionality, front and side impact testing, and resistance to rollover. Assessments are done with various methods and tools: Computer crash simulation (typically Finite element analysis), crash test dummies, partial system sled and full vehicle crashes.

Visualization of how a car deforms in an asymmetrical crash using finite element analysis.

Fuel Economy/Emissions: Fuel economy is the measured fuel efficiency of the vehicle in miles per gallon or liters per 100 km. Emissions testing the measurement of the vehicles emissions: hydrocarbons, nitrogen oxides (NO), carbon monoxide (CO), carbon dioxide (CO2), and evaporative emissions.

Vehicle Dynamics: Vehicle dynamics is the vehicle's response of the following attributes: ride, handling, steering, braking, and traction. Design of the chassis systems of suspension, steering, braking, structure (frame), wheels and tires, and traction control are highly leveraged by the Vehicle Dynamics engineer to deliver the Vehicle Dynamics qualities desired.

NVH Engineering (Noise, Vibration, and Harshness): NVH is the customer's feedback (both tactile (feel) and audible (hear)) from the vehicle. While sound can be interpreted as a rattle, squeal, or hoot; a tactile response can be seat vibration, or a buzz in the steering wheel. This feedback is generated by components either rubbing, vibrating or rotating. NVH response can be classified in various ways: power train NVH, road noise, wind noise, component noise, and squeak and rattle. Note, there are both good and bad NVH qualities. The NVH engineer works to either eliminate bad NVH, or change the ‘bad NVH’ to good (i.e. exhaust tones).

Performance: Performance is a measurable and testable value of a vehicles ability to perform in various conditions. Performance can be considered in a wide variety of tasks, but it's generally associated with how quickly a car can accelerate (i.e. 0–60 mph, 1/4 mile, trap speed, top speed, etc), how short and

quickly a car can come to a complete stop from a set distance (i.e. 70-0 mph), how much g-force a car can generate without losing grip, recorded trap lap times, cornering speed, brake fade, etc. Performance can also reflect the amount of control in inclement weather (snow, ice, rain).

Shift Quality: Shift Quality is the driver's perception of the vehicle to an automatic transmission shift event. This is influenced by the power train (engine, transmission), and the vehicle (driveline, suspension, engine and power train mounts, etc). Shift feel is both a tactile (feel) and audible (hear) response of the vehicle. Shift Quality is experienced as various events: Transmission shifts are felt as an upshift at acceleration (1-2), or a downshift maneuver in passing (4-2). Shift engagements of the vehicle are also evaluated, as in Park to Reverse, etc.

Durability/Corrosion engineering: Durability and Corrosion engineering is the evaluation testing of a vehicle for its useful life. This includes mileage accumulation, severe driving conditions, and corrosive salt baths.

Package/Ergonomics Engineering: Package Engineering is a discipline that designs/analyzes the occupant accommodations (seat roominess), ingress/egress to the vehicle, and the driver's field of vision (gauges and windows). The Package Engineer is also responsible for other areas of the vehicle like the engine compartment, and the component to component placement. Ergonomics is the discipline that assesses the occupant's access to the steering wheel, pedals, and other driver/passenger controls.

Climate Control: Climate Control is the customer's impression of the cabin environment and level of comfort related to the temperature and humidity. From the windshield defrosting, to the heating and cooling capacity, all vehicle seating positions are evaluated to a certain level of comfort.

Drivability: Drivability is the vehicle's response to general driving conditions. Cold starts and stalls, RPM dips, idle response, launch hesitations and stumbles, and performance levels.

Cost: The cost of a vehicle program is typically split into the effect on the variable cost of the vehicle, and the up-front tooling and fixed costs associated with developing the vehicle. There are also costs associated with warranty reductions, and marketing.

Program timing: To some extent programs are timed with respect to the market, and also to the production schedules of the assembly plants. Any new part in the design must support the development and manufacturing schedule of the model.

Assembly Feasibility: It is easy to design a module that is hard to assemble, either resulting in damaged units, or poor tolerances. The skilled product development engineer works with the assembly/manufacturing engineers so that the resulting design is easy and cheap to make and assemble, as well as delivering appropriate functionality and appearance.

4.2. Development Engineer.

A development engineer is a job function within automotive engineering, in which the development engineer has the responsibility for coordinating delivery of the engineering attributes of a complete automobile (bus, car, truck, van, SUV, etc.) as dictated by the automobile manufacturer, governmental regulations and the customer who buys the product.

Much like the systems engineer, the development engineer is concerned with the interactions of all systems in the complete automobile. While there are multiple components and systems in an automobile that have to function as designed, they must also work in harmony with the complete automobile. As an example, the brake system's main function is to provide braking functionality to the automobile. Along with this, it must also provide an acceptable level of: pedal feel (spongy, stiff), brake system ‘noise’ (squeal, shudder, etc), and interaction with the ABS (anti-lock braking system)

Another aspect of the development engineer's job is a trade-off process required to deliver all the automobile attributes at a certain acceptable level. An example of this is the trade-off between engine performance and fuel economy. While some customers are looking for maximum power from their engine, the automobile is still required to deliver an acceptable level of fuel economy. From the engine's perspective, these are opposing requirements. Engine performance is looking for maximum displacement (bigger, more power), while fuel economy is looking for a smaller displacement engine (e.g.1.4L vs. 5.4L). The engine size, though is not the only contributing factor to fuel economy and automobile performance. Other attributes include: automobile weight, aerodynamic drag, transmission gearing, emission control devices, and tires.

The development engineer is also responsible for organizing automobile level testing, validation, and certification. Components and systems are designed and tested individually by the product engineer. The final evaluation though, has to be conducted at the automobile level to evaluate system to system interactions. As an example, the audio system (radio) needs to be evaluated at the automobile level. Interaction with other electronic components can cause interference. Heat dissipation of the system and ergonomic placement of the controls need to be evaluated. Sound quality in all seating positions needs to be provided at acceptable levels.

There are also other automotive engineers:

The aerodynamics engineers will often give guidance to the styling studio so that the shapes they design are aerodynamic, as well as attractive.

Body engineers will also let the studio know if it is feasible to make the panels for their designs.

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8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.

9. Prepare and deliver a 10-minute presentation about automotive engineering.

UNIT VI
WATER RESOURCES

Water resources are sources of water that are useful or potentially useful. Uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually all of these human uses require fresh water.

97 % of the water on the Earth is salt water. Only three percent is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is found mainly as groundwater, with only a small fraction present above ground or in the air.

Fresh water is a renewable resource, yet the world's supply of clean, fresh water is steadily decreasing. Water demand already exceeds supply in many parts of the world and as the world population continues to rise, so too does the water demand. Awareness of the global importance of preserving water for ecosystem services has only recently emerged as, during the 20th century, more than half the world’s wetlands have been lost along with their valuable environmental services for Water Education. The framework for allocating water resources to water users (where such a framework exists) is known as water rights

5.1. Sources of fresh water

Surface water is water in a river, lake or fresh water wetland. Surface water is naturally replenished by precipitation and naturally lost through discharge to the oceans, evaporation, vapor transpiration and sub-surface seepage.

Although the only natural input to any surface water system is precipitation within its watershed, the total quantity of water in that system at any given time is also dependent on many other factors. These factors include storage capacity in lakes, wetlands and artificial reservoirs, the permeability of the soil beneath these storage bodies, the runoff characteristics of the land in the watershed, the timing of the precipitation and local evaporation rates. All of these factors also affect the proportions of water lost.

Human activities can have a large and sometimes devastating impact on these factors. Humans often increase storage capacity by constructing reservoirs and decrease it by draining wetlands. Humans often increase runoff quantities and velocities by paving areas and channelizing stream flow.

The total quantity of water available at any given time is an important consideration. Some human water users have an intermittent need for water. For example, many farms require large quantities of water in the spring, and no water at all in the winter. To supply such a farm with water, a surface water system may require a large storage capacity to collect water throughout the year and release it in a short period of time. Other users have a continuous need for water, such as a power plant that requires water for cooling. To supply such a power plant with water, a surface water system only needs enough storage capacity to fill in when average stream flow is below the power plant's need.

Nevertheless, over the long term the average rate of precipitation within a watershed is the upper bound for average consumption of natural surface water from that watershed.

Natural surface water can be augmented by importing surface water from another watershed through a canal or pipeline. It can also be artificially augmented from any of the other sources listed here; however, in practice the quantities are negligible. Humans can also cause surface water to be ‘lost’ (i.e. become unusable) through pollution.

Brazil is the country estimated to have the largest supply of fresh water in the world, followed by Russia and Canada.

5.2. Under river flow

Throughout the course of a river, the total volume of water transported downstream will often be a combination of the visible free water flow together with a substantial contribution flowing through sub-surface rocks and gravels that underlie the river and its floodplain called the hyporheic zone. For many rivers in large valleys, this unseen component of flow may greatly exceed the visible flow. The hyporheic zone often forms a dynamic interface between surface water and true ground-water receiving water from the ground water

when aquifers are fully charged and contributing water to ground-water when ground waters are depleted. This is especially significant in karsts areas where pot-holes and underground rivers are common.

5.3. Ground water

Sub-surface water, or groundwater, is fresh water located in the pore space of soil and rocks. It is also water that is flowing within aquifers below the water table. Sometimes it is useful to make a distinction between sub-surface water that is closely associated with surface water and deep sub-surface water in an aquifer (sometimes called ‘fossil water’).

Sub-surface water can be thought of in the same terms as surface water: inputs, outputs and storage. The critical difference is that due to its slow rate of turnover, sub-surface water storage is generally much larger compared to inputs than it is for surface water. This difference makes it easy for humans to use sub-surface water unsustainably for a long time without severe consequences. Nevertheless, over the long term the average rate of seepage above a sub-surface water source is the upper bound for average consumption of water from that source.

The natural input to sub-surface water is seepage from surface water. The natural outputs from sub-surface water are springs and seepage to the oceans.

If the surface water source is also subject to substantial evaporation, a sub-surface water source may become saline. This situation can occur naturally under endorheic bodies of water, or artificially under irrigated farmland. In coastal areas, human use of a sub-surface water source may cause the direction of seepage to ocean to reverse which can also cause soil salinization. Humans can also cause sub-surface water to be ‘lost’ (i.e. become unusable) through pollution. Humans can increase the input to a sub-surface water source by building reservoirs or detention ponds.

5.4. Desalination

Desalination is an artificial process by which saline water (generally sea water) is converted to fresh water. The most common desalination processes are distillation and reverse osmosis. Desalination is currently expensive compared to most alternative sources of water, and only a very small fraction of total human use is satisfied by desalination. It is only economically practical for high-valued uses (such as household and industrial uses) in arid areas. The most extensive use is in the Persian Gulf.

5.4. Frozen water

Several schemes have been proposed to make use of icebergs as a water source, however to date this has only been done for novelty purposes. Glacier runoff is considered to be surface water.

The Himalayas, which are often called "The Roof of the World", contain some of the most extensive and rough high altitude areas on Earth as well as the greatest area of glaciers and permafrost outside of the poles. Ten of Asia’s

largest rivers flow from there and more than a billion people's livelihoods depend on them. To complicate matters, temperatures are rising more rapidly here than the global average. In Nepal the temperature has risen with 0.6 degree over the last decade, whereas the global warming has been around 0.7 over the last hundred years.

5.5. Uses of fresh water

Uses of fresh water can be categorized as consumptive and non-consumptive (sometimes called 'renewable'). A use of water is consumptive if that water is not immediately available for another use. Losses to sub-surface seepage and evaporation are considered consumptive, as is water incorporated into a product (such as farm produce). Water that can be treated and returned as surface water, such as sewage, is generally considered non-consumptive if that water can be put to additional use. Water use in power generation and industry is generally described using an alternate terminology, focusing on separate measurements of withdrawal and consumption. Withdrawal describes the removal of water from the environment, while consumption describes the conversion of fresh water into some other form, such as atmospheric water vapor or contaminated waste water.

5.6. Agricultural water use

It is estimated that 69 % of worldwide water use is for irrigation, with 15-35 % of irrigation withdrawals being unsustainable.[5] It takes around 3,000 liters of water, converted from liquid to vapor, to produce enough food to satisfy one person's daily dietary need. This is a considerable amount, when compared to that required for drinking, which is between two and five liters. To produce food for the now over 7 billion people who inhabit the planet today requires the water that would fill a canal ten meters deep, 100 meters wide and 7.1 million kilometers long – that's enough to circle the globe 180 times.

Fifty years ago, the common perception was that water was an infinite resource. At this time, there was fewer than half the current number of people on the planet. People were not as wealthy as today, consumed fewer calories and ate less meat, so less water was needed to produce their food. They required a third of the volume of water we presently take from rivers. Today, the competition for water resources is much more intense. This is because there are now seven billion people on the planet, their consumption of water-thirsty meat and vegetables is rising, and there is increasing competition for water from industry, urbanization bio fuel crops, and water reliant food items. In future, even more water will be needed to produce food because the Earth's population is forecast to rise to 9 billion by 2050. An additional 2.5 or 3 billion people, choosing to eat fewer cereals and more meat and vegetables could add an additional five million kilometers to the virtual canal mentioned above.

An assessment of water management in agriculture was conducted in 2007 by the International Water Management Institute in Sri Lanka to see if the world had sufficient water to provide food for its growing population. It assessed the

current availability of water for agriculture on a global scale and mapped out locations suffering from water scarcity. It found that a fifth of the world's people, more than 1.2 billion, live in areas of physical water scarcity, where there is not enough water to meet all demands. One third of the world's population does not have access to clean drinking water, which is more than 2.3 billion people. A further 1.6 billion people live in areas experiencing economic water scarcity, where the lack of investment in water or insufficient human capacity makes it impossible for authorities to satisfy the demand for water. The report found that it would be possible to produce the food required in future, but that continuation of today's food production and environmental trends would lead to crises in many parts of the world. To avoid a global water crisis, farmers will have to strive to increase productivity to meet growing demands for food, while industry and cities find ways to use water more efficiently.

In some areas of the world irrigation is necessary to grow any crop at all, in other areas it permits more profitable crops to be grown or enhances crop yield. Various irrigation methods involve different trade-offs between crop yield, water consumption and capital cost of equipment and structures. Irrigation methods such as furrow and overhead sprinkler irrigation are usually less expensive but are also typically less efficient, because much of the water evaporates, runs off or drains below the root zone. Other irrigation methods considered to be more efficient include drip or trickle irrigation, surge irrigation, and some types of sprinkler systems where the sprinklers are operated near ground level. These types of systems, while more expensive, usually offer greater potential to minimize runoff, drainage and evaporation. Any system that is improperly managed can be wasteful all methods have the potential for high efficiencies under suitable conditions, appropriate irrigation timing and management. Some issues that are often insufficiently considered are saltinization of sub-surface water and contaminant accumulation leading to water quality declines.

As global populations grow, and as demand for food increases in a world with a fixed water supply, there are efforts under way to learn how to produce more food with less water, through improvements in irrigation[9] methods[10] and technologies, agricultural water management, crop types, and water monitoring. Aquaculture is a small but growing agricultural use of water. Freshwater commercial fisheries may also be considered as agricultural uses of water, but have generally been assigned a lower priority than irrigation (e.g. the Aral Sea and the Pyramid Lake).

5.7. Industrial water use

It is estimated that 22 % of worldwide water use is industrial. Major industrial users include hydroelectric dams, thermoelectric power plants, which use water for cooling, ore and oil refineries, which use water in chemical processes, and manufacturing plants, which use water as a solvent. Water

withdrawal can be very high for certain industries, but consumption is generally much lower than that of agriculture.

Water is used in renewable power generation. Hydroelectric power derives energy from the force of water flowing downhill, driving a turbine connected to a generator. This hydroelectricity is a low-cost, non-polluting, renewable energy source. Significantly, hydroelectric power can also be used for load following unlike most renewable energy sources which are intermittent. Ultimately, the energy in a hydroelectric power plant is supplied by the sun. Heat from the sun evaporates water, which condenses as rain in higher altitudes and flows downhill. Pumped-storage hydroelectric plants also exist, which use grid electricity to pump water uphill when demand is low, and use the stored water to produce electricity when demand is high.

Hydroelectric power plants generally require the creation of a large artificial lake. Evaporation from this lake is higher than evaporation from a river due to the larger surface area exposed to the elements, resulting in much higher water consumption. The process of driving water through the turbine and tunnels or pipes also briefly removes this water from the natural environment, creating water withdrawal. The impact of this withdrawal on wildlife varies greatly depending on the design of the power plant. Pressurized water is used in water blasting and water jet cutters. Also, very high pressure water guns are used for precise cutting. It works very well, is relatively safe, and is not harmful to the environment. It is also used in the cooling of machinery to prevent overheating, or prevent saw blades from overheating. This is generally a very small source of water consumption relative to other uses.

Water is also used in many large scale industrial processes, such as thermoelectric power production, oil refining and fertilizer production and other chemical plant use and natural gas extraction from shale rock. Discharge of untreated water from industrial uses is pollution. Pollution includes discharged solutes (chemical pollution) and increased water temperature (thermal pollution). Industry requires pure water for many applications and utilizes a variety of purification techniques both in water supply and discharge. Most of this pure water is generated on site, either from natural freshwater or from municipal grey water. Industrial consumption of water is generally much lower than withdrawal, due to laws requiring industrial grey water to be treated and returned to the environment. Thermoelectric power plants using cooling towers have high consumption, nearly equal to their withdrawal, as most of the withdrawn water is evaporated as part of the cooling process. The withdrawal, however, is lower than in once-through cooling systems.

5.8. Drinking water

It is estimated that 8 % of worldwide water use is for household purposes. These include drinking water, bathing, cooking, sanitation, and gardening. Basic household water requirements have been estimated by Peter Gleick at around 50

liters per person per day, excluding water for gardens. Drinking water is water that is of sufficiently high quality so that it can be consumed or used without risk of immediate or long term harm. Such water is commonly called potable water. In most developed countries, the water supplied to households, commerce and industry is all of drinking water standard even though only a very small proportion is actually consumed or used in food preparation.

5.9. Recreation water use

Recreational water use is usually a very small but growing percentage of total water use. Recreational water use is mostly tied to reservoirs. If a reservoir is kept fuller than it would otherwise be for recreation, then the water retained could be categorized as recreational usage. Release of water from a few reservoirs is also timed to enhance whitewater boating, which also could be considered a recreational usage. Other examples are anglers, water skiers, nature enthusiasts and swimmers.

Recreational usage is usually non-consumptive. Golf courses are often targeted as using excessive amounts of water, especially in drier regions. It is, however, unclear whether recreational irrigation (which would include private gardens) has a noticeable effect on water resources. This is largely due to the unavailability of reliable data. Additionally, many golf courses utilize either primarily or exclusively treated effluent water, which has little impact on potable water availability.

Some governments, including the Californian Government, have labeled golf course usage as agricultural in order to deflect environmentalists' charges of wasting water. However, using the above figures as a basis, the actual statistical effect of this reassignment is close to zero. In Arizona, an organized lobby has been established in the form of the Golf Industry Association, a group focused on educating the public on how golf impacts the environment.

Recreational usage may reduce the availability of water for other users at specific times and places. For example, water retained in a reservoir to allow boating in the late summer is not available to farmers during the spring planting season. Water released for whitewater rafting may not be available for hydroelectric generation during the time of peak electrical demand.

5.10. Environmental water use

Explicit environmental water use is also a very small but growing percentage of total water use. Environmental water may include water stored in impoundments and released for environmental purposes (held environmental water), but more often is water retained in waterways through regulatory limits of abstraction. Environmental water usage includes watering of natural or artificial wetlands, artificial lakes intended to create wildlife habitat, fish ladders, and water releases from reservoirs timed to help fish spawn, or to restore more natural flow regimes

Like recreational usage, environmental usage is non-consumptive but may reduce the availability of water for other users at specific times and places. For example, water release from a reservoir to help fish spawn may not be available to farms upstream, and water retained in a river to maintain waterway health would not be available to water abstractors downstream.

5.11. Water crisis and water stress.

The concept of water stress is relatively simple. According to the World Business Council for Sustainable Development, it applies to situations where there is not enough water for all uses, whether agricultural, industrial or domestic. Defining thresholds for stress in terms of available water per capita is more complex, however, entailing assumptions about water use and its efficiency. Nevertheless, it has been proposed that when annual per capita renewable freshwater availability is less than 1,700 cubic meters, countries begin to experience periodic or regular water stress. Below 1,000 cubic meters, water scarcity begins to hamper economic development and human health and well-being.

In 2000, the world population was 6.2 billion. The UN estimates that by 2050 there will be an additional 3.5 billion people with most of the growth in developing countries that already suffer water stress. Thus, water demand will increase unless there are corresponding increases in water conservation and recycling of this vital resource. In building on the data presented here by the UN, the World Bank goes on to explain that access to water for producing food will be one of the main challenges in the decades to come. Access to water will need to be balanced with the importance of managing water itself in a sustainable way while taking into account the impact of climate change, and other environmental and social variables.

Business activity ranging from industrialization to services such as tourism and entertainment continues to expand rapidly. This expansion requires increased water services including both supply and sanitation, which can lead to more pressure on water resources and natural ecosystems.

The trend towards urbanization is accelerating. Small private wells and septic tanks that work well in low-density communities are not feasible within high-density urban areas. Urbanization requires significant investment in water infrastructure in order to deliver water to individuals and to process the concentrations of wastewater – both from individuals and from business. These polluted and contaminated waters must be treated or they pose unacceptable public health risks.

In 60 % of European cities with more than 100000 people, groundwater is being used at a faster rate than it can be replenished. Even if some water remains available, it costs more and more to capture it.

Climate change could have significant impacts on water resources around the world because of the close connections between the climate and hydrological

cycle. Rising temperatures will increase evaporation and lead to increases in precipitation, though there will be regional variations in rainfall. Overall, the global supply of freshwater will increase. Both droughts and floods may become more frequent in different regions at different times, and dramatic changes in snowfall and snow melt are expected in mountainous areas. Higher temperatures will also affect water quality in ways that are not well understood. Possible impacts include increased eutrophication. Climate change could also mean an increase in demand for farm irrigation, garden sprinklers, and perhaps even swimming pools. There is now ample evidence that increased hydrologic variability and change in climate has and will continue have a profound impact on the water sector through the hydrologic cycle, water availability, water demand, and water allocation at the global, regional, basin, and local levels.

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Due to the expanding human population, competition for water is growing such that many of the world major aquifers are becoming depleted. This is due both for direct human consumption as well as agricultural irrigation by groundwater. Millions of pumps of all sizes are currently extracting groundwater throughout the world. Irrigation in dry areas such as northern China and India is supplied by groundwater, and is being extracted at an unsustainable rate. Cities that have experienced aquifer drops between 10 to 50 meters include Mexico City, Bangkok, Manila, Beijing, Madras and Shanghai.

5.12. Pollution and water protection

Water pollution is one of the main concerns of the world today. The governments of numerous countries have striven to find solutions to reduce this problem. Many pollutants threaten water supplies, but the most widespread, especially in developing countries, is the discharge of raw sewage into natural waters; this method of sewage disposal is the most common method in underdeveloped countries, but also is prevalent in quasi-developed countries such as China, India and Iran. Sewage, sludge, garbage, and even toxic pollutants are all dumped into the water. Even if sewage is treated, problems still arise. Treated sewage forms sludge, which may be placed in landfills, spread out on land, incinerated or dumped at sea. In addition to sewage, nonpoint source pollution such as agricultural runoff is a significant source of pollution in some parts of the world, along with urban storm water runoff and chemical wastes dumped by industries and governments.

Over the past 25 years, politicians, academics and journalists have frequently predicted that disputes over water would be a source of future wars. Commonly cited quotes include: that of former Egyptian Foreign Minister and former Secretary-General of the United Nations Boutrous Ghali, who forecast,

“The next war in the Middle East will be fought over water, not politics”; his successor at the UN, Kofi Annan, who in 2001 said, “Fierce competition for fresh water may well become a source of conflict and wars in the future,” and the former Vice President of the World Bank, Ismail Serageldin, who said the wars of the next century will be over water unless significant changes in governance occurred. The water wars hypothesis had its roots in earlier research carried out on a small number of trans boundary rivers such as the Indus, Jordan and Nile. These particular rivers became the focus because they had experienced water-related disputes. Specific events cited as evidence include Israel’s bombing of Syria’s attempts to divert the Jordan’s headwaters, and military threats by Egypt against any country building dams in the upstream waters of the Nile. However, while some links made between conflict and water were valid, they did not necessarily represent the norm.

The only known example of an actual inter-state conflict over water took place between 2500 and 2350 BC between the Sumerian states of Lagash and Umma. Water stress has most often led to conflicts at local and regional levels. Tensions arise most often within national borders, in the downstream areas of distressed river basins. Areas such as the lower regions of China's Yellow River or the Chao Phraya River in Thailand, for example, have already been experiencing water stress for several years. Water stress can also exacerbate conflicts and political tensions which are not directly caused by water. Gradual reductions over time in the quality and/or quantity of fresh water can add to the instability of a region by depleting the health of a population, obstructing economic development, and exacerbating larger conflicts.

Water resources that span international boundaries are more likely to be a source of collaboration and cooperation, than war. Scientists working at the International Water Management Institute, in partnership with Aaron Wolf at Oregon State University, have been investigating the evidence behind water war predictions. Their findings show that, while it is true there has been conflict related to water in a handful of international basins, in the rest of the world’s approximately 300 shared basins the record has been largely positive. This is exemplified by the hundreds of treaties in place guiding equitable water use between nations sharing water resources. The institutions created by these agreements can, in fact, be one of the most important factors in ensuring cooperation rather than conflict.

The International Union for the Conservation of Nature (IUCN) published the book Share: Managing water across boundaries. One chapter covers the functions of trans-boundary institutions and how they can be designed to promote cooperation, overcome initial disputes and find ways of coping with the uncertainty created by climate change. It also covers how the effectiveness of such institutions can be monitored.

5.13. World water supply and distribution

Food and water are two basic human needs. However, global coverage figures from 2002 indicate that, of every 10 people: roughly 5 have a connection to a piped water supply at home (in their dwelling, plot or yard); 3 make use of some other sort of improved water supply, such as a protected well or public standpipe; 2 are unserved. In addition, 4 out of every 10 people live without improved sanitation.

At Earth Summit 2002 governments approved a Plan of Action to:

Halve by 2015 the proportion of people unable to reach or afford safe drinking water. The Global Water Supply and Sanitation Assessment 2000 Report (GWSSAR) defines 'Reasonable access' to water as at least 20 liters per person per day from a source within one kilometer of the user's home.

Halve the proportion of people without access to basic sanitation. The GWSSR defines 'Basic sanitation' as private or shared but not public disposal systems that separate waste from human contact.

In 2025, water shortages will be more prevalent among poorer countries where resources are limited and population growth is rapid, such as the Middle East, Africa, and parts of Asia. By 2025, large urban and perurban areas will require new infrastructure to provide safe water and adequate sanitation. This suggests growing conflicts with agricultural water users, who currently consume the majority of the water used by humans.

Generally speaking the more developed countries of North America, Europe and Russia will not see a serious threat to water supply by the year 2025 not only because of their relative wealth, but more importantly their populations will be better aligned with available water resources. North Africa, the Middle East, South Africa and northern China will face very severe water shortages due to physical scarcity and a condition of overpopulation relative to their carrying capacity with respect to water supply. Most of South America, Sub-Saharan Africa, Southern China and India will face water supply shortages by 2025; for these latter regions the causes of scarcity will be economic constraints to developing safe drinking water, as well as excessive population growth.

1.6 billion people have gained access to a safe water source since 1990. The proportion of people in developing countries with access to safe water is calculated to have improved from 30 percent in 1970 to 71 percent in 1990, 79 percent in 2000 and 84 percent in 2004. This trend is projected to continue.

Water supply and sanitation require a huge amount of capital investment in infrastructure such as pipe networks, pumping stations and water treatment works. It is estimated that Organization for Economic Cooperation and Development (OECD) nations need to invest at least USD 200 billion per year to replace aging water infrastructure to guarantee supply, reduce leakage rates and protect water quality.

International attention has focused upon the needs of the developing countries. To meet the Millennium Development Goals targets of halving the proportion of the population lacking access to safe drinking water and basic sanitation by 2015, current annual investment on the order of USD 10 to USD 15 billion would need to be roughly doubled. This does not include investments required for the maintenance of existing infrastructure.

Once infrastructure is in place, operating water supply and sanitation systems entails significant ongoing costs to cover personnel, energy, chemicals, maintenance and other expenses. The sources of money to meet these capital and operational costs are essentially either user fees, public funds or some combination of the two.

But this is where the economics of water management start to become extremely complex as they intersect with social and broader economic policy. Such policy questions are beyond the scope of this article, which has concentrated on basic information about water availability and water use. They are, nevertheless, highly relevant to understanding how critical water issues will affect business and industry in terms of both risks and opportunities.

The World Business Council for Sustainable Development in its H2OScenarios engaged in a scenario building process to:

Clarify and enhance understanding by business of the key issues and drivers of change related to water.

Promote mutual understanding between the business community and non-business stakeholders on water management issues.

Support effective business action as part of the solution to sustainable water management.

It concludes that:

Business cannot survive in a society that thirsts.

One does not have to be in the water business to have a water crisis.

Business is part of the solution, and its potential is driven by its engagement.

Growing water issues and complexity will drive up costs.

COMPREHENSION

1. Read the text; as your read, note the topic dealt with in each paragraph, underline the topic sentence, key words, and important facts as your go along.

2. Analyze how the facts are connected, how the topic of a paragraph is connected with that of a preceding paragraph.

3. Make a list of all points you are going to mention in your précis .Write them down using the necessary key terms. These notes must contain all the essential facts.

4. Write a précis of the text.

5. Sum up the main points presented in the text. Write the plan of the text in the form of statements.

6. Develop your plan into summary.

7. Make your summary coherent by a sparing use of connectors.

8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.

9. Prepare and deliver a 10-minute presentation about water resources.

UNIT VII
WATER SUPPLY

Water supply is the provision of water by public utilities, commercial organizations, community endeavours or by individuals, usually via a system of pumps and pipes. Irrigation is covered separately.

In 2010 about 84 % of the global population (6.74 billion people) had access to piped water supply through house connections or to an improved water source through other means than house, including standpipes, "water kiosks", protected springs and protected wells. However, about 14 % (884 million people) did not have access to an improved water source and had to use unprotected wells or springs, canals, lakes or rivers for their water needs.

A clean water supply, especially so with regard to sewage, is the single most important determinant of public health. Destruction of water supply and/or sewage disposal infrastructure after major catastrophes (earthquakes, floods, war, etc.) poses the immediate threat of severe epidemics of waterborne diseases, several of which can be life-threatening.

6.1. Technical overview

Water supply systems get water from a variety of locations, including groundwater (aquifers), surface water (lakes and rivers), conservation and the sea through desalination. The water is then, in most cases, purified, disinfected through chlorination and sometimes fluoridated. Treated water then either flows by gravity or is pumped to reservoirs, which can be elevated such as water towers or on the ground (for indicators related to the efficiency of drinking water distribution see non-revenue water). Once water is used, wastewater is typically discharged in a sewer system and treated in a wastewater treatment plant before being discharged into a river, lake or the sea or reused for landscaping, irrigation or industrial use

6.2. Service quality

Many of the 3.5 billion people having access to piped water receive a poor or very poor quality of service, especially in developing countries where about 80 % of the world population lives. Water supply service quality has many dimensions: continuity; water quality; pressure; and the degree of responsiveness of service providers to customer complaints

Continuity of water supply is taken for granted in most developed countries, but is a severe problem in many developing countries, where sometimes water is only provided for a few hours every day or a few days a week. It is estimated that about half of the population of developing countries receives water on an intermittent basis.

6.3. Water quality and water pressure

Drinking water quality has a micro-biological and a physic-chemical dimension. There are thousands of parameters of water quality. In public water supply systems water should, at a minimum, be disinfected – most commonly through the use of chlorination or the use of ultra violet light – or it may need to undergo treatment, especially in the case of surface water. For more details, please see the separate entries on water quality, water treatment and drinking water.

Water pressures vary in different locations of a distribution system. Water mains below the street may operate at higher pressures, with a pressure reducer located at each point where the water enters a building or a house. In poorly managed systems, water pressure can be so low as to result only in a trickle of water or so high that it leads to damage to plumbing fixtures and waste of water. Pressure in an urban water system is typically maintained either by a pressurized water tank serving an urban area, by pumping the water up into a tower and relying on gravity to maintain a constant pressure in the system or solely by pumps at the water treatment plant and repeater pumping stations.

Typical UK pressures are 4–5 bars for an urban supply. However, some people can get over eight bars or below one bar. A single iron main pipe may cross a deep valley, it will have the same nominal pressure and, however, each consumer will get a bit more or less because of the hydrostatic pressure (about 1 bar/10 m height). So people at the bottom of a 100-foot (30 m) hill will get about 3 bars more than those at the top.

The effective pressure also varies because of the supply resistance even for the same static pressure. An urban consumer may have 5 meters of ½-inch lead pipe running from the iron main, so the kitchen tap flow will be fairly unrestricted, so high flow. A rural consumer may have a kilometer of rusted and limed ¾ iron pipe, so their kitchen tap flow will be small.

For this reason the UK domestic water system has traditionally (prior to 1989) employed a ‘cistern feed’ system, where the incoming supply is connected to the kitchen sink and also a header/storage tank in the attic. Water can dribble into this tank through a ½ lead pipe, plus ball valve, and then supply the house on 22 or 28 mm pipes. Gravity water has a small pressure (say ¼ bar in the bathroom) but needs wide pipes allow higher flows. This is fine for baths and toilets but is frequently inadequate for showers. People install shower booster pumps to increase the pressure. For this reason urban houses are increasingly

using mains pressure boilers (combies) which take a long time to fill a bath but suit the high back pressure of a shower.

6.4. Comparing the performance of water and sanitation service providers

Comparing the performance of water and sanitation service providers (utilities) is needed, because the sector offers limited scope for direct competition (natural monopoly). Firms operating in competitive markets are under constant pressure to outperform each other. Water utilities are often sheltered from this pressure, and it frequently shows: some utilities are on a sustained improvement track, but many others keep falling further behind best practice. Benchmarking the performance of utilities allows simulating competition, establishing realistic targets for improvement and creating pressure to catch up with better utilities. Information on benchmarks for water and sanitation utilities is provided by the International Benchmarking Network for Water and Sanitation Utilities.

A great variety of institutions have responsibilities in water supply. A basic distinction is between institutions responsible for policy and regulation on the one hand; and institutions in charge of providing services on the other hand.

6.5. Policy and regulation

Water supply policies and regulation are usually defined by one or several Ministries, in consultation with the legislative branch. In the United States the United States Environmental Protection Agency, whose administrator reports directly to the President, is responsible for water and sanitation policy and standard setting within the executive branch. In other countries responsibility for sector policy is entrusted to a Ministry of Environment (such as in Mexico and Colombia), to a Ministry of Health (such as in Panama, Honduras and Uruguay), a Ministry of Public Works (such as in Ecuador and Haiti), a Ministry of Economy (such as in German states) or a Ministry of Energy (such as in Iran). A few countries, such as Jordan and Bolivia, even have a Ministry of Water. Often several Ministries share responsibilities for water supply. In the European Union, important policy functions have been entrusted to the supranational level. Policy and regulatory functions include the setting of tariff rules and the approval of tariff increases; setting, monitoring and enforcing norms for quality of service and environmental protection; benchmarking the performance of service providers; and reforms in the structure of institutions responsible for service provision. The distinction between policy functions and regulatory functions is not always clear-cut. In some countries they are both entrusted to Ministries, but in others regulatory functions are entrusted to agencies that are separate from Ministries.

6.6. Regulatory agencies

Dozens of countries around the world have established regulatory agencies for infrastructure services, including often water supply and sanitation, in order to better protect consumers and to improve efficiency. Regulatory agencies can

be entrusted with a variety of responsibilities, including in particular the approval of tariff increases and the management of sector information systems, including benchmarking systems. Sometimes they also have a mandate to settle complaints by consumers that have not been dealt with satisfactorily by service providers. These specialized entities are expected to be more competent and objective in regulating service providers than departments of government Ministries. Regulatory agencies are supposed to be autonomous from the executive branch of government, but in many countries have often not been able to exercise a great degree of autonomy. In the United States regulatory agencies for utilities have existed for almost a century at the level of states, and in Canada at the level of provinces. In both countries they cover several infrastructure sectors. In many US states they are called Public Utility Commissions. For England and Wales, a regulatory agency for water (OFWAT) was created as part of the privatization of the water industry in 1989. In many developing countries, water regulatory agencies were created during the 1990s in parallel with efforts at increasing private sector participation.

Many countries do not have regulatory agencies for water. In these countries service providers are regulated directly by local government, or the national government. This is, for example, the case in the countries of continental Europe, in China and India.

6.7. Service provision

Water supply service providers, which are often utilities, differ from each other in terms of their geographical coverage relative to administrative boundaries; their sectored coverage; their ownership structure; and their governance arrangements.

Many water utilities provide services in a single city, town or municipality. However, in many countries municipalities have associated in regional or inter-municipal or multi-jurisdictional utilities to benefit from economies of scale. In the United States these can take the form of special-purpose districts which may have independent taxing authority. An example of a multi-jurisdictional water utility in the United States is WASA, a utility serving Washington, DC and various localities in the state of Maryland. Multi-jurisdictional utilities are also common in Germany, where they are known as ‘Zweckverbaende’, in France and in Italy.

In some federal countries there are water service providers covering most or all cities and towns in an entire state, such as in all states of Brazil and some states in Mexico (see Water supply and sanitation in Mexico). In England and Wales, water supply and sewerage is supplied almost entirely through ten regional companies. Some smaller countries, especially developed countries, have established service providers that cover the entire country or at least most of its cities and major towns. Such national service providers are especially

prevalent in West Africa and Central America, but also exist, for example, in Tunisia, Jordan and Uruguay (see also water supply and sanitation in Uruguay). In rural areas, where about half the world population lives, water services are often not provided by utilities, but by community-based organizations which usually cover one or sometimes several villages.

6.8. Sector coverage

Some water utilities provide only water supply services, while sewerage is under the responsibility of a different entity. This is for example the case in Tunisia. However, in most cases water utilities also provide sewer and wastewater treatment services. In some cities or countries utilities also distribute electricity. In a few cases such multi-utilities also collect solid waste and provide local telephone services. An example of such an integrated utility can be found in the Colombian city of Medellín. Utilities that provide water, sanitation and electricity can be found in Frankfurt, Germany (Mainova), in Casablanca, Morocco and in Gabon in West Africa. Multi-utilities provide certain benefits such as common billing and the option to cross-subsidize water services with revenues from electricity sales, if permitted by law.

6.9. Ownership and governance arrangements

Water supply providers can be either public private mixed or cooperative. Most urban water supply services around the world are provided by public entities. As Willem-Alexander, Prince of Orange (2002) stated, "The water crisis that is affecting so many people is mainly a crisis of governance – not of water scarcity." The introduction of cost-reflective tariffs together with cross-subsidization between richer and poorer consumers is an essential governance reform in order to reduce the high levels of Unaccounted or Water (UAW) and to provide the finance needed to extend the network to those poorest households who remain unconnected. Partnership arrangements between the public and private sector can play an important role in order to achieve this objective

6.10. Private sector participation

An estimated 10 percent of urban water supply is provided by private or mixed public-private companies, usually under concessions, leases or management contracts. Under these arrangements the public entity that is legally responsible for service provision delegates certain or all aspects of service provision to the private service provider for a period typically ranging from 4 to 30 years. The public entity continues to own the assets. These arrangements are common in France and in Spain. Only in few parts of the world water supply systems have been completely sold to the private sector (privatization), such as in England and Wales as well as in Chile. The largest private water companies in the world are Suez and Veolia Environment from France; Aqua de Barcelona from Spain; and Thames Water from the UK, all of which are engaged internationally.

6.11. Public water service provision

90 % of urban water supply and sanitation services are currently in the public sector. They are owned by the state or local authorities, or also by collectives or cooperatives. They run without an aim for profit but are based on the ethos of providing a common good considered to be of public interest. In most middle and low-income countries, these publicly-owned and managed water providers can be inefficient as a result of political interference, leading to over-staffing and low labor productivity. Ironically, the main losers from this institutional arrangement are the urban poor in these countries. Because they are not connected to the network, they end up paying far more per liter of water than do more well-off households connected to the network who benefit from the implicit subsidies that they receive from loss-making utilities. We are still so far from achieving universal access to clean water and sanitation shows that public water authorities, in their current state, are not working well enough. Yet some are being very successful and are modeling the best forms of public management. As Ryutaro Hashimoto, former Japanese Prime Minister, notes: 'Public water services currently provide more than 90 per cent of water supply in the world. Modest improvement in public water operators will have immense impact on global provision of services.'

6.12. Governance arrangements

Governance arrangements for both public and private utilities can take many forms. Governance arrangements define the relationship between the service provider, its owners, its customers and regulatory entities. They determine the financial autonomy of the service provider and thus its ability to maintain its assets, expand services, attract and retain qualified staff, and ultimately to provide high-quality services. Key aspects of governance arrangements are the extent to which the entity in charge of providing services is insulated from arbitrary political intervention; and whether there is an explicit mandate and political will to allow the service provider to recover all or at least most of its costs through tariffs and retain these revenues. If water supply is the responsibility of a department that is integrated in the administration of a city, town or municipality, there is a risk that tariff revenues are diverted for other purposes. In some cases, there is also a risk that staff are appointed mainly on political grounds rather than based on their professional credentials.

6.13. Tariffs

Almost all service providers in the world charge tariffs to recover part of their costs. According to estimates by the World Bank the average (mean) global water tariff is US$ 0.53 per cubic meter. In developed countries the average tariff is US$ 1.04, while it is only U$ 0.11 in the poorest developing countries. The lowest tariffs in developing countries are found in South Asia (mean of US$ 0.09/m3), while the highest are found in Latin America (US$ 0.41/m3) Data for 132 cities were assessed. The tariff is estimate for a consumption level of 15

cubic meters per month. Few utilities do recover all their costs. According to the same World Bank study only 30 % of utilities globally, and only 50 % of utilities in developed countries generate sufficient revenue to cover operation, maintenance and partial capital costs.

According to another study undertaken in 2006 by NUS Consulting, the average water and sewerage tariff in 14 mainly OECD countries excluding VAT varied between US$ 0.66 per cubic meter in the United States and the equivalent of US$ 2.25 per cubic meter in Denmark. However, water consumption is much higher in the US than in Europe. Therefore, residential water bills may be very similar, even if the tariff per unit of consumption tends to be higher in Europe than in the US.

A typical family on the US East Coast paid between US$30 and US$70 per month for water and sewer services in 2005.

In developing countries, tariffs are usually much further from covering costs. Residential water bills for a typical consumption of 15 cubic meters per month vary between less than US$ 1 and US$ 12 per month.

Water and sanitation tariffs, which are almost always billed together, can take many different forms. Where meters are installed, tariffs are typically volumetric (per usage), sometimes combined with a small monthly fixed charge. In the absence of meters, flat or fixed rates – which are independent of actual consumption – are being charged. In developed countries, tariffs are usually the same for different categories of users and for different levels of consumption.

In developing countries, the situation is often characterized by cross-subsidies with the intent to make water more affordable for residential low-volume users that are assumed to be poor. For example, industrial and commercial users are often charged higher tariffs than public or residential users. Also, metered users are often charged higher tariffs for higher levels of consumption (increasing-block tariffs). However, cross-subsidies between residential users do not always reach their objective. Given the overall low level of water tariffs in developing countries even at higher levels of consumption, most consumption subsidies benefit the wealthier segments of society. Also, high industrial and commercial tariffs can provide an incentive for these users to supply water from other sources than the utility (own wells, water tankers) and thus actually erode the utility's revenue base.

6.14. Water metering and water meter

Metering of water supply is usually motivated by one or several of four objectives: First, it provides an incentive to conserve water which protects water resources (environmental objective). Second, it can postpone costly system expansion and saves energy and chemical costs (economic objective). Third, it allows a utility to better locate distribution losses (technical objective). Fourth, it allows to charge for water based on use, which is perceived by many as the fairest way to allocate the costs of water supply to users. Metering is considered

good practice in water supply and is widespread in developed countries, except for the United Kingdom. In developing countries it is estimated that half of all urban water supply systems are metered and the tendency is increasing.

Water meters are read by one of several methods:

a water customer writes down the meter reading and mails in a postcard with this info to the water department;

a water customer writes down the meter reading and uses a phone dial-in system to transfer this info to the water department;

a water customer logs in to the website of the water supply company, enters the address, meter ID and meter readings

a meter reader comes to the premise and enters the meter reading into a handheld computer;

meter reading is echoed on a display unit mounted to the outside of the premise, where a meter reader records them;

a small radio is hooked up to the meter to automatically transmit readings to corresponding receivers in handheld computers, utility vehicles or distributed collectors;

a small computer is hooked up to the meter that can either dial out or receive automated phone calls that give the reading to a central computer system.

Most cities are increasingly installing Automatic Meter Reading (AMR) systems to prevent fraud, to lower ever-increasing labor and liability costs and to improve customer service and satisfaction.

6.15. Costs and financing

The cost of supplying water consists to a very large extent of fixed costs (capital costs and personnel costs) and only to a small extent of variable costs that depend on the amount of water consumed (mainly energy and chemicals). The full cost of supplying water in urban areas in developed countries is about US$1–2 per cubic meter depending on local costs and local water consumption levels. The cost of sanitation (sewerage and wastewater treatment) is another US$1–2 per cubic meter. These costs are somewhat lower in developing countries. Throughout the world, only part of these costs is usually billed to consumers, the remainder being financed through direct or indirect subsidies from local, regional or national governments.

Besides subsidies water supply investments are financed through internally generated revenues as well as through debt. Debt financing can take the form of credits from commercial Banks, credits from international financial institutions such as the World Bank and regional development banks (in the case of developing countries), and bonds (in the case of some developed countries and some upper middle-income countries).

6.16 History of water supply

Throughout history people have devised systems to make getting and using water more convenient. Early Rome had indoor plumbing, meaning a system of

aqueducts and pipes that terminated in homes and at public wells and fountains for people to use. London water supply infrastructure developed over many centuries from early mediaeval conduits, through major 19th century treatment works built in response to cholera threats, to modern large scale reservoirs.

Water towers appeared around the late 19th century, as building height rose, and steam, electric and diesel-powered water pumps became available. As skyscrapers appeared, they needed rooftop water towers.

The technique of purification of drinking water by use of compressed liquefied chlorine gas was developed in 1910 by U.S. Army Major (later Brig. Gen.) Carl Rogers Darnall (1867–1941), Professor of Chemistry at the Army Medical School. Shortly thereafter, Major (later Col.) William J. Lyster (1869–1947) of the Army Medical Department used a solution of calcium hypochlorite in a linen bag to treat water. For many decades, Lyster's method remained the standard for U.S. ground forces in the field and in camps, implemented in the form of the familiar Lyster Bag (also spelled Lister Bag). Darnall's work became the basis for present day systems of municipal water 'purification'.

Desalination appeared during the late 20th century, and is still limited to a few areas.

During the beginning of the 21st Century, especially in areas of urban and suburban population centers, traditional centralized infrastructure have not been able to supply sufficient quantities of water to keep up with growing demand. Among several options that have been managed are the extensive use of desalination technology, this is especially prevalent in coastal areas and in "dry" countries like Australia. Decentralization of water infrastructure has grown extensively as a viable solution including Rainwater harvesting and Stormwater harvesting where policies are eventually tending towards a more rational use and sourcing of water incorporation concepts such as "Fit for Purpose". This section requires expansion.

6.17. Standardization

International standards for water supply system are covered by International Classification of Standards (ICS) 91.140.60.

Outbreaks of diseases due to contaminated water supply:

In 1854 a cholera outbreak in London's Soho district was identified by Dr. John Snow as originating from contaminated water from the Broad street pump. This can be regarded as a founding event of the science of epidemiology.

In 1980 a hepatitis A surge due to the consumption of water from a feces-contaminated well, in Pennsylvania.

In 1987 a cryptosporidiosis outbreak is caused by the public water supply of which the filtration was contaminated, in western Georgia.

Fluoride intoxication in a long-term hem dialysis unit of university hospital due to the failure of a water deionization system.

In 1988 many people were poisoned in Camelford, when a worker put 20 tonnes of aluminum sulphate in the wrong tank..

In 1993 a fluoride poisoning outbreak resulting from overfeeding of fluoride in the Mississippi.

In 1993 Milwaukee Cryptosporidium outbreak.

An outbreak of typhoid fever in northern Israel which was associated with the contaminated municipal water supply.

In 1997 369 cases of cryptosporidiosis occurred caused by a contaminated fountain in the Minnesota zoo. Most of the sufferers were children.

In 1998 a non-chlorinated municipal water supply was blamed for a campylobacteriosis outbreak in northern Finland.

In 2000 a gastroenteritis outbreak that was brought by a non-chlorinated community water supply, in southern Finland.

In 2000 an E. coli outbreak occurred in Walkerton Ontario Canada. Seven people died from drinking contaminated water. Hundreds suffered from the symptoms of the disease not knowing if they too would die.

In 2004 contamination of the community water supply, serving the Bergen city centre of Norway, was later reported after the outbreak of waterborne giardiasis]

In 2007 contaminated drinking water was pinpointed which had led to the outbreak of gastroenteritis with multiple etiologies in Denmark.

6.18. Water supply network

A water supply system or water supply network is a system of engineered hydrologic and hydraulic components which provide water supply. A water supply system typically includes:

A drainage basin (see water purification – sources of drinking water);

A raw (untreated) water collection point (above or below ground) where the water accumulates, such as a lake, a river, or groundwater from an underground aquifer. Untreated drinking water (usually water being transferred to the water purification facilities) may be transferred using uncovered ground-level aqueducts, covered tunnels or underground water pipes.

Water purification facilities. Treated water is transferred using water pipes (usually underground).

Water storage facilities such as reservoirs, water tanks, or watertowers. Smaller water systems may store the water in cisterns or pressure vessels. (Tall buildings may also need to store water locally in pressure vessels in order for the water to reach the upper floors.)

Additional water pressurizing components such as pumping stations may need to be situated at the outlet of underground or above ground reservoirs or cisterns (if gravity flow is impractical)

A pipe network for distribution of water to the consumers (which may be private houses or industrial, commercial or institution establishments) and other usage points (such as fire hydrants)

Connections to the sewers (underground pipes, or aboveground ditches in some developing countries) are generally found downstream of the water consumers, but the sewer system is considered to be a separate system, rather than part of the water supply system.

6.19. Water abstraction and raw water transfer

Raw water (untreated) is collected from a surface water source (such as an intake on a lake or a river) or from a groundwater source (such as a water well drawing from an underground aquifer) within the watershed that provides the water resource.

Shallow dams and reservoirs are susceptible to outbreaks of toxic algae, especially if the water is warmed by a hot sun. The bacteria grow from stormwater runoff carrying fertilizer into the river where it acts as a nutrient for the algae. Such outbreaks render the water unfit for human consumption.

The raw water is transferred to the water purification facilities using uncovered aqueducts, covered tunnels or underground water pipes.

6.20. Water treatment

Virtually all large systems must treat the water; a fact that is tightly regulated by global, state and federal agencies, such as the World Health Organization (WHO) or the United States Environmental Protection Agency (EPA). Water treatment must occur before the product reaches the consumer and afterwards (when it is discharged again). Water purification usually occurs close to the final delivery points to reduce pumping costs and the chances of the water becoming contaminated after treatment.

Traditional surface water treatment plants generally consist of three steps: clarification, filtration and disinfection. Clarification refers to the separation of particles (dirt, organic matter, etc.) from the water stream. Chemical addition (i.e. alum, ferric chloride) destabilizes the particle charges and prepares them for clarification either by settling or floating out of the water stream. Sand, anthracite or activated carbon filters refine the water stream, removing smaller particulate matter. While other methods of disinfection exist, the preferred method is via chlorine addition. Chlorine effectively kills bacteria and most viruses and maintains a residual to protect the water supply through the supply network.

6.21. Water distribution network

Most (treated) water distribution happens through underground pipes. Pressurizing the water is required between the small water reserve and the end-user.

The product, delivered to the point of consumption, is called fresh water if it receives little or no treatment or drinking water if the treatment achieves the water quality standards required for human consumption.

Once treated, chlorine is added to the water and it is distributed by the local supply network. Today, water supply systems are typically constructed of plastic, ferrous, or concrete circular pipe. However, other "pipe" shapes and material may be used, such as square or rectangular concrete boxes, arched brick pipe, or wood. Near the end point, the network of pipes through which the water is delivered is often referred to as the water mains.

The energy that the system needs to deliver the water is called pressure. That energy is transferred to the water, therefore becoming water pressure, in a number of ways: by a pump, by gravity feed from a water source (such as a water tower) at a higher elevation, or by compressed air.

The water is often transferred from a water reserve such as a large communal reservoir before being transported to a more pressured reserve such as a water tower.

In small domestic systems, the water may be pressured by a pressure vessel or even by an underground cistern (the latter however does need additional pressurizing). This eliminates the need of a water-tower or any other heightened water reserve to supply the water pressure.

These systems are usually owned and maintained by local governments, such as cities, or other public entities, but are occasionally operated by a commercial enterprise (see water privatization). Water supply networks are part of the master planning of communities, counties, and municipalities. Their planning and design requires the expertise of city planners and civil engineers, who must consider many factors, such as location, current demand, future growth, leakage, pressure, pipe size, pressure loss, fire fighting flows, etc. using pipe network analysis and other tools. Construction comparable sewage systems, was one of the great engineering advances that made urbanization possible. Improvement in the quality of the water has been one of the great advances in public health.

As water passes through the distribution system, the water quality can degrade by chemical reactions and biological processes. Corrosion of metal pipe materials in the distribution system can cause the release of metals into the water with undesirable aesthetic and health effects. Release of iron from unlined iron pipes can result in customer reports of ‘red water’ at the tap. Release of copper from copper pipes can result in customer reports of ‘blue water’ and/or a metallic taste. Release of lead can occur from the solder used to join copper pipe together or from brass fixtures. Copper and lead levels at the consumer's tap are regulated to protect consumer health.

Utilities will often adjust the chemistry of the water before distribution to minimize its corrosiveness. The simplest adjustment involves control of pH and alkalinity to produce water that tends to pass corrosion by depositing a layer of calcium carbonate. Corrosion inhibitors are often added to reduce release of metals into the water. Common corrosion inhibitors added to the water are phosphates and silicates.

Maintenance of a biologically safe drinking water is another goal in water distribution. Typically, a chlorine based disinfectant, such as sodium hypochlorite or monochloramine is added to the water as it leaves the treatment plant. Booster stations can be placed within the distribution system to ensure that all areas of the distribution system have adequate sustained levels of disinfection.

6.22. Topologies of water distribution networks

Like electric power lines, roads, and microwave radio networks, water systems may have a loop or branch network topology, or a combination of both. The piping networks are circular or rectangular. If any one section of water distribution main fails or needs repair, that section can be isolated without disrupting all users on the network.

Most systems are divided into zones. Factors determining the extent or size of a zone can include hydraulics, telemetry systems, history, and population density. Sometimes systems are designed for a specific area then are modified to accommodate development. Terrain affects hydraulics and some forms of telemetry. While each zone may operate as a stand-alone system, there is usually some arrangement to interconnect zones in order to manage equipment failures or system failures.

Water supply networks usually represent the majority of assets of a water utility. Systematic documentation of maintenance works using a Computerized Maintenance Management System is a key to a successful operation of a water utility.

COMPREHENSION

1. Read the text; as your read, note the topic dealt with in each paragraph, underline the topic sentence, key words, and important facts as your go along.
2. Analyze how the facts are connected, how the topic of a paragraph is connected with that of a preceding paragraph.
3. Make a list of all points you are going to mention in your précis .Write them down using the necessary key terms. These notes must contain all the essential facts.
4. Write a précis of the text.
5. Sum up the main points presented in the text. Write the plan of the text in the form of statements.
6. Develop your plan into summary.
7. Make your summary coherent by a sparing use of connectors.
8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.
9. Prepare and deliver a 10-minute presentation about water supply.

ЗАКЛЮЧЕНИЕ

Студенты, окончившие курс обучения по данной программе, должны владеть орфографической, орфоэпической, лексической, грамматической и стилистической нормами изучаемого языка в пределах программных требований и правильно использовать их во всех видах речевой коммуникации, и в научной сфере в форме устного и письменного общения.

При обучении различным видам речевой деятельности (чтению, говорению, письму) использован принцип их совокупности и взаимной связи с учетом специфики каждого вида речевой деятельности. Управление процессом усвоения обеспечивается четкой постановкой цели на каждом конкретном этапе обучения. Определяющим фактором в достижении установленного уровня того или иного вида речевой деятельности является требование профессиональной направленности практического владения иностранным языком.

Текстовый материал пособия носит профессионально-ориентированный характер. В качестве учебных текстов и литературы для чтения была использована оригинальная монографическая и периодическая литература по тематике широкого профиля строительного вуза, а также статьи из журналов, издаваемых за рубежом.

Авторы надеются, что предложенное пособие окажет реальную помощь студентам направления подготовки 08.03.01 Строительство в плане коммуникации в различных областях профессиональной деятельности.

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APPENDICES

Appendix 1

Abbreviations Used in Science

A, amp.	ampere	ампер (ед. силы тока)
ABC	plastics	пластмассы, состоящие из трех мономерных химикатов – акрилонитрила, бутадиена и стирола
abs.	absolute absolute value	абсолютный абсолютное значение, абсолютная величина
a.c.	alternating current	переменный ток
amp-hr	ampere-hour	ампер-час
anhyd.	anhydrous	безводный
a.p.	atmospheric pressure	атмосферное давление
approx.	approximately	приблизительно
at.	atomic	атомный
arm.	atmosphere	атмосфера
aq.	aqueous	водный
b.p.	boiling point	точка кипения
B.T.U.	British Thermal Unit	Британская тепловая единица
c.c.	cubic centimeter	кубический сантиметр
c.g.	centre of gravity	центр тяжести
cgs	centimeter-gram-second (system)	система единиц сантиметр-грамм-секунда (СГС)
cfin	cubic feet per second	кубические футы в минуту
cfs	cubic feet per minute	кубические футы в секунду
c.m.	cubic meter	кубический метр
cm	centimeter	сантиметр
coeff.	coefficient	коэффициент, константа
conc.	concentration concentrated	концентрация концентрированный
const.	constant	константа, постоянная величина
crit.	critical	критический
cryst.	crystalline	кристаллический
cu ft	cubic foot	кубический фут

cu in	cubic inch	кубический дюйм
cu m or m^3	cubic meter	кубический метр
d or dia	diameter	диаметр
d.	decomposed	Расщепленный, распавшийся
db	decibel	децибел
d.c.	direct current	постоянный ток, прямой ток
decomp.	decomposition	разложение
deg	degree	градус
C	degree Centigrade	градусы по шкале Цельсия
F	degree Fahrenheit	градусы по шкале Фаренгейта
K	degree Kelvin	градусы по шкале Кельвина
R	degree Reaumur	градусы по шкале Реомюра
dil.	dilute	разбавлять
dist.	distilled	перегнанный
doz	dozen	дюжина
e.m.f.	electromotive force	электродвижущая сила
eq. or eqn.	equation	уравнение
expt.	experiment	эксперимент
fig.	figure (diagram)	иллюстрация, рисунок, чертеж
f.p.	freezing point	точка ($t°$) замерзания, затвердевания, кристаллизации
fpm	feet per minute	футы в минуту
fps	feet per second	футы в секунду
fps	foot-pound-second (system)	система фут-фунт-секунда
f.s.d.	full-scale deflection	отклонение на полную шкалу
ft	foot, feet	фут (около 30,5 см)
g	gram	грамм
gal	gallon	галлон (Англия – 4,54 л, США – 3,78 л)
G.L.C.	Gas Liquid Chroma-tography	газо-жидкостная хроматография
gpm	gallon per minute	галлон в минуту
H	henry (electricity)	генри (ед. индуктивности)
h. or hr	hour	час
hp	horsepower	лошадиная сила (ед. мощности)

Hyd.	hydrated	гидратированный
i.e.	insoluble circuit	интегрирующая цепь
i.e.	(id est) that is	то есть
insol.	insoluble	нерастворимый
ips	inches per second	дюймов в секунду
IR	infra-red	инфракрасный
i.r.	insoluble residue	нерастворимый остаток
j	Joule	джоуль
kc	kilocycle	килогерц
kg	kilogram	килограмм
kg-m	kilogram-meter	килограммометр
kg/m^3	kilograms per cubic meter	килограмм на кубический метр
km	kilometer	километр
kv	kilovolt	киловольт
kw	kilowatt	киловатт
kwhr	kilowatt-hour	киловатт-час
I	liter	литр
lb	pound	фунт
Ib-ft	pound-foot	фунто-фут
Ib-in	pound-inch	фунто-дюйм
liq.	liquid	жидкость; жидкий
m	meter	метр
M or mu	micron	микрон
μA	microampere	микроампер
ma	milliampere	миллиампер
max.	maximum	максимум
MeV	megaelectronvolt	мегаэлектронвольт
Mf	microfarad	микрофарада
mg	milligram	миллиграмм
min.	minimum	минимум
min	minute	минута
mm	millimeter	миллиметр
MMF	micromicrofarad	микромикрофарада
m.p.	melting point	точка ($t°$) плавления
mph	miles per hour	миль в час

mv	millivolt	милливольт
NR	natural rubber	натуральный каучук
oz	ounce	унция
p.d.	potential difference	разность потенциалов
ppm	parts per million	миллионные доли
ppt.	precipitate	осадок; осаждать
psi	pounds per square foot	фунты на квадратный фут
psf	pounds per square inch	давление в фунтах на квадрат
PVC	polyvinyl chloride	поливинилхлорид (ПВХ)
R.F.	radio frequency	высокая частота
r.a.m.	relative atomic mass	относительная атомная масса
r.d.	relative density	относительная плотность
r.h.	relative humidity	относительная влажность
r.m.m.	relative molecular mass	относительная молекулярная масса
r.m.s.	root mean square	среднее квадратичное
rpm	revolutions per minute	обороты в минуту
rps	revolutions per second	обороты в секунду
SBR	butadiene-styrene rubber	бутадиен, стирольный каучук
sec	second	секунда
sol.	soluble	растворимый
soln.	solution	раствор
sp.	specific	специфический, конкретный, точный, удельный
sq.	square	квадрат, площадь, прямоугольник
sq.ft.	square foot	квадратный фут
sq.in.	square inch	квадратный дюйм
s.t.p.	standard temperature and pressure	стандартные условия
temp.	temperature	температура
u.v.	ultra-violet	ультрафиолетовая область спектра, ультрафиолет; ультрафиолетовый

v.	volt	вольт
v. or V.	volume	том
va.	volt-ampere	вольт-ампер
vac.	vacuum	вакуум, разрежение; вакуумный
v.d.	vapour density	плотность пара
vol.	volume	объем
V.R.	velocity ratio	коэффициент скорости
W	watt	ватт
wt.	weight	вес
yd	yard	ярд
yr	year	год
z.	zero	ноль

Appendix 2

Latin Words and Abbreviations

a	acre	акр
A.D.	anno domini	нашей эры
a.m.	ante meridiem before noon	до полудня
apriori		заранее, независимо от нашего опыта
B.C.	before Christ	до нашей эры
cf.	confer = compare	сравни
c, ca	circa	приблизительно, около
e.g.	(exempli gratia) = for example	например
et al. [et 'ǽl]	et alii = and others	и другие
etc.	et cetera =and so on, and so forth	и так далее
et seq. or et seqq.	et sequentia = and the following	и далее
ib, ibid.	ibidem = in the same place	там же
id	idem = the same	тот же
i.e.	id est = that is	то есть
in situ		на месте
N.B.	nota bene	примечание, отметка
op. cit.	opere citato (a work cited)	в цитируемом труде
p.a., per an.	per annum = yearly	ежегодно, в год
pct	per centum = percent	процент
p.m.	post meridiem = after noon	после полудня
pro et con	pro et contra = for and against	за и против
sc or scil	scilicet = namely	а именно
terra incongnita		незнакомая область
vice versa	the opposite of what has been said	наоборот
viz	videlicet – that is to say	то есть, а именно
vs.	versus	против
v.v.	vice versa	наоборот

Appendix 3

Mathematical Symbols

+	plus	1) плюс 2) знак плюс 3) положительная величина добавочный, дополнительный
–	minus	1) минус, без 2) знак минус 3) отрицательная величина отрицательный
±	plus or minus	плюс-минус
× или ·	multiplication sign	знак умножения
.	point	точка (в десятичных дробях)
/ (или : , или –)	division sign	знак деления
:	1) ratio sign	знак отношения
	2) is to	относится к
::	1) sign of proportion	знак пропорции
	2) equals, as	равняется, равно
÷	(is) divided by	поделенное на
=	1) sign of equality	знак равенства
	2) equals, (is) equal to	равняется, равно
≠	(is) not equal to	не равно
≈	approximately equal	приблизительно равно
≡	is equivalent to/ is identical with	тождественно-равный
>	greater than	больше (чем)
<	less than	меньше (чем)
≥	equal or greater than	больше (чем) или равно
≤	equal or less than	меньше (чем) или равно
∞	1) infinity 2) infinite	бесконечность, бесконечно удаленная точка; бесконечный
∝	varies as/is proportional to	пропорционально чему-либо

3:9::4:12	three is to nine as four is to twelve	3 к 9 относится, как 4 к 12
ε	is an element of (a set)	эпсилон; является элементом множества
∉	is not an element of (a set)	не является элементом множества
∅ or {}	is an empty set	пустое множество
∩	intersection	знак пересечения (множества)
U	union	знак объединения (множества)
x^4	[eks] to the power four/to the fourth power	*x* в 4-й степени
π	Pi	пи (число)
r	[a: (r)] = radius of circle	р (радиус)
πr^2	pi r squared (formula for area of circle)	пи р квадрат
n!	*n* factorial	н факториал
a^*	*a* star	а со звездочкой
a′	*a* prime	а штрих
a‴	*a* second prime или *a* double prime	а два штриха
a‴	*a* third prime или *a* triple prime	а три штриха
b_1	*b* sub one или *b* first	б один (б с индексом один)
b_2	*b* sub two или b second	б два (б с индексом два)
c_m	*c* sub *m* или *c m*-th	с м (*c* с индексом м)
a'_1	*a* first prime	а один штрих
a''_2	*a* second, second prime	а два штрих
a_m	*a* sub *m* или *a m*-th	а эмтое
b'_c	*b* prime, sub *c* или *b* sub *c*, prime	б цетое штрих
log	logarithm	логарифм
sin	sine	синус
cos	cosine	косинус
tan, tg	tangent	тангенс
ctg, cot	cotangent	котангенс
sec	secant	секанс
cosec	cosecant	косеканс
∑	summation	знак суммирования

dx	differential of x	дифференциал x
dy/dx	derivative of y with respect to x	производная y по x
d^2y/dx^2	second derivative of y with respect to x	вторая производная y по x
$d^n n/dx^n$	n-th derivative of y with respect to x	н-я производная y по x
$\int$	integral of	интеграл от
$\int f(x)dx$	integral of a function of x over dx	интеграл от функции $f(x)$ по dx
$\int_n^m$	integral between limits n and m	интеграл в пределах от n до m
$\|x\|$	absolute value of x	абсолютное значение x
%	per cent	процент
$\sqrt{}$	square root (out) of	квадратный корень из
$\sqrt[3]{}$	cube root (out) of	кубический корень из
$\sqrt[n]{}$	n-th root (out) of	корень n-й степени из
[]	brackets pl square brackets pl.	квадратные скобки
()	parentheses pl, round brackets pl.	круглые скобки
{}	braces pl	фигурные скобки
$\|\|$	parallel to	параллельно
°	degree	градус
′	1) minute 2) foot, feet	минута фут, футы
″	1) second 2) inch	секунда дюйм
$n\angle$	angle	угол
n	right angle	прямой угол
	perpendicular	перпендикуляр, перпендикулярный

Appendix 4

Numerical Expressions

US	GB and other European countries
1 000 000 000 = 10^9	_____
a/one billion	a/one thousand million(s)
1 000 000 000 000 =10^{12}	_____
a/one trillion	a/one billion
1 000 000 000 000 000 = 10^{15}	_____
a/one quadrillion	a/one thousand billion(s)
1 000 000 000 000 000 000 = 10^{18}	_____
a/one quadrillion	a/one trillion

VULGAR FRACTIONS	DECIMAL FRACTIONS
1/8 an/one eighth	0,125 (nought) point one two five
1/4 an/one quarter	0,25 (nought) point two five
1/3 an/one third	0,33 (nought) point three three
1/2 an/one half	0,5 (nought) point five
3/4 three quarters	0,75 (nought) point seven five

Notes:

1. In the spoken forms of vulgar fractions, the versions and a half/ quarter/third are preferred to and one half/quarter/third whether the measurement is approximate or precise. With more obviously precise fractions like 1/8, 1/16, and one eighth/sixteenth is normal. Complex fractions like 3/462, 20/83 are spoken as three over four-six-two; twenty over eighty-three, especially in mathematical expressions, e.g. twenty-two over seven for 22/7.

2. When speaking ordinary numbers we can use zero, nought or ohfor the number 0; zero is the most common US usage and the most technical or precise form, oh is the least technical or precise. In using decimals, to say nought point five for 0.5 is a more precise usage than point five.

3. In most continental European countries a comma is used in place of the GJ3/US decimal point Thus 6,014 is written 6,014 in France. A space is used to separate off the thousands in numbers larger than 9999, e.g. 10000 or 875380. GB/US usage can also have a comma in this place, e.g. 7,500,000. This comma is replaced by a full point in continental European countries, e.g. 7.500.000. Thus 23,500.75 (GB/US) will be written 23.500,75 in France and Russia.

Appendix 5

Reading Mathematical Symbols

½	a (one) half
1/6	a (one) sixth
¾	three fourths
0	nought = zero
0.5	(nought) point five
0.004	(nought) point two noughts four = two oesfour=point zero zero four
0.28	nought point twenty eight
2.50	two point five (nought)
53.46	fifty-three point four six = five three point four six
10,000	ten thousand
a^0	*a* to the power of zero
a^2	*a* squared
a^3	*a* cubed
10^{-5}	the minus fifth power of ten = ten to the minus fifth power
10^2	ten to the second (power) = ten squared
10^{-1}	ten to the minus first (power)
10^3	ten to the third (power) = ten cubed
$a = b$	*a* equals *b* = *a* is equal to *b*
$a \# b$	*a* is not equal to *b*
$a > b$	*a* is greater than *b*
$a < b$	*a* is less than *b*
$a >> b$	*a* is much greater than *b*
$a << b$	*a* is much less than *b*
$a \approx b$	*a* is approximately equal to *b*
a_b	*a* sub *b* – *a* subscript *b*
$a + b$	*a* plus *b*
$a - b$	*a* minus *b*
$a \times b$	*a* times *b* = *a* multiplied by *b*
$a \div b$	*a* divided by *b*
a / b	*a* over *b*
$a\,b / c\,d$	*a* times *b* over *c* times *d*
[*a*]	*a* in brackets
(*a*)	*a* in parentheses
( )	round brackets
[ ]	square brackets
%	per cent
52 %	fifty-two per cent

$d\,x$	differential of x
$\int$	the integral of
$\iint$	double integral
$(x^2/y^3)^m$	x squared divided by y cubed in parentheses to the m-th (power)
$\sqrt{a}$	square root of a
$\sqrt[3]{a}$	third (cube) root of a
ln$x$	natural logarithm of x
Log$x$	common) logarithm of
$\mathrm{Log}_{10}2 = 0{,}30103$	logarithm of two to the base ten is naught point three naught one naught three

Appendix 6

Measurements

in	inch (es)	**sq**	inch (es)	**cu in**	cubic inch (es)
ft	foot/feet	**sq ft**	square foot/feet	**cu ft**	cubic foot/feet
yd	yard/ (s)	**sq yd**	square yard/ (s)	**cu yd**	cubic yard/ (s)
-	mile (s)	**-**	square mile (s)	**-**	cubic mile (s)
mm	millimeter (s)	**mm^2**	square millimeter (s)	**mm^3**	cubic millimeter (s)
cm	centimeter (s)	**cm^2**	square centimeter (s)	**$cm^{3/}$cc**	cubic centimeter (s)
m	meter (s)	**m^2**	square meter (s)	**m^3**	cubic meter (s)
km	kilometer (s)	**km^2**	square kilometer (s)	**-**	cubic kilometer (s)

Appendix 7

Weights and Measures

length	**Metric**	**GBandUS**
10 millimeters (mm) 100 centimetersres	=1 centimeter (cm) =1 meter (m)	0.3937 inches (in) 39.37 inches *or* 1.094 yards (yd)
1000 meters	=1 kilometer (km)	0.62137 miles *or* about 5/8 mile
surface		
100 square meters (m^2) 100 acres 100 hectares	=1 are (a) =1 hectare (ha) =1 square kilometer (km^2)	0.0247 acres 2.471 acres 0.386 square miles
weight		
10 milligrams (mg) 100 centigrams 1000 grams 1000 kilograms	=1 centigram (eg) =1 gram (g) =1 kilogram (kg) =1 tonne	0.1543 grains 15.4323 grains 2.2046 pounds 19.684 cwt
capacity		
1000 milliliters (ml) 10 liters	=1 liter (1) =1 decaliter (dl)	1.75 pints *or* 2.101 US pints 2.1997 gallons *or* 2.63 US gallons

Appendix 8

Quantities, Units and Symbols

Quantity	Symbol	Unit	Symbol	Derivation
acceleration	a	$m \cdot s^{-2}$	–	velocity/time
acceleration due to gravity	g	$m \cdot s^{-2}$	–	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
Amplification factor	μ	a ratio	–	–
angle	$\theta_p \varphi_p a_1$	–	–	–
of incidence	i	degree or radian	∘	–
of refraction	r	degree or radian	∘	–
Bragg	θ	number	–	–
critical	c	degree or radian	∘	–
anode slope resistance	R_A	ohm	Ω	$\Delta V_a/\Delta V_a$
area	A	meters×square	m^2	$l \times b$
atomic number	Z	a number	–	number of protons
Avogadro constant	L, N_a	number	–	–
breadth	b	meter	m	fundamental unit
capacitance	C	farad	f	charge/p.d
charge, electric	Q	coulomb	C	current × time
on electron	e	coulomb	C	$1.6 \cdot 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	a ratio	–	
density	ρ	$kg \cdot m^{-3}$	–	m/V
distance along path	s	meter	m	fundamental unit
efficiency	η	a ratio	–	work output/work input
Electrochemical equivalent	Z	$g \cdot C^{-1}$	–	mass/charge

Electromotive force	E	volt	V	energy/charge
electron	e			
energy	E	joule	J	N·m
kinetic	$E_к$	joule	J	$NmE_k = Smv^2$
potential	E_p	joule	J	$NmE_p = mgh$
Faraday constant	F	coulomb·mol^{-1}	C·mol^{-1}	96500 C·mol^{-1}
field strength, electric	E	V·m^{-1}	–	potential gradient: p.d./dist.
magnetic	H	ampereturns	–	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f./rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	M	–
force	F	newton	N	kg·m·s^{-2}
free energy	ΔG	joule	J	–
frequency	f	hertz	H_z	oscillations/time
gas constant	r	joule	J	energy
half–life, radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J·K^{-1}	–	quantity of heat/ temp, rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J·K^{-1}·kg^{-1}	–	heat capacity/mass
heat, quantity of	q	joule	J	energy
height	h	metre	m	fundamental unit
image distance	v	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
self	L	henry	H	–
intensity of radiation	I	a number	–	–
latent heat	L	joule	J	quantity of heat
–, specific	l	J·kg^{-1}	–	quantity of heat
–, molar	L_m	joule·mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampereturns	–	–

magnetic moment	m	Wbm	–	torque in unit magnetic field
magnification, linear	m	a ratio	–	–
mass	m	kilogram	kg	fundamental unit
number	A	a number	–	number of neutrons +protons
molar volume	V_m	(dm^3)	–	volume of 1 mole
molar solution	M	a ratio	–	moles/dm^3
moment of force	–	Nm	–	force × perp. distance
neutron number	N	a number	–	number of neutrons
number	n	–	–	–
of molecules	N	–	–	–
of turns on coil	n	a number	–	–
order of spectrum	p	a number	–	–
object distance	u	metre	m	fundamental unit
peak current	I_0	ampere	A	*see* current
peak e.m.f.	E_0	volt	V	*see* e.m.f.
period	T	second	s	fundamental unit
permeability	μ	$H{\cdot}m^{-1}$	–	henry/metre
of vacuum	μ_0	$H{\cdot}m^{-1}$	–	–
relative	μ_r	a ratio	–	$\mu = \mu/\mu_0$
permittivity	ε	Fm^{-1}	–	farad/meter
of vacuum	ε_0	Fm^{-1}	–	farad/meter
–, relative	ε_r	a ratio	–	$\varepsilon_r = \varepsilon/\varepsilon_0$
Potential, electric	V	volt	V	energy/charge
Potential difference	V	volt	V	energy/charge
power	P	watt	W	Js^{-1}
pressure	P	pascal	P_a	Nm^{-2}: force/area
Radius	r	meter	m	fundamental unit
Reactance	X	ohm	**Ω**	E_0/I_0
Refractive index	n	a ratio	–	–
Resistance	R	ohm	Ω	p.d./current
Resistivity, electrical	p	ohm-meter	–	resistance × length

Relative density	d	a ratio	–	P_{sub}/P_{water}
r.m.s. current	I_{rms}	ampere	A	see current
r.m.s. voltage	V_{rms}	volt	V	see e.m.f.
slit separation	S	meter	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
Temp., interval	θ	degree	°or K	–
Temp., absolute	T	kelvin	K	fundamental unit
thickess	d	meter	m	fundamental unit
Time	t	second	s	fundamental unit
Torque	T	Nm	–	see moment
Tirns ratio	T	a ratio	–	nn_{sec}/n_{prim}
(unit of electricity)	–	kWh	–	kilowatt × hour
Velocity	u, v	$m\ s^{-1}$	–	distance/time
–, angular	ω	$second^{-1}$	s^{-1}	angle/time
– of e.m. waves	c	ms^{-1}	–	–
– of sound	v	ms^{-1}	–	–
volume	V	meter cubed	m^3	I·b·h
wavelength	λ	meter	m	fundamental unit
work	w	joule	J	force × distance (N·m)
weight	W	newton	N	$kg{\cdot}m{\cdot}s^{-2}$ or mg

Appendix 9

Letters Used as Symbols for Quantities

Letter	Quantity
A	area, mass number
a	acceleration
B	magnetic flux density
b	breadth
C	capacitance, heat capacity
c	specific heat capacity, velocity of e.m. waves in vacuum, critical angle
d	relative density, thickness, distance apart
E	energy, electric field strength, electromotive force. E_k kinetic energy, E_p potential energy, E_0 peak e.m.f.
e	charge on electron (or proton), an electron
F	Faraday constant, force
f	frequency, focal length
G	free energy conductance
g	acceleration due to gravity
H	magnetic field strength, magnetizing force, heat of reaction
h	height
I	intensity of radiation, electric current
I_0	peak current
i	angle of incidence
k	a constant
L	self-inductance, latent heat, Avogadro constant
L_m	molar latent heat
l	length, specific latent heat
M	mutual inductance, molar solution
m	mass, electromagnetic moment, magnification
N	number of molecules, neutron number
N_a	Avogadro constant
N	a number, refractive index, number of moles, a neutron
P	power
p	pressure, order of a spectrum, a proton
Q	electric charge

q	quantity of heat
R	resistance
R_a	anode slope resistance, molar gas constant
r	angle of refraction, gas constant (nR), radius
s	distance along a path, slit separation
T	period, thermodynamic (absolute) temperature, torque, tension, turns ratio
t	time
t_s	half-life
u	initial velocity, velocity of molecules, object distance
V	volume, electrical potential, potential difference
V_m	molar volume
V	velocity, image distance, velocity of sound
W	weight
w	work
X	reactance
Z	atomic number
z	charge onion, electrochemical equivalent
a	an angle
Δ	an increment (finite)
ε	permittivity
η	efficiency
θ	temperature (Celsius), temperature difference, an angle, Bragg angle
λ	wavelength, decay constant
μ	permeability, amplification factor
π	ratio of circumference to diameter of circle
P	density, receptivity
Φ	magnetic flux
φ	an angle
ω	angular velocity

Appendix 10

Important Values, Constants and Standards

1. s.t.p. = standard temperature and pressure, expressed as 1.00 atm or 760 mmHg or 101 kPa (= $kN \cdot m^2$) (Pa = pascal) and 0 °C or 273.15 K
2. Temperature of triple point of water, 273.16 K
3. Gas constant, 8.314 $JK^{-1} \cdot mol^{-1}$
4. Standard volume of a mole of gas at s.t.p., 22.4 dm^3
5. The Faraday constant, F, $9{,}65 \cdot 10^4$ $C \cdot mol^{-1}$
6. The Avogadro constant, L, $6{,}02 \cdot 10^{23}$ mol^{-1}
7. The Planck constant, h, $6{,}63 \cdot 10^{-34}$ Js
8. Speed of light, c, $3{,}00 \cdot 10^8$ ms^{-1}
9. Mass of proton, ${}_1^1H$ $1{,}67 \cdot 10^{-27}$ kg
mass of neutron, ${}_0^1$ $1{,}67 \cdot 10^{-27}$ kg
mass of electron, *e*, $9{,}11 \cdot 10^{-31}$ kg
electronic charge, *e*, $-1{,}60 \cdot 10^{-19}$ C
10. 1 cal = 4,18 J
11. Specific heat capacity of water, 4.18 $J \cdot g^{-1} \cdot K^{-1}$
13. Ionic product of water, $K_w = 1.008 \cdot 10^{-14}$ $mol^2\ dm^{-6}$, at 289 K (25 °C)

Appendix 11

Greek Alphabet

Capital, small		English equivalent	Russian equivalent
Αα	alpha	a	Альфа
Ββ	beta	b	Бета
Γγ	gamma	g	Гамма
Δδ	delta	d	Дельта
Εε	epsilon	e(short)	Эпсилон
Ζζ	(d)zeta	z	Дзета
Ηη	eta	e(long)	Эта
Θθ	theta	th	Тета
Ιι	iota	i	Йота
Κκ	kappa	k	Каппа
Λλ	lambda	l	Лямбда
Μμ	mu	m	Мю
Νν	nu	n	Ню
Ξξ	xi	x	Кси
Οο	omicron	o(short)	Омикрон
Ππ	pi	p	Пи
Ρρ	rho	r	Ро
Σσ	sigma	s	Сигма
Ττ	tau	t	Тау
Υυ	upsilon	u	Ипсилон
Φφ	phi	ph	Фи
Χχ	chi	ch	Хи
Ψψ	psi	ps	Пси
Ωω	omega	o(long)	Омега

Appendix 12

List of Chemical Elements

Ac	actinium	актиний
Ag	argentum= silver	серебро
Al	aluminium (US = um)	алюминий
Am	americium	америций
At	argon	аргон
As	arsenic	мышьяк
At	astatine	астат
Au	aurum = gold	золото
B	boron	бор
Ba	barium	барий
Be	beryllium	бериллий
Bi	bismuth	висмут
Bk	berkelium	беркелий
Br	bromine	бром
C	carbon	углерод
Ca	calcium	кальций
Cd	cadmium	кадмий
Ce	cerium	церий
Cf	californium	калифорний
Cl	chlorine	хлор
Cm	curium	кюрий
Co	cobalt	кобальт
Cr	chromium	хром
Cs	caesium	цезий
Cu	copper	медь
Py	dysprosium	диспрозий
Er	erbium	эрбий
Es	einsteinium	эйнштейний
Eu	europium	европий
F	fluorine	фтор
Ee	ferrum=iron	железо
Em	fermium	(рмий
Er	francium	франций
Ga	gallium	галлий
Gd	gadolinium	гадолиний
Ge	germanium	германий
H	hydrogen	водород
He	helium	гелий

Hf	hafnium	гафний
Hg	hydrargyrum = mercury	ртуть
Ho	holmium	гольмий
I	iodine	йод
In	indium	индий
Ir	iridium	иридий
K	kalium=potassium	калий
Kr	krypton	криптон
Ku	kurchatovium	курчатовий
La	lanthanum	лантан
Li	lithium	литий
Lr	lawrencium	лоуренсий
Lu	lutetium	лютеций
Md	mendelevium	менделевий
Mg	magnesium	магний
Mn	manganese	марганец
Mo	molybdenum	молибден
N	nitrogen	азот
Na	natrium = sodium	натрий
Nb	niobium = columbium	ниобий
Nd	neodymium	неодим
Ne	neon	неон
Ni	nickel	никель
No	nobelium	нобелий
Np	neptunium	нептуний
Ns	nilsborium	нильсборий
O	oxygen	кислород
Os	osmium	осмий
P	phosphorus	фосфор
Pa	protactinium	протактиний
Pb	plumbum=lead	свинец
Pd	palladium	палладий
Pm	promethium	прометий
Po	polonium	полоний
Pr	praseodymium	празеодим
Pt	platinum	платина
Pu	plutonium	плутоний
Ra	radium	радий
Rb	rubidium	рубидий
Re	rhenium	рений
Rh	rhodium	родий

Rn	radon	радон
Ru	ruthenium	рутений
S	sulpher/sulfur (US)	сера
Sb	antimony = stibium	сурьма
Sc	scandium	скандий
Se	selenium	селен
Si	silicon	кремний
Sm	samarium	самарий
Sn	stannum = tin	олово
Sr	strontium	стронций
Ta	tantalum	тантал
Tb	terbium	тербий
Tc	technetium	технеций
Te	tellurium	теллур
Th	thorium	торий
Ti	titanium	титан
Tl	thallium	таллий
Tm	thulium	туллий
U	uranium	уран
V	vanadium	ванадий
w	wolfram = tungsten	вольфрам
Xe	xenon	ксенон
Y	yttrium	иттрий
Yb	ytterbium	иттербий
Zn	zinc	цинк
Zr	zirconium	цирконий

Appendix 13

Thermal Expansion, Temperature

temperature (n)	A property of an object that indicates in which direction heat energy will flow if the object is placed in thermal contact with another object. Heat energy flows from places of higher temperature to places of lower temperature
Zeroth law of thermodynarnics	If two bodies Xand Fare each separately in thermal equilibrium with another body Z, then they are in thermal equilibrium with one another. In the most common case the body Z is a thermometer
temperature scale	A sequence of values which represent temperature. Such a sequence is usually obtained by choosing two fixed points (identified by specified properties of stated substances) between which there are subdivisions made on a chosen basis. The Celsius scale has 99 divisions between the melting point of pure water and the boiling point of pure water
Celsius scale	A temperature scale for which the ice point is at 0° and the steam point is at 100°. One Celsius degree is denned as 1/100 of the temperature interval between the ice point and the steam point
Centigrade scale	The name formerly used for the Celsius scale. The name is not now used in International System of Units (SI) but is often used by meteorologists
Fahrenheit scale	A temperature scale for which the ice point is at 32° F and the steam point at 212° F. Originally the zero was obtained in a freezing mixture and another point was fixed at 96° for blood temperature
Reaumur scale	A temperature scale in which the ice point is at 0° and the steam point at 80°
ideal gas scale	A scale in which changes of temperature are measured either by changes of pressure, or changes of volume, for gases operating at pressure low enough for the gases to behave as ideal gases
Thermodynamic scale	A temperature scale which does not depend upon the working properties of any substance. The ideal gas scale is identical with this scale

absolute scale	A thermodynamic temperature scale in which the lower fixed point is absolute zero of temperature and the interval is identic with that on the Celsius scale. The temperature on the absolute scale is obtained by adding to u, the Celsius temperature, // **a** where **a** is the coefficient of expansion of a gas at constant pressure. This gives a scale on which the ice point is 273.15°; **i.e.** °A = °C + 273.15. The absolute scale was often called the Kelvin scale and temperatures measured in °A or °K. In SI units temperature is measured in kelvins (K) by defining the triple point of water as 273.16 K. The ice point is then 273.15 K. The kelvin has the same size as the degree absolute
fixed points	Those points on a temperature scale which are fixed and which can be referred to a given property of a substance. The two main fixed points are the ice point and the steam point
ice point	That fixed point on a temperature scale at which pure solid water (ice) and pure liquid water are in equilibrium at 101325 $N \cdot m^2$ (760 mm Hg). It may be more simply described as the melting point of pure ice at standard pressure (101325 $N \cdot m^2$ or 760 mm Hg)
steam point	That fixed point on a temperature scale at which pure water boils at standard pressure (101325 $N \cdot m^2$; 760 mm Hg). This is 100° on the Celsius scale
zinc point	A fixed point on an international temperature scale, fixed at the temperature at which zinc changes from liquid to solid (the freezing point of zinc) at standard pressure (101325 $N \cdot m^2$). This corresponds to 419.58 °C
International temperature scale	A practical scale which is as near as possible to the thermodynamic scale but easily referable to a series of fixed points. Triple point of hydrogen –259.34 °C Boiling point of neon –246.048 °C Triple point of oxygen –218.789 °C Triple point of water 0.0 °C Boiling point of oxygen –182.962 °C Boiling point of water 100.0 °C Freezing point of zinc oil 419.58 °C Freezing point of silver 961.93 °C Freezing point of gold 1064.43 °C Below 630°C platinum resistance thermometer; up to 1064°C a thermocouple or special platinum resistance thermometer; above 1064 °C a radiation pyrometer

Appendix 14

List of International Words

abberation	bacterium	chemist
abiotic	barrier	chicory
abscissa	biatomic	chlorophyll
abstract	bifurcation	chromosome
accelerate	binary	chord
accumulate	binominal	chrome
acetate	biochemistry	circulation
acre	biogenetic	coagulation
acyclic	bio mass	coefficient
adequate	biophysics	collapse
aeration	biosphere	colloid
aerobe	bomb	compact
agglomerate	boolean	component
aggregate	briquette	compost
allomorph	buffer	concentric
amalgam	bushel	conglomeration
ammonia	calcic	conjunction
amorphism	calculate	coordinate
amphibian	caliber	copernican
anabolism	calibrate	corpuscle
anaerobe	calorie	corrode
androgenesis	camphor	cosecant
anode	canal	cosine
anomalous	capillary	cotangent
antioxidant	capsule	covalence
apical	carat	crater
apparatus	carbide	criterion
Archimedus	carbon	crystallize
Aristotel	carburettor	cube
artesian	carotene	cultivate
asphalt	catalysis	cybernetics
associate	category	cyclic
atmosphere	cathode	cyclone
attribute	cellulose	cylinder
autoclave	cement	cytology
automorphous	centigrade	date
autotrophic	ceramic	deactivation
axiom	centrifugal	degenerate v
azimuth	chemical	deposit

derivative	fungicide	irrational
design	galaxy	irregular
destruction	Galilean	isobar
deviation	Gaussian	isolate
diagonal	genotype	juvenile
diagram	glucose	latent
diameter	gradient	linear
differentiate	granulation	locomotion
diffuse	graph	logarithm
discrete	gravel	machine
divergence	gynogenesis	magma
drainage	hectar	maize
effect	heterogeneity	marginal
ejection	homogeneity	median
electrify	horizon	meridian
electrode	hormone	membrane
electron	humus	metabolism
ellipse	hybrid	metamorphosis
embryo	hydroponic	meter
emission	hyperbola	element
empirical	hypotenuse	micrograph
endocrine	hypothesis	microorganism
epicentre	idea	migrate
epithelium	identity	minus
equator	ignore	minute
equilibrium	immunology	modify
equivalent	impulse	module
erosion	incidence	molecule
ethylen	index	mollusc
Euclidian	inertia	momentum
eulerian	injection	muscle
evolution	innervation	Naperian
explicit	insecticide	negative
exponent	instinct	nerve
extreme	integral	neuron
fauna	integration	neutral
fibre	intense	Newtonian
figure	interference	null
fluctuation	interpret	operate
focus	intrusion	ordinary
formula	invariance	ordinate
fundamental	ion	oscillation

osmotic	protozoan	stationary
oval	pyramid	sterile
packet	Pythagorean	structure
parabola	quadrant	substance
parallelepiped	quantum	substratum
parallelogram	quartz	sulphate
parameter	quasi-	summation
percent	radar	superphosphate
period	radial	symmetry
peripheral	radiant	synthesis
perpendicular	radiate	tangent
perspective	radius	technique
perturbation	rational	temperature
pesticide	reason	tendency
phase	receptor	termite
phenomenon	reflex	texture
phial	regime	thermal
phosphate	regulate	topography
photograph	relief	trachea
photosynthesis	remark	transduction
phylum	reptile	transpiration
physiology	resistance	unbalanced
phytogrome	resource	uniform
plus	resume	unique
polycilinder	rhesis	utilize
polynomial	rhythm	valence
positive	ribonuclease	variable
postulate	ribosome	vegetative
potential	rotation	vermiculate
press	satellite	vernier
primary	scheme	vibration
primitive	secretion	virus
principle	segment	volcano
prism	separate	
problem	service	
procedure	special	
process	specific	
product	spectrum	
profile	sphere	
project	spiral	
proportion	spontaneous	
protein	sporophyl	

Appendix 15

Irregular verbs

Infinitive	*Past simple*	*Past participle*	*Перевод*
abide	abode; abided	abode; abided	пребывать; держаться
arise	arose	arisen	подняться; возникнуть
awake	awoke	awaked; awoke	будить; проснуться
backbite	backbitten	backbitten	клеветать
backslide	backslid	backslid	отпадать
be	was; were	been	быть
bear	bore	born; borne	родить
beat	beat	beaten	бить
become	became	become	становиться
befall	befell	befallen	случиться
beget	begot; begat	begotten	порождать
begin	began	begun	начинать
begird	begirt	begirt	опоясывать
behold	beheld	beheld	зреть
bend	bent	bent; bended	наклоняться (в стороны)
bereave	bereft; bereaved	bereft; bereaved	лишать
beseech	besought; beseeched	besought; beseeched	умолять; упрашивать
beset	beset	beset	осаждать
bespeak	bespoke	bespoke; bespoken	заказывать
bespit	bespat	bespat	заплевывать
bestride	bestrode	bestridden	садиться; сидеть верхом
bet	bet; betted	bet; betted	держать пари
betake	betook	betaken	приниматься; отправляться
bid	bad; bade; bid	bid; bidden	велеть; просить
bind	bound	bound	связать
bite	bit	bit; bitten	кусать
bleed	bled	bled	кровоточить
bless	blessed	blessed; blest	благословлять
blow	blew	blown; blowed	дуть

break	broke	broken	(с)ломать
breed	bred	bred	выращивать
bring	brought	brought	приносить
broadcast	broadcast	broadcast	распространять; разбрасывать
browbeat	browbeat	browbeaten	запугивать
build	built	built	строить
burn	burnt; burned	burnt; burned	жечь; гореть
burst	burst	burst	разразиться; взорваться
bust	bust; busted	bust; busted	разжаловать
buy	bought	bought	покупать
can	could	could	мочь; уметь
cast	cast	cast	кинуть; лить металл
catch	caught	caught	ловить,хватать, успеть
chide	chid; chided	chid; chided; chidden	бранить
choose	chose	chosen	выбирать
cleave	clove; cleft; cleaved	cloven; cleft; cleaved	рассечь
cling	clung	clung	цепляться; льнуть
come	came	come	приходить
cost	cost	cost	стоить
countersink	countersank	countersunk	зенковать
creep	crept	crept	ползти
crow	crowed; crew	crowed	петь (о петухе)
cut	cut	cut	резать
dare	durst; dared	dared	сметь
deal	dealt	dealt	иметь дело
dig	dug	dug	копать
dive	dived; dove	dived	нырять; погружаться
do	did	done	делать
draw	drew	drawn	рисовать,тащить
dream	dreamt; dreamed	dreamt; dreamed	грезить; мечтать
drink	drank	drunk	пить
drive	drove	driven	водить (машину etc.)
dwell	dwelt	dwelt	обитать; задерживаться
eat	ate	eaten	кушать; есть
fall	fell	fallen	падать

feed	fed	fed	кормить
feel	felt	felt	чувствовать
fight	fought	fought	сражаться; бороться
find	found	found	находить
fit	fit	fit	подходить по размеру
flee	fled	fled	бежать; спасаться
fling	flung	flung	бросить
floodlight	floodlighted; floodlit	floodlighted; floodlit	освещать прожектором
fly	flew	flown	летать
forbear	forbore	forborne	воздерживаться
forbid	forbad; forbade	forbidden	запрещать
forecast	forecast; forecasted	forecast; forecasted	предсказывать
foresee	foresaw	foreseen	предвидеть
foretell	foretold	foretold	предсказывать
forget	forgot	forgotten	забывать
forgive	forgave	forgiven	прощать
forsake	forsook	forsaken	покидать
forswear	forswore	forsworn	отрекаться
freeze	froze	frozen	замерзать
gainsay	gainsaid	gainsaid	отрицать; противоречить
get	got	got	получать
gild	gilt; gilded	gilt; gilded	позолотить
gird	girded; girt	girded; girt	опоясывать
give	gave	given	давать
go	went	gone	идти
grave	graved	graved; graven	гравировать
grind	ground	ground	точить; молоть
grow	grew	grown	расти
hamstring	hamstringed; hamstrung	hamstringed; hamstrung	подрезать поджилки
hang	hung; hanged	hung; hanged	вешать
have	had	had	иметь
hear	heard	heard	слушать
heave	heaved; hove	heaved; hove	подымать(ся)
hew	hewed	hewed; hewn	рубить; тесать
hide	hid	hidden	прятать(ся)

hit	hit	hit	ударять; попадать в цель
hold	held	held	держать
hurt	hurt	hurt	причинить боль
inlay	inlaid	inlaid	вкладывать; выстилать
input	input; inputted	input; inputted	входить
inset	inset	inset	вставлять; вкладывать
interweave	interwove	interwoven	воткать
keep	kept	kept	хранить; содержать
ken	kenned; kent	kenned	знать; узнавать по виду
kneel	knelt; kneeled	knelt; kneeled	стоять на коленях
knit	knit; knitted	knit; knitted	вязать
know	knew	known	знать
lade	laded	laded; laden	грузить
lay	laid	laid	класть; положить
lead	led	led	вести
lean	leant; leaned	leant; leaned	опираться; прислоняться
leap	leapt; leaped	leapt; leaped	прыгать
learn	learnt; learned	learnt; learned	учить
leave	left	left	оставить
lend	lent	lent	одалживать
let	let	let	позволять
lie	lay	lain	лежать
light	lit; lighted	lit; lighted	освещать
lose	lost	lost	терять
make	made	made	делать; производить
may	might	might	мочь; иметь возможность
mean	meant	meant	подразумевать
meet	met	met	встретить
miscast	miscast	miscast	неправильно распределять роли
misdeal	misdealt	misdealt	поступать неправильно
misgive	misgave	misgiven	внушать опасения
mishear	misheard	misheard	ослышаться
mishit	mishit	mishit	промахнуться
mislay	mislaid	mislaid	класть не на место
mislead	misled	misled	ввести в заблуждение

misread	misread	misread	неправильно истолковывать
misspell	misspelt; misspeled	misspelt; misspeled	писать с ошибками
misspend	misspent	misspent	экономить
mistake	mistook	mistaken	ошибаться
misunderstand	misunderstood	misunderstood	неправильно понимать
mow	mowed	mown; mowed	косить
outbid	outbid	outbid	перебивать цену
outdo	outdid	outdone	превосходить
outfight	outfought	outfought	побеждать (в бою)
outgrow	outgrew	outgrown	вырастать из
output	output; outputted	output; outputted	выходить
outrun	outran	outrun	перегонять; опережать
outsell	outsold	outsold	продавать лучше или дороже
outshine	outshone	outshone	затмевать
overbid	overbid	overbid	повелевать
overcome	overcame	overcome	компенсировать
overdo	overdid	overdone	пережари(ва)ть
overdraw	overdrew	overdrawn	превышать
overeat	overate	overeaten	объедаться
overfly	overflew	overflown	перелетать
overhang	overhung	overhung	нависать
overhear	overheard	overheard	подслуш(ив)ать
overlay	overlaid	overlaid	покры(ва)ть
overpay	overpaid	overpaid	переплачивать
override	overrode	overridden	отвергать; отклонять
overrun	overran	overrun	переливаться через край
oversee	oversaw	overseen	надзирать за
overshoot	overshot	overshot	расстрелять
oversleep	overslept	overslept	прос(ы)пать
overtake	overtook	overtaken	догонять
overthrow	overthrew	overthrown	свергать
partake	partook	partaken	принимать участие
pay	paid	paid	платить
plead	pleaded; pled	pleaded; pled	обращаться к суду
prepay	prepaid	prepaid	платить вперед

prove	proved	proved; proven	доказывать; оказаться
put	put	put	класть
quit	quit; quitted	quit; quitted	покидать; оставлять; выходить
read	read; red	read; red	читать
rebind	rebound	rebound	перевязывать
rebuild	rebuilt	rebuilt	перестроить
recast	recast	recast	видоизменять; преобразовывать
redo	redid	redone	повторять сделанное
rehear	reheard	reheard	слушать вторично
remake	remade	remade	переделывать
rend	rent	rent	раздирать
repay	repaid	repaid	отдавать долг
rerun	reran	rerun	выполнять повторно
resell	resold	resold	перепродавать
reset	reset	reset	возвращать
resit	resat	resat	пересиживать
retake	retook	retaken	забирать
retell	retold	retold	пересказывать
rewrite	rewrote	rewritten	пере(за)писать
rid	rid; ridded	rid; ridded	избавлять
ride	rode	ridden	ездить верхом
ring	rang	rung	звонить
rise	rose	risen	подняться
rive	rived	riven	расщеплять
run	ran	run	бежать; течь
saw	sawed	sawn; sawed	пилить
say	said	said	говорить; сказать
see	saw	seen	видеть
seek	sought	sought	искать
sell	sold	sold	продавать
send	sent	sent	посылать
set	set	set	ставить; устанавливать
sew	sewed	sewed; sewn	шить
shake	shook	shaken	трясти
shave	shaved	shaved; shaven	брить(ся)
shear	sheared	shorn; sheared	стричь
shed	shed	shed	проливать

shine	shone; shined	shone; shined	светить; сиять
shoe	shod	shod	обувать; подковывать
shoot	shot	shot	стрелять; давать побеги
show	showed	shown; showed	показывать
shred	shred; shredded	shred; shredded	кромсать; расползаться
shrink	shrank; shrunk	shrunk	сокращаться; сжиматься; отпрянуть
shrive	shrove; shrived	shriven; shrived	исповедовать
shut	shut	shut	закрывать
sing	sang	sung	петь
sink	sank	sunk	опускаться; погружаться; тонуть
sit	sat	sat	сидеть
slay	slew	slain	убивать
sleep	slept	slept	спать
slide	slid	slid	скользить
sling	slung	slung	швырять; подвешивать
slink	slunk	slunk	идти крадучись
slit	slit	slit	раздирать(ся); разрезать (вдоль)
smell	smelt; smelled	smelt; smelled	пахнуть; нюхать
smite	smote	smitten	ударять; разбивать
sow	sowed	sowed; sown	(по)сеять
speak	spoke	spoken	говорить
speed	sped; speeded	sped; speeded	ускорять; спешить
spell	spelt; spelled	spell; spelled	писать или читать по буквам
spend	spent	spent	тратить
spill	spilt; spilled	spilt; spilled	проливать
spin	spun; span	spun	прясть
spit	spat; spit	spat; spit	плевать
split	split	split	расщепить(ся)
spoil	spoilt; spoiled	spoilt; spoiled	портить
spotlight	spotlit; spotlighted	spotlit; spotlighted	осветить
spread	spread	spread	распространиться
spring	sprang	sprung	вскочить; возникнуть
stand	stood	stood	стоять

stave	staved; stove	staved; stove	проламывать; разби(ва)ть
steal	stole	stolen	красть
stick	stuck	stuck	уколоть; приклеить
sting	stung	stung	жалить
stink	stank; stunk	stunk	вонять
strew	strewed	strewn; strewed	усеять; устлать
stride	strode	stridden	шагать; наносить удар
strike	struck	struck	ударить; бить; бастовать
string	strung	strung	нанизать; натянуть
strive	strove	striven	стараться
sublet	sublet	sublet	передавать в субаренду
swear	swore	sworn	(по)клясться; присягнуть
sweep	swept	swept	мести; промчаться
swell	swelled	swollen; swelled	разбухать
swim	swam	swum	плавать
swing	swung	swung	качаться
take	took	taken	взять; брать
teach	taught	taught	учить
tear	tore	torn	рвать
tell	told	told	рассказывать; сказать
think	thought	thought	думать
thrive	throve; trived	thriven; trived	процветать
throw	threw	thrown	бросить
thrust	thrust	thrust	толкнуть; сунуть
tread	trod	trod; trodden	ступать
unbend	unbent	unbent	разогнуть(ся)
underbid	underbid	underbid	снижать цену
undercut	undercut	undercut	сбивать цены
undergo	underwent	undergone	проходить; подвергаться
underlie	underlay	underlain	лежать в основе
underpay	underpaid	underpaid	оплачивать слишком низко
undersell	undersold	undersold	продавать дешевле
understand	understood	understood	понимать
undertake	undertook	undertaken	предпринять
underwrite	underwrote	underwritten	подписыва(ть)ся

undo	undid	undone	уничтожать сделанное
unfreeze	unfroze	unfrozen	размораживать
unsay	unsaid	unsaid	брать назад свои слова
unwind	unwound	unwound	развертывать
uphold	upheld	upheld	поддерживать
upset	upset	upset	опрокинуть(ся)
wake	woke; waked	woken; waked	просыпаться; будить
waylay	waylaid	waylaid	подстерегать
wear	wore	worn	носить (одежду)
weave	wove; weaved	woven; weaved	ткать
wed	wed; wedded	wed; wedded	выдавать замуж
weep	wept	wept	плакать
wet	wet; wetted	wet; wetted	мочить; увлажнять
win	won	won	выигрывать
wind	wound	wound	заводить (механизм)
withdraw	withdrew	withdrawn	взять назад; отозвать
withhold	withheld	withheld	удерживать
withstand	withstood	withstood	противиться
work	worked; wrought	worked; wrought	работать
wring	wrung	wrung	скрутить; сжать
write	wrote	written	писать

Appendix 16

LANGUAGE REVIEW

VERB TENSES

PAST SIMPLE

Positive	*Negative*	*Question*
I worked here. You/We/They worked here. He/She worked here.	I didn't work here. You/We/They didn't work here. He/She didn't work here.	Did I work here? Did you/we/they work here? Did he/she work here?

The past simple is used to talk about:

past events	I went to the cinema last night.
past consequences	I was lonely so I joined a club.
narrative events	The teacher grabbed my pencil and shook his finger at me.
biographical events	He left Holland and joined his brother.
historical events	Van Gogh was born in Holland in 1853.
reported statements	You said (that) be lived in Oxford.
reported questions	He asked if 1 lived in London.

PRESENT CONTINUOUS

Positive	*Negative*	*Question*
I'm working now. You/We/They're working now. He/She's working now.	I'm not working now. You/We/They aren't working now. He/She isn't working now.	Am I working now? Are you/we/they working now? Is he/she working now?

The present continuous is used to:

– express present activities	I'm writing a letter.
– describe future arrangements	She's going to Ireland next week.
– talk about temporary situations.	I'm staying with my German penfriend.

Some verbs are not normally used in the continuous tenses, e.g. think, believe, understand like, know, want, hear, see, smell, feel, sound, taste. They are only used in the present continuous when they become deliberate, e.g. What are you doing? I'm thinking.

GOING TO FUTURE

Positive	*Negative*	*Question*
I'm going to work tomorrow. You/We/They're going to work tomorrow. He/She's going to work tomorrow.	I'm not going to work tomorrow. You/We/They aren't going to work tomorrow. He/She isn't going to work tomorrow.	Am I going to work tomorrow? Are you/we/they going to work tomorrow? Is he/she going to work tomorrow?

Going to future is used to:

– talk about plans and future intention — I'm going to stay at home this weekend.

– make predictions from present evidence — We're going to have a lovely autumn.

VERB HAVE GOT

Positive	*Negative*	*Question*
I've got a car. You/We/They've got a car. He/She's got a car.	I haven't got a car. You/We/They haven't got a car. He/She's got a car.	Have I got a car? Have you/we/they got a car? Has he/she got a car?

have got is used to talk about:

family — I've got two sisters and a brother.
qualifications — Have you got a driving licence?
possessions — I haven't got a car

PRESENT PERFECT

Positive	*Negative*	*Question*
I've worked in France. You/We/They've worked in France. He/She's worked in France.	I haven't worked in France. You/We/They haven't worked in France. He/She hasn't worked in France.	Have I worked in France? Have you/we/they worked in France? Has he/she worked in France?

The present perfect simple is used to:

– talk about experience — recently with just, already, still, yet
I haven't been to Scotland but I've been to Ireland.

– talk about length of time up to the present with for and since	How long have you lived there? I've lived therefor Ave years/since 1988. They've just arrived.
– talk about events which have happened	I've already seen it.

PAST CONTINUOUS

Positive	*Negative*	*Question*
I was working.	I wasn't working.	Was I working?
You/We/They were working.	You/We/They weren't working.	Were you/we/they working?
He/She was working	He/She wasn't working.	Was he/she working?

The past continuous is used:

– in contrast with the past simple	We were camping in France when forest fires broke out.
– to describe events happening at a specific time	What were you doing at ten o'clock last night?
– to give the background to events	I was having coffee with a friend. Some men were playing ‘bowls’.

PAST PERFECT

Positive	*Negative*	*Question*
I'd (had) gone.	I hadn't gone.	Had I gone?
Short answer		
Yes, you had.	No, you hadn't.	

The past perfect is used:

– to describe an event which occurred before another in the past	When he arrived at the station, the train had left.
– in reported statements	She said (that) she had met him a year ago.
– in reported questions	They asked her why she had gone to the grocer's.

IMPERATIVE

Positive	*Negative*
Go past the church.	Don't worry.

The imperative is used for:

– directions	Turn right at the bank.
– warnings and advice	Never take a lot of money with you.
	Don't forget to lock your door.
– commands	Talk to Bob.
	Don't phone.

PASSIVE FORM

Present simple passive

It is made in Britain.
They are made of wood.

The passive is used when we are interested in the process or the events rather than the person who is/was responsible for them, e.g. You are fined is more common than The police fine him because we are not interested in who fines the person. It is formed by combining a tense of the verb to be with a past participle of' the main verb.

The passive is used to:

– describe processes	The dogs are trained in two stages.
– talk about legal procedures with impersonal you	You are sent to prison.

GERUND or -ING FORM

The gerund or -ing form is used:

– after verbs like: love, like, enjoy, don't mind, hate	I like cooking./ I don't mind cleaning.
– to express sequence of time with	After leaving school, I went to university.
before and after	Before becoming a painter, he was a teacher

With before, and after + gerund the subject must be the same in both clauses.

QUESTION TAGS

With a positive sentence, you use a negative tag.	He's late, isn't he?
With a negative sentence, you use a positive tag.	He isn't late, is he?

The tag uses the auxiliary verbs, e.g. is, are, was, were, have, can, do, does, did.

In questions beginning with I'm, the negative tag is aren't I.
e.g. I'm late, aren't I?
Question tags are often used in remarks about the weather.
e.g. It's a lovely day, isn't it?
Question tags are used to:

– check and confirm facts	He comes from Brazil, doesn't he?
	He isn't married, is he?
– express surprise	He wasn't, was he?

MODAL VERBS

The following modal verbs are used in this book:
can, could, shall, should, ought to, must, may, might, will would, need

1 The form of the modal is the same with each pronoun, e.g. I/you/he/they can't sing.

2 Modals always come before the main verb in positive and negative sentences, e.g. I must go.

3 Questions are formed by inverting the subject and the modal, e.g. Where shall we go?

4 The negative is formed by putting not (n't) immediately after the modal verb, e.g. I mustn't/couldn't/ shouldn't. The exception is the modals will (negative = won't) and shall (negative = shan't).

Have to is used instead of must in future and past tenses, e.g. she'll have to, she had to.

can

Can is used to:

– express ability	I can sing.
– make requests	Can I use the phone, please?
– offer help	Can I help you?
– refuse help	I'm sorry. I'm afraid I can't
– draw conclusions	He can't be Italian.

The infinitive of can (ability) is to be able to, e.g. If you go sailing, you must be able to swim.

could

Could is used to:

– make requests	Could I have a brochure, please?
– make suggestions	We could show her some folk dancing.
– draw conclusions	He could be Spanish.

shall

Shall is used to:

– offer help	Shall I fake that for you?
– ask for suggestions	What shall we do this evening?
	What shall I buy?

should and **ought to**

Positive	Negative	Question
I should go.	I shouldn't go.	Should I go?
You ought to go.	You oughtn't to go.	Ought I to go?

Should and ought to are used to:

ask for advice	What should I do?
	Should I take a sleeping pill?
give advice	He shouldn't work so late.

must

Must is used to

express obligation	You must do it.
draw conclusions	They must be English.

may and **might**

Positive	*Negative*	*Question*
I may come late. She might come late.	I may not arrive on time. She might not arrive on time.	May I use the phone? (May here = polite request)

May is used to:

– make polite requests,	I may/might give her a ring.
– talk about possible future events	May I use the phone?
– draw conclusions	She might be American.

will / won't

Positive	*Negative*	*Question*
There'll be a lot of traffic.	There won't be much traffic.	Will there be much traffic?

Will/won't are used:

– to talk about future predictions	There'll be a lot of traffic on the M25.
– to make promises	We'll send you a postcard.

– in predictions and promises combined with time clauses beginning with when and as soon as	I'll phone as soon as we get to France.
– to accept warnings and advice	O.K. I will. Don't worry, I won't.
– in first conditional if clauses	If you come up too fast your lungs will hurt.

VERB **have to**

P r e s e n t

Positive	*Negative*	*Question*
You have to meet them at the station.	You don't have to meet them at the airport.	Do you have to meet them? Short answer *Positive*: Yes, I do. *Negative*: No, I don't.

P a s t

Positive	*Negative*	*Question*
I had to meet them at the station.	I didn't have to meet them at the airport	Did you have to meet them? Short answer *Positive*: Yes, I did. *Negative*: No, I didn't.

1. Have to is used to talk about duties and obligations.

2. Note that we use do/does/did to make the negative and question forms of have to, e.g. He doesn't have to go. Do they have to go? You cannot say: ~~he hasn't to go~~, or ~~have they to go~~.

1. Don't have to/Doesn't have to mean the same as needn't, i.e. there is no obligation to do something..

2. Had to is the past tense form of have to. have got to and must.

3. The use of have to often suggests that someone else is telling you what to do.

VERB **allowed to**

Positive	*Negative*	*Question*
You're allowed to smoke.	You're not allowed to smoke. /You aren't allowed to smoke.	Are you allowed to smoke? Short answer *Positive*: Yes? you are. *Negative*: No, you aren't.

1 Allowed to is used to talk about permission, rules and laws.

2 To be allowed to is the passive form of the verb to allow.

3 Allowed to cannot usually be used with the impersonal pronoun it, i.e. you cannot say: ~~It is allowed to smoke~~ but it can be used with the impersonal pronoun you, e.g. You are allowed to smoke.

VERB **used to**

Positive	*Negative*	*Question*
I used to live in that house.	I didn't use to live here.	Did you use to live there? Short answer *Positive*: Yes, I did. *Negative*: No, I didn't.

Used to is used to:

– talk about past habits	I used to speak Punjabi at home but I don't now.
– talk about past situations	We didn't use to have a washing machine.

REPORTED STATEMENTS

Direct speech	*Reported speech*
'I'm thirty-five.' (Present simple)	He said that he was thirty-five. (Past simple)
'I'm working this evening.' (Present continuous)	She said that she was working this evening. (Past continuous)
I've been here before.' (Present perfect)	She said that she had been there before. (Past perfect)
'I met him last year.' (Past simple)	She said that she had met him a year ago. (Past perfect)
but	
I want to go home.' (Present simple)	He says he wants to go home. (Present simple)

1. When the tense of the main reporting verb is in the past, the tense of the reported speech is changed.

2. When the tense of the main reporting verb is in the present, there is no change of tense in the reported speech.

3. That can be used after the main reporting verb, e.g. He said (that) he wanted to go home.

REPORTED QUESTIONS

Direct speech	*Reported speech*
'How old are you?'	She asked (him) how old he was.
'Are you coming?'	She asked (him) if he was coming.
'Do you work in London?'	She asked me if I worked in London.

Tense changes in reported questions are the same as in reported statements.
The word order of the question in reported questions always changes, e.g.
'Where are you going?' – He asked me where I was going.
The auxiliary verbs do/does/did are not used in reported questions.

INDIRECT REQUESTS AND INSTRUCTIONS

Positive
(Can/Could you) ask/tell her to phone back later (?)
Negative
(Can/Could you) ask/tell her not to phone me at work (?)
In this type of sentence, ask and tell are followed by an object plus an infinitive.

REPORTED REQUESTS AND COMMANDS

Direct request		*Reported request*			
Can Could	you come and see me?	She	wants would like asked	me you him her us them	to go and see her

'Please don't phone me.'	She asked me not to phone her.
Direct command	Reported command
'Talk to Bob.'	She told me to talk to Bob.
'Don't phone me.'	She told me not to phone her.

1 Reported requests and commands are made by using verbs like: want, would like: ask and tell with an object and an infinitive.

2 You cannot say: ~~She wants that you. come.~~

3 Note that tell must be followed by a personal direct object, e.g. / told her to go home.

You cannot say: ~~I told to go home~~.

TIME CLAUSES IN THE PAST WITH WHEN, WHILE, AFTER AND BEFORE

When

When he arrived, he made a phone call.

In time clauses with while, after and before the gerund with -ing can be used if the subject of both clauses is the same.

While

While we were camping in France, we saw a forest fire, or
While camping in France, we saw a forest fire, but
While we were camping in France, he arrived.

After

After driving/After he drove all night, he spent the day in bed. but
After they left, he went to bed.

Before

Before going to bed/Before she went to bed, she had a shower, but
Before they arrived, she made some coffee.

TIME CLAUSES IN THE FUTURE WITH WHEN AND AS SOON AS

When he arrives, I'll ask him.
As soon as she phones, I'll let you know.

Although the main verb is expressed by a will future, the verb in the time clause stays in the present simple tense.

CONDITIONAL CLAUSES WITH IF (First conditional)

If it rains, I'll take my umbrella.
If it rains, I won't come.
If it doesn't rain, we'll go to the beach.

In this book, the first conditional is used to:

– describe possible consequences	If you come up too fast, your lungs will hurt.
– threaten or warn people	If you don't go away, I'll call the police.

The first conditional is similar to time clauses in the future with when and as soon as. The main verb is expressed by a will future but the verb in the if clause stays in the present simple.

If … not is sometimes replaced by unless, e.g. / won't come unless you really need we.

CLAUSES OF CONTRAST WITH ALTHOUGH AND LINKING WORD HOWEVER

Two contrasting sentences and ideas can be linked with although, e.g. Although some still live in the outback, many now live in cities and towns.

The same idea can be expressed by using the linking word however at the beginning of the second sentence, e.g. Some still live in the outback. However, many now live in cities and towns.

CLAUSES OF RESULT WITH SO/SUCH . . . THAT

I was so tired (that) 1 fell asleep.

It was such an amazing sight (that) I took a whole roll of film.

1.So and such are often followed by a clause of result beginning with that.

2.Sometimes the word that is omitted.

3.For differences between so and such see the Degree section of this Language review.

RELATIVE CLAUSES

Non-defining relative clauses

Louisa, who's a nurse, lives in Oxford.

Merton College, which was founded in 1264, is one of the oldest Oxford colleges.

Isabel is at a language school, where she is studying for her FCE.

1. A non-defining relative clause adds more Information to that in the main clause.

2. If the relative clause is in the middle of a sentence, there are usually commas around it. If it is at the end, there is usually a comma before it.

Defining relative clauses with who, which and where

Robert Burns was a Scottish poet who wrote Auld Lang Syne.

Tartan is a cloth which has a special criss-cross pattern.

Harris is an island where they make tweed.

1. A defining relative clause defines the person, thing or place we are talking about.

2. There is no comma before a defining relative clause.

Relative clauses without *who, that and which*

A German girl (whom/that) I know went to India for a holiday last year.

Who, that and which can be omitted if they are objects of the verb in the defining relative clause.

Whom is the object form of who. It is used in written English but rarely in spoken English.

COMPARISON OF ADJECTIVES

Comparative adjectives are formed:

- by adding -er to the end of shorter adjectives, e.g. high – higher.
- by putting more or less in front of longer adjectives, e.g. polluted – more polluted, expensive – less expensive.

Comparative adjectives can be modified by adding intensifiers such as much and a bit, e.g. much higher, a bit cheaper.

COMPARISON OF ADVERBS

Most comparative adverbs are formed by adding more to the adverb, e.g. more often, more frequently, more slowly. However, with short adverbs like hard, early, late, fast, the comparative is formed by adding -er, e.g. harder/earlier, later.

FREQUENCY ADVERBS

Once	a week	always	occasionally
Twice	a fortnight	usually	hardly ever
Three times	a month	often	
Four times	a year	sometimes	never

Adverbial phrases of frequency are usually positioned at the end of the relevant clause or sentence.

Adverbs of frequency are usually positioned before the main verb but after the verb to be.

STATIVE VERBS

Certain verbs can be used before adjectives and combined with like before a noun.

It sounds nice.	It sounds like sizzling sausages.
It looks delicious.	It looks like juicy fruit.
It feels good.	It feels like home.
It tastes disgusting.	It tastes like sour milk.
It smells strange.	It smells like fish.
It seems long.	It seems like a year.

QUANTITY

Adjectives					*Pronouns*	
All					All	
Most					Most	
Many	young	people	like	big	Many	of them) like big cities.

Some	cities.	Some	
A few		A few	
Both		Both	
No		None (of them) likes big cities.	

Quantity words with countable nouns

too many	
not many	
a lot (of)	people
plenty (of)	
(not) enough	

Quantity words with uncountable nouns

too much	
not much	
a lot (of)	food
plenty (of)	
(not) enough	

DEGREE

Adverbs of degree

I'm very/rather/quite/fairly/a bit/ not at all shy

1 Most adverbs of degree go before the words they modify.

2.-ly intensifiers can be used in place of very. e.g. She's terribly kind

So/Such a. . .

It's such a beautiful beach.

They're such beautiful animals.

It's so beautiful.

1 Such is used before an adjective plus a noun.

2 So is used before an adjective or an adverb.

3 Both so and such can be linked to a clause of result or consequence, e.g. It was such ah amazing sight (that) I took a whole roll of film.

PREPOSITIONS

During

He died during the war.

During a fit of madness, he cut off his ear.

During is used with a noun which says when something happened, hot how long.

It cannot be used in the same way as for.

ADJECTIVES WITH PREPOSITIONS

Of	I’m frightened / afraid of the dark.
	I’m proud / ashamed of what I did.
About	I’m angry/annoyed/upset about breaking the glass.
	I’m worried about Jenny.

With	I’m pleased / disappointed with my exam results.
	I’m bored / fed up with this book.
	I’m angry / annoyed with her.
At	I’m surprised/ shocked at the news.
	I’m good/bad/hopeless at cooking.

REFLEXIVE PRONOUNS

myself	ourselves
yourself	yourselves
herself	themselves
himself	
itself	

Reflexive pronouns are used when the subject and the object are the same person, e.g.

I had to live in conflict with myself.

He shot himself.

VOCABULARY

Aa

absorb	поглощать
accelerate	ускорять
access	подход
accommodate	вмещать; размещать; приспосабливать
accomplish	выполнять, достигать
accompany	сопровождать
According to	в соответствии с
accuracy	точность
accurate	точный, правильный
achieve	достигать, добиваться
achievement	достижение, подвиг
acquire	приобретать
action	действие, воздействие
activity	деятельность, активность
acute	острый
adapt	приспособляться, прилаживать
add	прибавлять; присоединять
addition	прибавление;
In addition to	кроме того, в дополнение к
adequate	отвечающийтребованиям,соответствующий, достаточный
adjacent	примыкающий
adjust	пригонять, прилаживать
admit	признавать, допускать
adopt	принимать; заимствовать
advance	прогресс
advantage	преимущество, выгода; удобство
advocate	узаконить
affect	эстетически
aesthetically	влиять, воздействовать
afford	позволить себе *(что-л.);* предоставлять
aggregate	заполнитель
age	возраст; век, эпоха
agree	соответствовать
aim (at)	предусматривать, иметь целью
air-conditioning	кондиционирование воздуха
allow	позволять; делать возможным
alone	только
alter	переделывать

alternate	чередующийся; on
alternate days	через день
ambient	окружающий
amenities	удобства
amount	количество; величина
analysis	исследование
angle	угол
annual	ежегодный; годовой
apart	отдельно
appear	казаться, возникать
appearance	появление; внешний вид
application	применение
apply	применять
area	район; площадь
arise	возникать
art	располагать, устраивать
arrange	искусство, умение
artificial	искусственный
assembly	скопление людей
associate	соединять, ассоциировать
assume	предполагать
assumption	предположение
assure	обеспечивать, гарантировать
attain	достигать
attempt	попытка
attention	внимание
pay attention to	обращать внимание
auxiliary	вспомогательный
available	доступный,имеющийся в наличии
availability	наличие
average	средний; обычный
average	равняться в среднем; составлять в среднем
avoid	избегать

Bb

backacter (=backhoe)	обратная лопата
basement	подвал *(здания)*
basic	основной, главный
basin	бассейн, водоем; акватория порта
beam	балка
beauty	красота
behaviour	поведение *(металла),* режим работы *(машины и т.п.)*

believe	полагать
bendingload (stress)	изгибающая нагрузка(напряжение)
benefit	выгода;
to be of benefit	выгодный
beneficial	выгодный
berth	причал; причаливать
besides	кроме, в добавление к
bind	связывать
blast furnace	доменная печь
branch	отрасль
Break down	разрушать(ся)
breakwater	волнорез
bridge	мост
brick	кирпич
brittle	хрупкий
body of water	водный массив
boom	стрела
bucket	ковш
bulk	масса, объем
built-up	составной, сборный; *зд.* застроенный
built-in	встроенный
burn	гореть

Cc

calculate	вычислять; рассчитывать
calculation	вычисление; расчет
call for	требовать, предусматривать
capable of	способный к
capacity	мощность; пропускная способность
per capita	на человека
careful	тщательный
cargo	груз
carry out	перевозить; выполнять
case	случай
cast	отливать; заливать *(бетон)*
cathodic	катодный
cement	причинять, вызывать
cause	цемент
century	век, столетие
certain	определенный; уверенный
chain	цепь
challenge	угроза
chance	случайность; случай

by chance	случайно
change	изменение; изменяться)
charge	загрузка (порция); загружать
cheapest	самый дешевый
chemicals	химикаты
chief	главный, основной
choice	выбор
circulation	переход; перемещение людского потока
circumstances	обстоятельства
claim	требовать, заявлять
claim to be	считать
clam shell	грейфер
clarified	осветленный
clear	ясный
close	тщательный; близкий, непосредственный
closely	тесно
coexistence	покрытие
coating	сосуществование
coil	змеевик
collapse	крах; разрушение
collect	собирать; улавливать
combination	сочетание;
combined with	в сочетании с
common	общий; распространенный; заурядный
commercial	торговый; экономический
communal	общественный
community	связь; коммуникация
communication	общество
comparatively	сравнительно
compare	сравнивать;
comparison	по сравнению
as compared to	сравнение
complementary	дополняющий
complete	завершать
completely	полностью
complex	сложный, комплексный
comply (with)	подчиняться; действовать согласно правилам
composition	обширный
comprehensive	состав; произведение
compression	сжатие
compressive	сжимающий
computation	вычисление

computer	компьютер
conceal	скрывать
conceive	задумывать
conceivable	упредположительно
concentrate	сосредоточивать, концентрировать
concentration	сосредоточение
concept	понятие; концепция
conception	понятие; замысел
concern	забота; касаться;
concrete	бетон
concrete	конкретный
condition	условие
under conditions	в условиях
condition	обусловливать
conductivity	проводимость
conduit	водовод
confine	ограничивать
confuse	приводить в беспорядок
confusion	путаница, смятение
congestion	перенаселенность
connect	связывать
consider	считать,учитывать
considerable	значительный
consideration	рассмотрение; соображение; учет
take into consideration	принимать во внимание, учитывать
consist of	состоять из
consequences	последствия
consequently	следовательно
constitute	составлять
constituent	составляющий
construct	строить
construction	строительство; конструкция
consume	потреблять
consumption	потребление
contamination	содержать
contain	загрязнение; заражение
contemporary	современный
content(s)	суть, содержание
continuity	непрерывность; беспредельность
continuous	непрерывный; замкнутый, сплошной
contrary to	в отличие от
contribute	способствовать

contribution	вклад
control	контроль, регулирование; контролировать, регулировать
convenience	удобство
convenient	удобный
conventional	обычный, традиционный
convert	преобразовывать; обращать
cool	охлаждать
cooling	охлаждение
cope with	справиться, совладать
core	ядро
correspondingly	соответственно
corrosion	коррозия
cost	стоимость, цена
costly	дорогостоящий
counterpart	прототип
couple	соединять; спаривать
crack	щель; трещина
crane	кран
create	создавать
creation	создание
creative	творческий
crime	преступление
crush	дробить, раздавливать
current	современный; циркулирующий, находящийся в обращении
cut	срезать, резать
cycle	цикл

Dd

dam	плотина
damage	повреждение; разрушение
danger	опасность
dead weight	полная грузоподъемность *(судна)*
deal with	иметь дело с
decade	десятилетие
decide	решать
decomposable	подверженныйразложению
decorate	украшать
decoration	отделка
deep	глубокий
define	определять
definition	определение

degree	степень; градус; уровень
deliver	доставлять
delivery	доставка, поставка
demand	потребность; требование
demolish	разрушать, сносить
density	плотность
departure	отбытие, отправление
depend	onзависеть от; dependingon в зависимости от
deposits	залежи; месторождение
deposit	накопить(ся)
depth	глубина
derive	извлекать
description	сорт
desert	пустыня
deserve	заслуживать
design	проектировать; предназначать
designer	проектировщик
designate	определять; называть
designation	предназначение
desired	требуемый, желаемый
despite	несмотря на
destroy	разрушать
determination	определение
determine	определять
develop	развивать, разрабатывать
waterpower development	гидроузел
development	развитие; застройка; разработка;
device	прибор; устройство; механизм
differ	отличаться; различаться
different	различный
dig	рыть, копать
dimension	размеры; объем; соблюдать нужные размеры
direct	направлять
disadvantage	недостаток; ущерб
disaster	бедствие
disastrous	гибельный
discharge	спуск воды ,сброс; расход
discharge	спускать, сливать ,сбрасывать (паводок)
discover	обнаруживать
disposal	удаление
distance	расстояние
distant	отдаленный

distribute	распределять
distribution	распределение
diverse	разнообразный
divert	отводить
divide	подразделять
dock	док, порт
domestic	жилой *(дом),* бытовой
double	удваивать
dragline	канатно-скребковый экскаватор; драглайн
drain(s)	канализационная труба
drainage	канализация*(сток)*
dream	мечта
drill	бурить
drilled	пробуренный
drilled well	скважина, артезианский колодец
drive	приводить в движение; *зд.* двигать(ся)
drought	засуха
dry	сухой; высушивать
dual	совместный, двойной; *зд.* совместного рассмотрения
due to	благодаря
durable	прочный, долговечный
durability	прочность, долговечность
dwelling	жилище, жилой дом

Ee

earth	земля; грунт
economy	хозяйство; экономика, экономия;
national economy	народное хозяйство
edge	острие, лезвие; кромка
education	образование
educational	учебный
effect	действие, воздействие,эффект;
to this effect	для этой цели
effective	действенный, эффективный
efficiency	эффективность; КПД
efficient	эффективный; целесообразный; продуктивный
either	любой *(из двух)*
in either case	в любом случае;
either ... or	или ... или
elaborate	разработанный тщательно
elevate	поднимать
elevation	подъем; отметка *(уровня)*

eliminate	устранять
elsewhere	(где-нибудь) в другом месте
embed	заделывать
embodiment	воплощение
emit	испускать
emphasize	подчеркивать
employ	использовать, применять
empty	выливать;впадать *(о реке)*
enable	давать возможность
enclose	огораживать,окружать
enclosure	загороженное место
endanger	подвергать опасности
energy	энергия
energy carrier	энергоноситель
engineering	техника; инжениринг
civil engineering	гражданское строительство
enlarge	увеличивать *(размеры)*
enlargement	увеличение
ensure	обеспечивать
entail	влечь за собой; вызывать
enterprise	предприятие
entire	полный, целый
entry	вход
envisage	рассматривать *(вопрос)*
environment	окружающая среда; окрестность, местность
equip	оборудовать
equipment	оборудование
equal	равняться
erect	возводить
erection	возведение
escape	выходить *(о воздухе)*
essentials	основное; предметы первой необходимости
essential	существенный, важный
essentially	существенно; существенным образом
establish	устанавливать
estimate	оценивать,определять
evaporate	испаряться
event	событие
evident	очевидный
evolve	разрабатывать
evolution	развитие
examine	рассматривать; исследовать, изучать

excavate	копать, рыть
excavation	выемка грунта
excess	избыток, излишек
exclusive	исключительный
exceed	превышать
execute	выполнять, осуществлять
execution	выполнение
exhaust	истощать
exist	существовать
expand	расширять(ся)
expansion	распространение,рост;
expect	ожидать
expensive	дорогой
experience	опыт
exploration	исследование
expression	выражение; изображение
expressive	выразительный
extend	расширять
extensive	обширный
extent	пространство, протяжение, степень;
to the extent (to ... extent)	до такой степени
extravagant	извлечение; добывание; добыча
extraction	непомерный
extreme	крайний, чрезвычайный
extremely	чрезвычайно, крайне

Ff

fabric	ткань
face	стоять лицом к (перед)
facilitate	облегчать
facilities	оборудование
failure	авария; разрушение
fan	вентилятор
faulty	ошибочный
favour	благосклонность
favourable	благоприятный
feature	особенность, черта
feed	снабжать; питать
find out	разузнавать, выяснять
fix	устанавливать, закреплять
fort	усилие, попытка
fixed	неизменный, установленный
flexible	гибкий

float	быть на плаву
float in	вводить на плаву
flood	паводок
flourish	разрастаться
flow	поток
fluid	жидкость; жидкая среда
flushing	поток; street-flushing operationsполивкаулиц
follow	следовать; the following следующий
foot per minute	фут в минуту
force	сила; заставлять; стимулировать
forecast	предсказание; прогноз; предсказывать; прогнозировать
foreign	инородный
forget	забывать
form	создавать; составлять, образовывать
formation	система
former (the former)	первый *(из двух)*
formerly	ранее, прежде
fortress	крепость
foul	загрязняться)
fraction	доля
frame	каркас
freedom	свободное пользование
frequency	частое повторение
frequently	часто, обычно
fresh	свежий
fuel	топливо; fossil fuelис копаемое топливо
fume	сильный, резкий запах; дым
function	назначение, деятельность; действовать; работать
fund	фонд *(денежный);* капитал
further	дальнейший; дополнительный
further	содействовать
furthermore	к тому же, кроме того

Gg

gate	ворота; шлюзные ворота
generate	вырабатывать, производить
generation	поколение;генерирование *(энергии)*
generator	генератор, источник энергии
goods	товары
gravel	гравий
gravity	сила тяжести

ground	грунт; площадка; testingground испытательная площадка
grow	расти
growth	рост
guarantee	обеспечивать
guide	быть руководителем
gypsum	гипс

Hh

handle	обрабатывать
handling	обработка грузов
happen	происходить
harbour	гавань, порт
harden	затвердевать, твердеть
rapid-hardening	быстро твердеющий
harm	наносить ущерб
harmful	вредный
harmonious	гармоничный
harness	использовать как источник электроэнергии
hazardous	опасный
head	напор *(воды)*
health	здоровье
heat	теплота; нагревать
heater	радиатор
heating	отопление; нагревание
height	высота
hence	следовательно
high	высокий
hoist	поднимать
hole	занимать
hold	отверстие; water-hole колодец
hollow	пустотелый
housing	жилищное строительство
human	человеческий
humanity	человечество
humidifier	увлажнитель
humidity	влажность
hydraulic	гидравлический, гидротехнический
hydropower	энергия воды

Ii

i.e. *лат.*	то есть, а именно
ignore	отвергать,пренебрегать, игнорировать
indispensable	необходимый

indicate	указывать
inevitably	неизбежно
inherent	неотъемлемый
influence	влияние; влиять
ingredients	составные части
inland	материковый
inquire	расследовать, исследовать
iron	железо
insignificant	несущественный
install	устанавливать
installation	установка
instance	пример;
for instance	например
insufficient	недостаточный
intake	водозабор
integral	неотъемлемый
integrate	составлять единое целое
intelligence	ум, интеллект
intend	намереваться
interaction	взаимодействие
intercourse	общение
interior	внутренний
internal	внутренний
interrelate	взаимосвязывать
introduce	вводить
investment	исследование
investigation	капиталовложение
involve	вовлекать, включать
issue	спорный вопрос; проблема

Jj

jack	домкрат
jetty	причал;
oil jetty	нефтяной причал
joint	совместный
junction	узел *(дорог);* соединение
justice	справедливость;
to do justice	отдать должное
justification	оправдание, обоснование

Ll

labour	рабочий;
labourforce	рабочая сила
lack	(полное) отсутствие; недостаток; испытывать недостаток;

for lack of	из-за недостатка
land	причаливать
land slide	оползень
lake	озеро
last	сохраняться; быть достаточным
latter	последний*(из двух названных)*
layer	закон
law	пласт, слой
layout	планировка
lay down	прокладывать
lead	вести; приводить *(к чему-л.)*
leakage	утечка
(at) least	по крайней мере
leave free	освободить
length	длина
level	уровень;
level of living	жизненный уровень; выравнивать
lift	подъем; поднимать
likewise	также
like	подобно
lime	известь
limit	ограничивать
limited	ограниченный
link	связывать
liquid	жидкость
list	вносить в список
load	нагрузка, груз; нагружать
locality	местность
location	местоположение; расположение
lock	шлюз
long-range = long-term	долгосрочный
loss	потеря

Mm

main	главный
maintain	поддерживать, сохранять
maintenance	поддержание; эксплуатация;
maintenance costs	эксплуатационные расходы
major	основной, главный
management	управление
managerial	управленческий
mankind	человечество
manufacture	производить, изготовлять

map	карта
marine	морской
marked	заметный, значительный
master plan	генеральный план
masonry	каменная *или* кирпичная кладка
matter; as a matter of fact	фактически; на самом деле;
no matter what	несмотря ни на что
mean	иметь в виду, значить
means	средства;
by means of	при помощи, посредством
meaningful	многозначительный
measure	измерять
medieval	средневековый
medium	среда
meet requirements	удовлетворять требованиям
mention	упоминать
mere	простой,только лишь
mind	ум;
in public mind	по мнению общественности;
to smb's mind	по чьему-то мнению
mix	смесь
mixture	смесь
mode (ofoperation)	метод, режим, способ
motion	движение
move	движение; двигаться, передвигаться
movement	движение; перемещение
mould	форма; формовать
mount	монтировать, устанавливать
mutually	взаимно

Nn

namely	а именно
navigation	судоходство
necessity	необходимость
need	потребность, нужда; нуждаться (в чём-л.*);*
neighbourly	добрососедский
noble	благородный
nuclear	ядерный
number	некоторое количество; ряд
note	отмечать

Oo

object	цель; предмет; элемент
objectionable	нежелательный

objective	цель
obstruction	помеха,препятствие
obtain	получать, приобретать; достигать
obvious	очевидный
ocean	океан
occupant	житель
occur	происходить, случаться, иметь место
odour	запах
offensive	неприятный; отвратительный
offshore	находящийся в открытом море
offsite	вне строительной площадки (заводской)
oil	нефть
only	единственный
operate	работать; приводить в действие
operation	работа; действие
opportunity	возможность
in order to	для того, чтобы
ordinary	простой, обыкновенный, обычный
origin	происхождение
original	первоначальный
otherwise	иначе, в противном случае
outlet	водовыпуск, сброс
outline	наметить в общих чертах
output	производство, выпуск
overcrowding	перенаселенность
overflow	переливаться own*a* свой, собственный
owing to	благодаря, вследствие

Pp

palatable	вкусный; приятный
panel	панель
part	деталь; часть
particle	частица
particular	особый, особенный; отдельный
particularly	особенно, в особенности
pass	проходить; быть принятым, получать одобрение *(о законе и т.п.)*
paste	тесто; тестообразная масса
pattern	образец, модель; схема
penetrate	проникать
percolate	просачиваться; фильтровать
perform	выполнять, исполнять
permanent	долговременный

permanence	прочность
permit	позволять, разрешать
pier	пирс, пристань
pipe	труба
pipeline	трубопровод
place	место;
to take place	случаться, иметь место
place	помещать
plain	простой; неармированный
plant	завод; парк строительных машин; установка
plant	растительный
plaster	штукатурка
plastics	пластмассы
pollute	загрязнять
precipitator	электрофильтр
precise	точный
predict	предсказывать
prediction	предсказание
prefabricated	заводского изготовления; сборный
prefabrication	заводское изготовление
prefer	предпочитать
preference	преимущество, предпочтение
preliminary	предварительный
premises	сооружения, здания
to be preoccupied	заниматься
prepare	изготовлять
preparation	приготовление; подготовка
preservation	сохранение
pressing	неотложный, настоятельный
prestressed	предварительно напряженный
prevail	преобладать
prevent	предотвращать
primary	первичный; первостепенный
prime	первостепенный, основной
previous	предыдущий
private	частный, личный
process	процесс
processing	обработка;
food processing	обработка пищевых продуктов
pollution	загрязнение
pool	водоем; бассейн
population	население

possess	обладать, владеть
possible	возможный
potential	возможный
power	мощность; энергия;
power station	электростанция
power	приводитьв действие
precast	предварительно изготовленный, сборный
precede	предшествовать
precipitate	осаждаться,выпадать в виде атмосферных осадков
produce	производить, вырабатывать
production	производство
project	проект; проектировать; выступать
prominent	выдающийся
properly	должным образом, правильно
promote	способствовать, содействовать
proper	должный; правильный
property	свойство
proposal	предложение
prospect	перспектива
protect	охранять, защищать
protection	защита; охрана
provetobe	оказываться
provide	обеспечивать; предоставлять, давать
provision	обеспечение
proximity	близость
pump	насос; качать
pure	чистый
purification	очистка
purity	чистота
purpose	назначение; цель

Qq

quality	качество
quantity	количество
quay	пристань;набережная
quiet	тихий, спокойный

Rr

radiant	лучистый
raise	поднимать
range	предел, диапазон
rank	относить к какой-л. категории
rapid	быстрый

rapidly	быстро
rapid-hardening	быстротвердеющий
rate	скорость; темп;
at a rate	со скоростью
raw	сырой, необработанный
ray	луч
reach	размах, взлет; доставать, достигать
readily	легко
realize	ясно понимать; реализовать
reason	причина; основание
receive	получать, принимать
recent	последний,недавний
recently	недавно
recognize	признавать
recreation	отдых
reduce	уменьшать, понижать
refer to	иметь отношение, относиться
with reference to	с учетом, со ссылкой на
refinement	усовершенствование; уточнение
refrigeration	охлаждение
refrigerator	холодильник
refuse	мусор; отбросы
regard	рассматривать, считать
with regard to	в отношении; что касается
regardless	независимоот, невзирая на
reinforced	армированный; усиленный
reinforced concrete	железобетон
reinforcement	арматура
reinterpretation	новое толкование
to be related	быть связанным
relation	отношение; in relation to относительно
relationship	отношение
relative	относительный
relatively	относительно
reliable	надежный
rely	полагаться, надеяться
remain	оставаться
remember	помнить, вспоминать
remote	отдаленный
removal	устранение, удаление
remove	удалять
render	исполнять, приводить в какое-либо состояние

renew	возобновлять, обновлять
repair	ремонт
repetition	повторение
replace	заменять; возвращать на место; вытеснять
represent	представлять
require	требовать
requirement	потребность; требование
requisite	необходимый, требуемый
research	исследование, изыскание
research	исследовать
reservoir	водоем; водохранилище
residential	жилой
resistance	стойкость; сопротивление
resistant	стойкий; прочный
resourses	ресурсы, возможности
respect	уважать; соблюдать; иметь отношение;
with respect to = in respect to	в отношении, что касается
responsibility	ответственность
result	результат, исход
result in	приводить к, давать в результате
retaining wall	подпорная стена
retract	втягиваться
reveal	открывать, обнаруживать
reverse	обратное направление (реверс)
revolve	вращать(ся)
rigid	жесткий; строгий
rise	подъем;
to give rise to	давать повод
road	дорога
rock-like	камнеподобный
rod	стержень; прут
rope	канат; трос
rotate	вращать(ся)
route	путь; маршрут
run off	сток (воды)
run out	истощаться
rural	сельский

Ss

safe	надежный; безопасный
safety	надежность; безопасность
(the) same	тот же самый

sanitary	гигиенический
sanitation	оздоровление; улучшение санитарных условий
satisfaction	удовлетворение
satisfactory	удовлетворительный
satisfy	удовлетворять
saturate	насыщать
saturated	насыщенный
save	экономить
scale	масштаб;
large-scale	широкомасштабный
search	поиск;исследование
security	безопасность; надежность
select	выбирать
selection	выбор
scientific	научный
semi	полу
semi-rigid	полужесткий
sense	смысл, значение
in any sense	в любом смысле
in the same sense	в том же самом смысле
scope	размах; объем (использования)
separate	разделяться, отделяться
serve	служить, обслуживать
set	схватываться (о бетоне)
settle out	осаждаться, давать осадок
settle on	опускаться на
sewage	сточные воды
sewerage	канализация
sewer	канализационная труба
shape	форма; очертание; to
take shape	принять определенную форму
shadow	тень
shelter	укрытие, кров; защита; убежище
shelter	давать приют, служить убежищем; защищать
shipbuilding	судостроение
shopping centre	торговый центр
shortage	недостаток, нехватка
shore	берег (морской)
shovel	лопата; совок
significant	важный, значительный
significance	важность, значение
signify	значить, означать

single	а один, единственный
simultaneously	одновременно
simulate	воспроизводить; походить (на что-л.)
similar	подобный, схожий
since	с тех пор как; так как
site	строительная площадка;
site planning	планирование работ на стройплощадке
situated	расположенный, находящийся в каких-л. условиях, обстоятельствах
size	размер; величина
skill	искусство, мастерство
skilled	квалифицированный
skyscraper	небоскреб
slab	плита
slag	шлак; окалина
slope	наклон; клониться, иметь наклон
society	общество
social	общественный
soil	почва; грунт
solve	(раз)решать (проблему)
solar	солнечный
solid	твердый; сплошной; цельный
soluton	решение, разрешение (проблемы и т. п.)
somewhat	что-то; кое-что; до некоторой степени
source	источник
space	пространство
speed	скорость
speedy	быстрый, скорый
spillage	утечка (нефти)
spillway	водослив
in spite of	несмотря на
spring	родник, ключ
stability	устойчивость
stable	устойчивый
standard	типовой, нормальный;
standard of living	жизненный уровень
standpoint	точка зрения
state	государство; состояние; заявлять
statement	утверждение, заявление
supply	подача (воздуха); снабжение
support	опора;поддерживать, быть основанием
supreme	наиболее важный

survey	топографическая съемка
survive	уцелеть; продолжать существовать, выжить
survival	выживание
suspended	взвешенный (хим.)
surround	окружать
surrounding(s)	окружение

Tt

task	задача
technique(s)	метод(ы)
technology	техника
tenant	жилец, житель
tend	иметь тенденцию
tensile	растягивающий
tension	растяжение
term	срок; называть;
in terms of	в смысле; с точки зрения
terminal	порт приписки
test	испытание
therefore	поэтому
thermal	тепловой
thorough	тщательный
thoroughly	тщательно
threaten	угрожать
thus	таким образом, так
tide	отлив, прилив
tight	плотный
timber	дерево; лесоматериал
time-consuming	отнимающий много времени
total	общий, весь
tower	башня
trade	торговля
traffic	дорожное движение, перевозки;
through traffic	сквозное движение
training	обучение, подготовка
transformation	реконструкция, преобразование
transmission	передача
transmit	передавать
treat	обрабатывать
treatment	обработка; очистка
trench	канава, траншея
trend	направление, тенденция
true	справедливый; истинный, настоящий

turbine	турбина;
reversible turbine	обратимая турбина (турбонасос);
reaction turbine	реактивная турбина
turn on / off	включать; выключать;
in turn	в свою очередь
type	вид, тип

Uu

ultimate	предельный
undergo	подвергаться, претерпевать
undersoil	подпочвенный слой
uniform	однородный; одинаковый
unifying	объединяющий
unit	элемент; установка; блок
unless	если не, пока не
unlike	в отличие от
urban	городской
urgent	срочный; крайне необходимый
urgently	крайне важно
use	применение, использование
utilize	использовать

Vv

valley	долина
value	значение; ценность
valuable	ценный
variable	переменный
variation	вариант; различив
variety	разнообразие
various	разнообразный, различный
vary	различаться, изменяться
volume	объем
valve	вентиль
vapour	пар
vast	обширный
vehicle	машина; транспортное средство
(the) very	самый; предельный
vessel	судно
view	цель;
with a view	с целью;
from the point of view	с точки зрения
violence	интенсивность
visible	зримый, очевидный
visually	зрительно, наглядно

vital	жизненно необходимый, важный
volume	объем

Ww

want	недостаток;
for want of	из-за недостатка
running water	водопровод
water-hole	скважина(водоносная)
water sources	водные источники
watertightness	водонепроницаемость
waste	отходы, отбросы; бесполезная трата
way	путь; способ;
in such a way	так; таким образом
well	колодец;
drilled well	артезианский колодец
as well as	также, так же как
as well	также, кроме того
weigh	взвешивать;
weigh against	сравнивать
weight	вес
whatever	какой бы ни
wheel	колесо
whereby	посредством чего
wherever	где бы (то) ни было
(the) whole	целое; все;
as a whole	в целом
whole	весь, целый
wholesome	полезный
wide	широкий
width	ширина
will	воля
winch	лебедка
wise	разумный
withstand	выдерживать, сопротивляться
wood	дерево; лесоматериал
workability	обрабатываемость

Xx

x-rays	рентгеновские лучи

Yy

yard	площадка, завод для отливки железобетонных изделий

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