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3 Research and development 1

A Research and development (R and D) is the **search** for new and **improved** products and industrial processes. Both industrial firms and governments **carry out** R and D. **Innovations** in products or processes normally follow a path from **laboratory** (lab) idea, through **pilot** or **prototype** production and manufacturing start-up, to full-scale production and market introduction. There are two main types of research. **Pure** or **basic research** aims to clarify **scientific** principles without a specific end product in view; **applied research** uses the **findings** of pure research in order to achieve a particular commercial objective. **Development** describes the improvement of a product or process by **scientists** in conjunction with **engineers**. Industry spends vast sums to **develop** new products and the means to produce them cheaply, efficiently, and safely.

B Research is important in many disciplines and there are different *types of research* with different *research professionals*. The type of research reflects the environment and the objectives. In addition, many research words have entered the general language.

Types of research

- academic research • applied research • clinical research
- development and evaluation research • experimental development • experimentation
- innovation • practical application • product development • pure basic research
- pure research • strategic basic research

Research professionals

- analyst • engineer • lab technician • research assistant • scientist • technician

General terms

- breakthrough • carry out • feasible • feasibility • me-too product
- patent • file* a patent • pipeline • pilot • prototype • register* a patent
- technical know-how (TKH)

product that have been made using principles, methods, practices or designs acquired from or closely similar to a competitor

*file/register a patent

C Notice the stress in the word families below often changes:

| verb | noun (process) | noun (person) | adjective |
|-------------|------------------|---------------|----------------|
| 'analyse | an'alysis | 'analyst | ana'lytical |
| 'innovate | inno'vation | 'innovator | inn'ovative |
| de'velop | de'velopment | de'veloper | develop'mental |
| ex'periment | experimen'tation | ex'perimenter | experi'mental |
| in'vent | in'vention | in'ventor | in'ventive |



'What a breakthrough - we've bred the first germ we can attack with everyday household objects!'

TASKS

1 Match the term with the correct definition.

| | |
|---------------------|--|
| applied research | the study of pure scientific principles |
| clinical research | the study of the parts and their relationship to one another |
| pilot study | changing and improving a product to achieve the best possible result |
| experimentation | looking at how scientific theory can be used in practice |
| pure basic research | looking at the effects of drugs or treatment on patients |
| product development | a new technique or idea |
| innovation | the process of tests and trials to see what happens under different conditions |
| analysis | small-scale experiment |

2 Use the word in brackets to form a word which fits in the sentence.

- 1 The scientists have presented a detailed _____ of the results. (analyse)
- 2 They have brought in a food _____ to help in the research. (analyse)
- 3 All process materials are tested using highly developed _____ techniques. (analyse)
- 4 The researchers have come up with an _____ idea for the use of recycled plastics. (innovate)
- 5 Charles Dyson is the _____ of a vacuum cleaner which works on a new principle. (invent)
- 6 The advent of the ballpoint pen was a wonderful _____. (invent)
- 7 They employ a large team of software _____. (develop)
- 8 A report has been prepared on the _____ tests that have been carried out. (develop)
- 9 Increasing numbers of people can now work from home thanks to _____ in telecommunications. (develop)
- 10 These methods of production are still at an _____ stage. (experiment)
- 11 The _____ is continuing work on the new drug. (experiment)
- 12 Many people are against animal _____. (experiment)

3 The following email has been received by the R and D department. Complete it using words from the list.

breakthrough • prototype • developmental • engineers
design • patent • innovative • experiment

Dear Frank

I had a preliminary meeting with Maria Altefors regarding her (a) _____ for a new children's pushchair. It's a simple but (b) _____ invention which will allow two children of different ages to be transported in a single unit. She has already registered a (c) _____ and I'd like us to develop a (d) _____. Could you arrange a meeting with the (e) _____ to discuss this? We will have to carry out (f) _____ tests to assess safety features and (g) _____ with different weight loads.

This could be a real (h) _____ in pushchair design!

Regards

Ruth

4 Research and development 2

A If you want to get **feedback** on a product or service, you can use **qualitative research**. Qualitative research uses open-ended **interviewing** to **explore** and **understand** the attitudes, opinions, feelings and behaviour of individuals or a group of individuals. Qualitative research has many common uses, including:

- **investigating** current product/service/brand positioning
- **identifying** strengths and weaknesses
- **exploring** alternative communication messages
- understanding why customers buy and use a product or service
- **evaluating** the impact of advertising or public relations campaigns

B Research is based around a wide range of *activities* – from detailed analysis to product improvement. Results from research activities need to be scientifically *measured* and then *reported*.

Research activities

analyse • assess • compile • determine • develop • discover • evaluate
 experiment • explore • find • identify • improve • innovate • investigate
 modify • record • search for • study • survey • test • trial

Measuring the results

constant • correlation • deviation • distribution • frequency • mean
 measurement scale • median • mode • norm • random • reliability
 sampling • standard • statistics • validity • variable • variance

Reporting the results

feedback • report • response

C The following words can be used as both nouns and verbs:

study • test • trial • experiment

- We plan to conduct a *study* of consumer attitudes.
- We are going to *study* consumer attitudes.
- We intend to *test* the reactions to our new advertising campaign.
- We will carry out the *tests* in order to get feedback on our advertising campaigns.
- The *trials* produced some very interesting results.
- We aim to *trial* our new products over the coming months.
- We have evaluated the reliability of the *experiments*.
- It is important to *experiment* with new processes.

Notice the following verb and noun patterns

| Form | noun ending | Noun |
|-------------|-------------|-----------------|
| compile | -ation | compilation |
| standardize | | standardization |
| evaluate | | evaluation |
| identify | -ication | identification |
| modify | | modification |
| assess | -ment | assessment |
| develop | | development |
| improve | | improvement |

TASKS

1 Choose the correct word from the box to complete the following.

distribution • random • scale • sampling • statistics
mean • frequency • median • mode

The collecting, classifying and analysing of information shown in numbers is known as (a) _____.

The middle value of a set of numbers is known as the (b) _____.

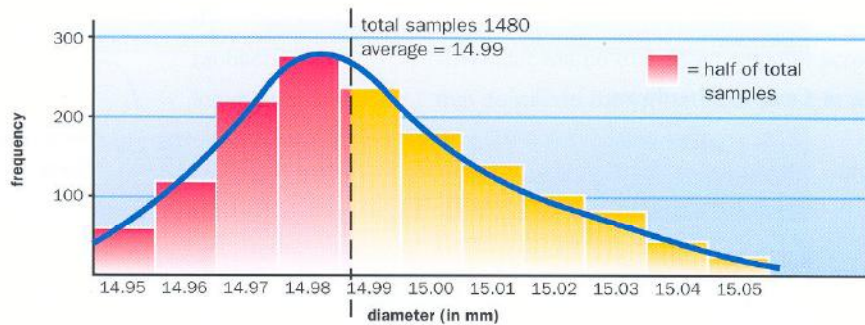
The average value is also known as the (c) _____.

The value which occurs most often is the (d) _____.

1,480 ball bearings were measured as part of quality control. The results are shown in a histogram. The histogram shows frequency (e) _____. The figures are based on a (f) _____ of 2,000 ball bearings. They were chosen at (g) _____; in no particular order, time or pattern. The measurement (h) _____ is in millimetres. The (i) _____ of 14.96mm is two.

Answer the following questions from the graph below.

The median is (j) _____. The mode of distribution is (k) _____. The mean is (l) _____.



2 Complete the following sentences with an appropriate verb from *Research Activities* on the page opposite. You will have to put the verb in the correct form.

- 1 They _____ a report on future energy requirements.
- 2 The temperature was measured every hour and carefully _____.
- 3 Following the accident, fire experts have to _____ the cause of the fire.
- 4 These clothes have not worn well so we will have to try and _____ the quality.
- 5 Scientists continue to _____ for a cure for cancer.
- 6 They are trying to _____ a solution to the problem of friction.

3 Put the following sentences in the correct order to describe the steps in the process of developing a new drug.

- a After hospital specialists have evaluated the drug, information gathered from clinical trials is analysed.
- b Data is subsequently sent to the Committee on Safety of Medicines.
- c Then an application is made to the government for a clinical licence.
- d Tests are then carried out on volunteers.
- e They are monitored closely for any other unwanted effects which were not identified earlier.
- f A decision is made by the committee and a licence issued before the new product is introduced.
- g Any side effects or toxicity are identified at this early stage.
- h First of all, a new substance is tested in the laboratories.

5 Information technology 1

A Information systems **collect, organize, store, process, retrieve** and **display** information in different formats (text, video, and voice). Information technology allows very fast, automated manipulation of **digital** data and their transformation from and to **analogue**.

Two basic technologies have been responsible for the development of the necessary **hardware**: **integrated circuits** and **digital communications**. Parallel advances have been made in **software**, particularly easy-to-use software products to **create, maintain, manipulate, and query files and records**. Many of these **software programs** are designed for use both by computer professionals and enthusiastic amateurs. Another important factor is the development of **computer networks** (►► 6).

B As technology develops, new *models* and *types* of computer appear. At the heart of all computers is the *hardware*. However, without *software*, computers are just dumb boxes, unable to perform any calculations or operations.

Models and types of computer

desktop • laptop • mainframe • notebook • server • terminal • workstation

Computer hardware

CPU (central processing unit) • dot matrix printer • expansion card • inkjet printer
 keyboard • laser printer • monitor • mouse • RAM (random access memory)
 scanner • screen • storage devices

Software

applet • application software • browser • database software • email software
 graphics software • operating system • search engine • spreadsheet
 word processing

C Many words in the field of IT come from American English. So you may see the following spellings:

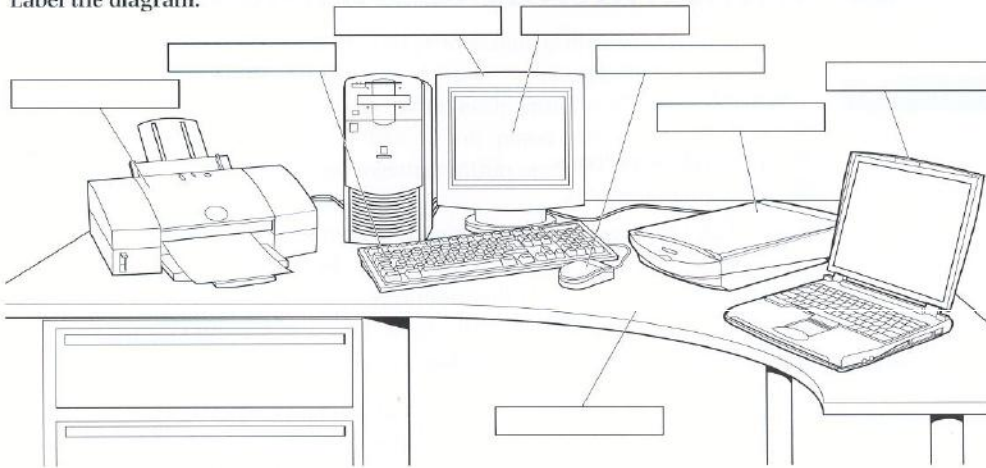
| British English | American English |
|-----------------|------------------|
| programme | program |
| analogue | analog |

The area of IT is developing very quickly; and the language to describe hardware, software and applications is also evolving at a high speed. As a result new noun + noun combinations often change to single nouns

| noun + noun | single noun |
|--------------|-------------|
| lap top | laptop |
| note book | notebook |
| work station | workstation |
| desk top | desktop |

TASKS

1 Label the diagram.



2 Combine one word from A and one word from B and match it with the appropriate definition in C.

| A | B | C |
|------------|-----------------|---|
| create | products | a monitor will do this on a computer screen |
| central | information | this describes the format of 0 and 1 in which information is stored |
| software | processing unit | these enable a computer to perform word processing, to create databases, and to manipulate numerical data |
| display | card | when two or more components are combined and then incorporated into a single package |
| digital | files | to make new programs, utilities or documents |
| expansion | network | a group of electronic machines connected by cables or other means which can exchange information and share equipment (such as printers and disk drives) |
| integrated | data | the principal microchip that the computer is built around |
| computer | circuits | you plug this into a slot to add features such as video, sound, modem and networking |

3 Complete each gap in the following text with a phrase from the table above.

- The computer monitor will _____ so you can see it on screen.
- Information is stored on a computer as _____.
- Spreadsheet and graphic software are examples of _____.
- Digital communications and _____ have allowed developments in hardware to be made.
- In order to organise data you should _____ where you can store data.
- When several computers are linked together you have a _____.
- The part of the computer which interprets and carries out instructions is the _____.
- An _____ can be inserted in your computer to give your computer extra capabilities.

6 Information technology 2

A A network includes:

- – techniques
- – physical connections
- – computer programs

used to **link** two or more computers.

Network users can:

- – **share files**, printers and other resources
- – send **electronic messages**
- – **run** programs on other computers

Each network operates according to a set of computer programs called network **protocols** for computers to talk to one another. Computer networks can now be **interconnected** efficiently through **gateways**. The biggest network is the **World Wide Web**. It consists of a large number of smaller interconnected networks called **internets**. These internets may **connect** tens, hundreds, or thousands of computers. They can share information with each other, such as **databases** of information. The internet allows people all over the world to **communicate** with each other effectively and inexpensively.

B Before a network can operate, it needs physical *connections* so that signals can be transmitted. After the network has been connected, it is ready for *operation*.

Network connections

- by the speed at which information is transferred, usually bits per second*
- bandwidth • baud • bits per second (bps) • optical fibre • packet receive • signal • transmit • transmission speed • twisted pair

Network operation

- configure • download • hack • hub • install • internet service provider (ISP) • local area network (LAN) • switch • transmit • upload • web page • website • wide area network (WAN) • wireless

C A prefix comes at the beginning of a word and usually has a specific meaning, for example inter = between.

Look at the following prefixes and their use in the above IT words/phrases:

| prefix | meaning of prefix | example of use |
|---------------|----------------------|---|
| inter- | between | internet, interconnect, interactive, international |
| intra- | within | intranet, e.g. company intranet |
| trans- | across | transmit, transfer, transaction |
| co-/com-/con- | with | combine, compatible, connect, configure |
| up- | up (to internet) | upload |
| down- | down (from internet) | download, downtime, i.e. when the network is down (not working) |

TASKS

1 Choose the correct word in each of the following.

- 1 The speed with which a modem can process data is measured in _____.
a) bandwidth b) bits per second (bps) c) signal
- 2 Cables consisting of several copper wires each with a shield are known as _____ cables.
a) twisted pair b) optical fibre c) power cables
- 3 Computers that are connected together within one building form a _____.
a) WAN b) ISP c) LAN
- 4 If you transfer a file from a remote computer to your computer, you _____.
a) download b) upload c) run
- 5 To send out information is to _____.
a) signal b) packet c) transmit
- 6 A document containing information and graphics that can be accessed on the internet is _____.
a) a website b) a web page c) the World Wide Web

2 Complete the words in the following sentences by adding the prefix *inter-*, *intra-*, *trans-*, *com-*, *con-*, *up-* or *down-*.

- 1 Last month computer _____ time cost the company over €10,000 in lost production.
- 2 The computers in the production department have now been successfully _____ connected with those in the planning department.
- 3 Once you have completed payment details the data will be _____ mitted via a secure link.
- 4 We cannot network these computers because the systems are not _____ patible.
- 5 Many companies distribute internal documents on their own _____ net.
- 6 Once the home page has been completed, we'll be ready to _____ load the site.
- 7 Cables are being laid throughout the building as the network requires physical _____ nections.
- 8 Using the network he was able to _____ bine the data from different reports.

3 Here is a list of instructions for someone wanting to set up a small network. Put the instructions in the correct order.

- a Make wiring and layout plans for your network.
- b Hook up the network cables by connecting everything to the hub.
- c Check that each computer has an IP address and give it a name.
- d If you're installing a small network, twisted pair will be adequate. However, in order to span greater distances and to minimize magnetic and electrical interference use fibre optic cable.
- e Decide on the type of network you want to install. To enable you to transfer large amounts of data, choose Fast Ethernet (100BaseT).
- f Install network adapters in the computers.
- g Add an internet gateway to your network to set up a shared internet connection.
- h Install driver software for the adapter driver and install client software to share printers and files.
- i Check which protocols are installed and add any other protocols you require.
- j Get the hardware you need: an Ethernet adapter card for each computer that doesn't have an Ethernet port, a hub if you've got more than two computers, cables and wall jacks.

31 Present tenses

A Sample sentences

The logistics department dispatches finished goods to our customers and receives raw materials from our suppliers. Delivery documentation is enclosed with the consignment, but the shipping papers aren't prepared in this department. In this area here the goods are loaded onto trucks; and over there incoming goods which have just arrived are unloaded. A consignment is just being delivered over there. We have been using plastic packaging for many years; however, next year we are moving to more environmentally-friendly materials.

B Form

Present simple and Present continuous

| | Positive | Negative | Question |
|-----------------------------------|---|--|--|
| <i>Present simple active</i> | We <i>receive</i> raw materials from our suppliers. | The supervisor <i>doesn't prepare</i> the papers. | Where <i>do</i> you store finished goods? |
| <i>Present simple passive</i> | All goods <i>are received</i> at this depot. | The bill of lading <i>isn't dispatched</i> . | Where <i>are</i> the goods stored? |
| <i>Present continuous active</i> | The supervisor <i>is checking</i> the delivery. | I <i>am not sending</i> out a bill of lading with this shipment. | When <i>are</i> we <i>moving</i> to the new depot? |
| <i>Present continuous passive</i> | Goods <i>are being unloaded</i> over there. | At present the pallets <i>are not being reused</i> . | Why <i>are</i> those crates <i>being moved</i> ? |

Present perfect

| | Positive | Negative | Question |
|--|--|--|---|
| <i>Present perfect simple active</i> | Our contractor <i>has built</i> a supporting wall. | They <i>have not drained</i> the water yet. | How many tunnels <i>have</i> they <i>dug</i> ? |
| <i>Present perfect simple passive</i> | The walls <i>have been built</i> . | The water <i>has not been drained</i> . | <i>Has</i> the cable <i>been laid</i> ? |
| <i>Present perfect continuous active</i> | The supervisor <i>has been checking</i> the walls today. | I <i>have not been working</i> on that site since last year. | How long <i>have</i> they <i>been excavating</i> at the site? |

Note: the *present perfect continuous passive* is very rare

C Uses

The *present tenses* are used to express a range of meanings.

The *present continuous* describes:

- 1 an activity at or around the time of speaking
At present we are using plastic packaging.
- 2 a fixed future plan
Next year we are building a new depot.

The *present simple* describes:

a regular or characteristic happening
How often do you receive shipments?

The *present perfect* describes:

- 1 an activity at a non-specific time in the past
Our contractor has built a new supporting wall.
- 2 an activity which started in the past and continues to the present
We have been working on this project since last year.

TASKS

- 1 Choose the correct verb form in each of the following.
- In this process, the mixture **is heated/is heating** to 120°C.
 - Once the salts **are dissolving/have dissolved**, the heat is reduced.
 - Several people **have survived/are surviving** the earthquake and **are treating/are being treated** in hospital at the moment.
 - For security purposes the employees **change/are changing** their passwords regularly.
 - Up until now people in this area **have taken/take** waste plastic to recycling centres, but at present we **have tried/are trying** a curbside collection system.

- 2 A journalist is asking some questions. Complete the answers by putting the verb in brackets into the appropriate present tense in the active or passive.

- A: Do you normally hold these products in stock?
B: No. They are normally made to order. (make)
- A: Is the chief engineer here at the moment?
B: I'm afraid not. He isn't currently inspecting the plant in the north of Scotland. (inspect)
- A: Can I see the new design?
B: Yes, of course. It is just coming off the production line. (come)
- A: How many units do you produce a month?
B: We produce 5,000 units a month and only a very small number are rejected. (produce) (reject)
- A: How long have you been using imported raw materials?
B: We imported rayon for many years but we only just began using imported polyester. (import) (begin)
- A: Is this the natural colour of the fabric?
B: No, this fabric is dyed. (dye)
- A: And how long will it be kept in store?
B: Not long at all. We will dispatch this load tomorrow afternoon. (dispatch)

- 3 Complete the following text with the correct form of the verbs in brackets.

Over the past ten years, this area (a) _____ (experience) severe flooding. Houses (b) _____ (damage) and roads (c) _____ (destroy). The local authority (d) _____ (decide) to introduce a flood control system. At present our workforce (e) _____ (build) a dam on the west side of the town and dikes along the river bank (f) _____ (heighten). We must complete the work within two months, so at present we (g) _____ (work) 24 hours a day. We (h) _____ (believe) that these measures will solve the problem in the short term but on 1st May we (i) _____ (start) work on a new watercourse. The plans (j) _____ already _____ (draw up) and we (k) _____ (be) ready to start next week.

32 Past tenses

A Last year we began a study of airbags on our four wheel drive vehicles. First we analysed the results of the tests that we had carried out. After the results had been compiled, we used modelling software to evaluate the performance of the airbags. This showed how well they had performed under different conditions. While we were evaluating the physical performance, another study was assessing the materials that we were using. All the results were then recorded into a database.

B Form

Past simple and Past continuous

| | Positive | Negative | Question |
|-------------------------|--|--|---|
| Past simple active | Last year we <i>began</i> a new study. | We <i>didn't develop</i> the software ourselves. | Where <i>did</i> you record the results? |
| Past simple passive | The performance of the air bags <i>was assessed</i> . | The results <i>weren't recorded</i> . | Where <i>were</i> the findings published? |
| Past continuous active | While the analyst <i>was carrying out</i> the test ... | ... the other technicians <i>were not recording</i> the results. | What <i>were</i> you doing during the test phase? |
| Past continuous passive | While the test <i>was being carried out</i> ... | ... the results <i>were not being recorded</i> . | Why <i>were</i> the findings being written down? |

Past perfect

| | Positive | Negative | Question |
|--------------------------------|--|--|--|
| Past perfect simple active | After we <i>had compiled</i> the results ... | Because they <i>had not recorded</i> the data ... | <i>Had</i> they carried out all the tests? |
| Past perfect simple passive | ... after the results <i>had been compiled</i> . | ... because the data <i>had not been recorded</i> . | <i>Had</i> all the tests been carried out? |
| Past perfect continuous active | The analyst <i>had been checking</i> the walls yesterday ... | We <i>had not been evaluating</i> the physical characteristics ... | How long <i>had</i> you been working on the project? |

Note: the *past perfect continuous active* is quite unusual and the *past perfect continuous passive* is very rare

C Uses

All the *past tenses* are used to express activities at a definite time in the past.

The *past simple* describes:

an activity at a definite time in the past

The study of airbags was started last year.

The *past continuous* describes:

an activity which is a time frame for another activity

While we were studying the airbags, we made a significant discovery.

While our team was studying performance, another team was looking at the characteristics.

The *past perfect* describes:

an activity that happened earlier than another activity in the past

Our studies showed how well the equipment had performed.

Notes:

We use the *past tenses* with these expressions:

yesterday *yesterday morning/afternoon/evening*

last *last night/week/month/year*

ago *one hour/two weeks/three months/four years ago*

in *in 2005/the 1990's/the 19th century*

TASKS

1 Six of the following sentences contain mistakes. Find the mistakes and correct them.

- 1 Sydney Harbour Bridge was building in 1932.
- 2 While they were carrying out tests in the laboratories, researchers were analysing past results.
- 3 The first real road builders in Britain was the Romans.
- 4 The Romans built roads of layers of broken stones of various sizes and were covering them with flat stones.
- 5 The system didn't working because the loudspeaker had been wrongly connected.
- 6 Before factories were told to stop polluting the environment, waste was being dumped in rivers and in the sea.
- 7 Louis Pasteur was discovering the action of germs while he was studying fermentation in wines.
- 8 The production process had already been shut down when the leak in the fuel tank was found.
- 9 Nuclear energy began to be used from the mid-1950s.
- 10 In the second half of the 20th century, the electronics industry transforming the way we work in factories.

2 Make past tense questions and answers using the words given.

1: *When were fibre optics first developed?*

- 1 When / be / fibre optics / first / develop?
- 2 The boxes / break / because they / make / of low quality materials.
- 3 The power supply / cut off / because / cables / come down / during the storm.
- 4 They / not complete / the foundations / by the time the building materials / arrive.
- 5 When / they / install / the solar panels?
- 6 be / this / the first hydroelectric scheme / in Scotland?
- 7 They / not use / wood chip / for heating / when the engineer / visit / the factory.
- 8 How / they / produce / gas / before they / discover / North Sea gas?
- 9 be / the oil pollution along the coastline / cause / by an oil tanker spillage?
- 10 How / they prepare access to this mine?

3 Complete the following report of an accident which happened in a factory with the correct form of the verbs in brackets.

On Friday morning at 9.25 a worker in the chemical plant (a) _____ (find) by a female colleague. He (b) _____ (lie) on the floor. His colleague (c) _____ (check) that he (d) _____ still _____ (breathe) and then (e) _____ (call) the emergency services. The injured man (f) _____ (take) to hospital where he later (g) _____ (recover). An investigation at the factory (h) _____ (find) that a bottle containing a dangerous chemical liquid (i) _____ (leave) open. Vapour from the liquid (j) _____ (escape) into the air. While he had been working in the room he (k) _____ (become) unwell. He (l) _____ (become) drowsy and then (m) _____ (fall) unconscious. Investigating officers are interviewing everyone who (n) _____ (work) in the factory that morning.

33 Future forms

A Sample sentences

A: When are we going to treat the first patients with the new drug?

B: The results from the tests won't be available before next year.

A: When is PharEurop going to register the drug?

B: They are preparing the preliminary forms next month. So they'll be ready before the summer.

A: And when are you going to publish that paper on the results?

B: I am submitting it to the medical journal after the summer.

B Form

1 There is no *to* after *will* or *shall*:

The results of the tests will be ready after the summer.

2 You need the verb *to be* with the *present continuous* and the *going to* forms:

I am submitting it to the medical journal after the summer.

When is PharEurop going to register the drug?

C Uses

Look at the differences in meanings between the following pairs of sentences:

I am going to upload the new web page next week. (I intend to do it: future with *going to*)

I am uploading the new web page next week. (It is my fixed plan to do it: future with *present continuous*)

We are going to digitize the pictures so that we can upload them to our website. (We intend to digitize them: future with *going to*)

The digital pictures will be uploaded to our website on 1st June. (The upload date is a fact: future with *will*)

Now look at this mini-dialogue. Notice the different shades of meaning between the three future forms:

A: When will the hardware be installed?

B: We are going to lay the network cables next Tuesday.

A: I'm seeing the electrical contractor tomorrow. We're going to review the site plan.

B: Good. So when do you think the system will go live.

A: The file server will be delivered on Friday.

B: And the work stations?

A: They're coming at the beginning of the following week.

Notes:

1 The *present continuous* needs an expression of future time to give it a future meaning.

The work stations are coming. (now)

The work stations are coming at the beginning of next week. (in the future)

2 Typical expressions of future time are:

tomorrow morning/afternoon/evening but tonight

next week/month/year

in two weeks/months/years

in the short/medium/long term

3 The negative of *will* is *won't*:

The results won't be ready this week.

TASKS

1 Match these present tense situations with the future intention.

- | | |
|--|--|
| 1 The building materials are being delivered. | a We're going to replace the faulty machine. |
| 2 There is a backlog of orders. | b We're going to build a new warehouse. |
| 3 We're shutting down production. | c The assembly line is going to be inspected. |
| 4 The workers need different interesting jobs to do. | d We're going to automate it in the near future. |
| 5 This is a very slow manual process. | e The workers are going to work overtime. |
| 6 There have been too many faulty goods recently. | f We're going to introduce job rotation. |

2 In the following situations choose the correct sentence, a) or b).

- You are reminding a colleague about the programme for tomorrow.
 - Remember that you'll meet the supplier at 12 o'clock.
 - Remember that you're meeting the supplier at 12 o'clock.
- Two colleagues are discussing the future visit by inspectors.
 - The inspectors won't allow us to store chemicals in this cupboard.
 - The inspectors are not allowing us to store chemicals in this cupboard.
- Designers are discussing the car models with airbags.
 - The use of airbags is going to save more lives in the future.
 - The use of airbags is saving more lives in the future.
- Two managers need the results from some research before November.
 - They won't be able to complete the research before November.
 - They aren't completing the research before November.
- A senior manager isn't looking forward to next week because he's worried about the tests.
 - Tests will be carried out next week.
 - Tests are being carried out next week.

3 A salesman is describing a new product to a customer. Complete what they say with *will* or *won't* and a verb from the box.

give • operate • deal • take • be • contact
install • provide • need • revolutionize • warm • see

S: This is an excellent new material which (a) _____ the use of solar panels.

C: I see, and how many hours of sunshine (b) _____ we _____ to produce energy?

S: It (c) _____ necessary to have sunshine. It (d) _____ in daylight only.

C: (e) _____ it _____ enough energy to warm the building in winter?

S: It (f) _____ the building but you may need additional heating when it is very cold.

C: What about installation?

S: We (g) _____ it for you. It (h) _____ long and you (i) _____ soon _____ how effective it is. We (j) _____ you a three year guarantee and if there are any problems we (k) _____ with them immediately.

C: When will you be able to install it?

S: As soon as we receive your order we (l) _____ you to discuss a suitable date.

34 Conditionals

A Sample sentences

If you follow these measures, the risk of burns will be substantially reduced.
 If you combined these two substances together there would be a serious risk of explosion.
 If you hadn't sealed the container, the vapour would have contaminated the environment.
 If you feel unwell, seek medical advice immediately.
 In case of contact with eyes, rinse immediately with plenty of water.

B Form

A conditional sentence has two clauses: the *if* clause and the main clause.
 There are four principal types of conditional sentences: conditional I, conditional II, conditional III and universal conditions.

| Conditional | <i>if</i> clause | main clause |
|-------------|-----------------------|---|
| I | <i>present simple</i> | <i>future with will</i> |
| II | <i>past simple</i> | <i>conditional with would</i> |
| III | <i>past perfect</i> | <i>past conditional with would have</i> |
| Universal | <i>present simple</i> | <i>present simple</i> |

Note that the following contractions are common in speech:

will – 'll, e.g. I'll *would have* – would've, e.g. we would've *would/had* – 'd, e.g. they'd

C Uses

We use conditional sentences to talk about the relationship between events and their consequences:

If our survey indicates the possibility of oil (event), then we will do some drilling (consequence).

Conditional I

Here the speaker sees the event as a real possibility:

If the oil field is productive, we will recover our exploration costs in a short time.

Conditional II

Here the speaker sees the event as a remote possibility:

If there was a blowout, we would evacuate the rig immediately.

Conditional III

Here the speaker recognizes that the event is an impossibility, i.e. cannot be fulfilled:

If we hadn't made this find, we would have leased out our tankers.

Universal Conditions

Here the speaker indicates that the consequence always follows the event:

If a rock is permeable, it allows water or other fluids, such as oil, to pass through it.

Notes:

- 1 These expressions mean '*if*' and '*only if*':
provided/providing (that) *on condition that* *so long as*
Provided that the results of our surveys are positive, we will continue to drill here.
- 2 These expressions indicate that a future event may or may not happen.
in case *in the case of* *in the event that* *in the event of*
In case of corrosion, stop all activity.
- 3 *unless* means '*if ... not*'
Do not return to the rig unless the supervisor gives instructions to do so.

TASKS

1 Match two parts to form conditional sentences.

- | | |
|---|---|
| 1 If these tests produce positive results, | a the accident would never have happened. |
| 2 If rubber is cooled to -200°C , | b download them onto your computer. |
| 3 If safety measures had been followed, | c we'd be able to do all the technical specifications in half the time. |
| 4 If you want to study the files from the internet, | d we could estimate the experimental error. |
| 5 If we bought a new software package, | e they would have taken nearly two months. |
| 6 If you want to use this software package on more than one system, | f it becomes brittle and will break. |
| 7 If the goods had been sent by sea, | g we'll continue with clinical trials. |
| 8 If we ran an additional test, | h you'll have to get a site licence. |

2 Complete these sentences using the words in brackets.

- The tests won't be continued unless _____ (there/be/better safety measures).
- He wouldn't have been injured if _____ (he/follow/the correct procedures).
- In the event of a collision, _____ (the airbag/inflate).
- If all vehicles were fitted with a catalytic converter, _____ (there/be/less/pollution).
- The reaction would be speeded up if _____ (we/introduce/a catalyst).
- If heat is applied, _____ (the substance/decompose).
- As long as disinfectant is used, _____ (infections/not be/ pass on).
- If iron is left in contact with air and water, _____ (it/rust).

3 Two site workers are discussing the weather. Complete the conversation with the correct form of the verbs in brackets.

- A: We'll carry on with the work when the conditions (a) _____ (improve).
- B: If we'd known the weather was going to be this bad, we (b) _____ (delay) the start of the project.
- A: Well, if the rain (c) _____ (stop) soon, we'll get the foundations laid by evening.
- B: It could have been worse. Do you remember building that bridge last year? If we (d) _____ (not build) the dike of sandbags, the river would have flooded the town.
- A: And if we hadn't brought in that earthmover, we (e) _____ (not make) it in time.
- B: If we get any more rain here, we (f) _____ (have to) repair the potholes in the road before we can use it.
- A: Provided it (g) _____ (stop) soon, we'll be able to start preparing the timber. If they'd chosen another time of year, we (h) _____ (not have) these problems. It would be much nicer if we (i) _____ (have) indoor jobs at this time of year!

36 Active vs passive

A Sample sentences

For our research studies we normally produce a preliminary analysis. We then publish the findings and circulate them to various experts. This is exactly what we did when we applied for the current patent. We are therefore very surprised that you have contacted us in this matter. We can assure you that we completed all the relevant documentation. In the meantime we will investigate your claims further.

For our research studies a preliminary analysis is normally produced. The findings are then published and circulated to various experts. This is exactly what was done when the current patent was applied for. We are therefore very surprised that we have been contacted in this matter. We can assure you that all the relevant documentation was completed. In the meantime your claims will be investigated further.

B Form

Every active sentence has at least two parts:
a subject [1] + an active verb form [2]

We normally produce a preliminary analysis.

[1] [2]

Every passive sentence has at least two parts:
a subject [1] + a passive verb form [2]

A preliminary analysis is normally produced.

[1] [2]

C Uses

We use the *active* verb form in speech and writing to describe actions and events. For example: Paper still plays a vital role in our lives – newspapers tell us the events of the day, and books entertain and educate us. Paper has been with us since 105 A.D. The Chinese first used it to make records; later it spread to all parts of the world.

We can use the *passive* in the following situations:

- 1 We are not interested in the doer.

Ancient paper was made entirely of rags; modern paper is made from wood pulp - a faster and cheaper alternative.

- 2 In process descriptions.

First the logs are stripped of bark, cut into smaller sections, and made into chips. The chips are put into a large tank called a digester and allowed to stew in a chemical mix under pressure. The wood pulp that is created by this process is then washed to remove any chemicals and pressed through screens to remove chunks and foreign objects. The pulp is then drained of water to form a mass that is then bleached and washed again.

The first two corresponding *active* sentences would be:

First we strip the logs of bark, then we cut them into smaller sections, and make them into chips. We then put the chips into a large tank called a digester and allow them to stew in a chemical mix under pressure.

- 3 In impersonal language.

The chemicals in this process are toxic; safety clothing must be worn.

This is the typical style of a written order or instruction. The corresponding *active* sentence would be:

The chemicals are toxic; wear safety clothing.

TASKS

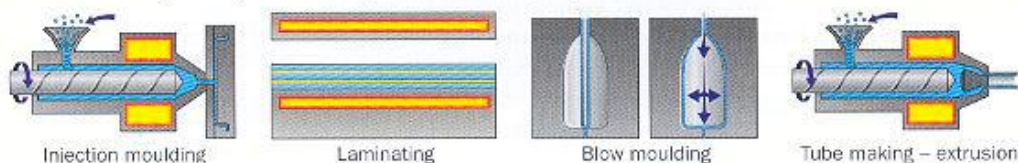
- 1 In the following sentences underline the verbs and decide if they are *active* or *passive*.
- 1 A repeater boosts the electrical signal so that longer cables can be used.
 - 2 Men's ties are usually made of silk or polyester.
 - 3 Nearly all paper can be recycled if it is sorted and contaminants are removed.
 - 4 Geothermal energy is produced below the earth's surface.
 - 5 The main sources of greenhouse gas emissions include fossil fuel generating plants and transportation vehicles.
 - 6 Manufacturers choose plastic containers for many different reasons.
 - 7 Oil was formed in underground rocks millions of years ago.

- 2 Here is a list of changes which have taken place in a town between 1960 and today. Use these notes and the verbs given to write sentences to describe these changes.

Example: *Four hotels have been built.*

| 1960 | today | verb |
|-----------------|-----------------------|-----------|
| no hotels | four hotels | build |
| wet land | no wet land | drain |
| small library | new library extension | open |
| three factories | no factories | close |
| river polluted | river clean | clean |
| few offices | new office block | build |
| no parks | two parks | establish |
| no airport | plans for airport | plan |

- 3 In the following description of how plastics are shaped, put the verb in brackets in the correct form.



There are many ways of shaping plastics. The most common way is by moulding. Blow-moulding (a) _____ (use) to make bottles. In this process, air (b) _____ (blow) into a blob of molten plastic inside a hollow mould and the plastic (c) _____ (force) against the sides of the mould.

Toys and bowls (d) _____ (make) by injection moulding. Thermoplastic chips (e) _____ first _____ (heat) until they melt and then forced into a water-cooled mould under pressure. This method (f) _____ (suit) to mass production.

Laminating (g) _____ (produce) the heat-proof laminate which (h) _____ (use), for example, for work surfaces in kitchens. In this process, a kind of sandwich (i) _____ (make) of layers of paper or cloth which (j) _____ (soak) in resin solution. They (k) _____ then _____ (squeeze) together in a heated press.

Thermoplastics can (l) _____ (shape) by extrusion. Molten plastic (m) _____ (force) through a shaped hole or die. Fibres for textiles and sheet plastic may (n) _____ (make) by extrusion.

39 Cause and effect

A Sample sentences

We are going to convert the assembly line because we believe it will improve overall effectiveness.
 Due to the frequent faults in finished products, we are going to install new machinery.
 As a result of the high cost of local raw materials, we are going to start importing from China.
 Plastics are a versatile family of materials; therefore they are suitable for a wide range of packaging applications.
 Since PET (polyethylene terephthalate) is a clear, tough polymer, it is ideal for use in soft drink bottles.

B Form

1 Clauses of cause:

Here a *subordinating conjunction* links the effect and the cause:

The automotive industry uses plastics because they are durable, resistant to corrosion and lightweight.

Here are the other main subordinating conjunctions:

as • since

2 Phrases of cause:

Here an *adverb phrase* introduces the cause:

Polystyrene manufacturers phased out the use of chlorofluorocarbons (CFCs) in the late 1980s because of concerns about the ozone layer.

Other expressions with a similar meaning are:

as a consequence of • due to • on account of • owing to

We always put a noun phrase after these expressions:

Because of the large number of back orders, we have put extra workers on the night shift. (not: because of the number of back orders is large)

3 Sentence connectors of cause:

Here a cause in one sentence is linked to an effect in the following sentence by a *connector*.

The maintenance team are here; therefore we'll need to shut down the machinery after this shift.

The connector 'therefore' points backwards to the cause and forwards to the effect. Other connecting words and expressions are:

accordingly • as a consequence/result • because of this • consequently
 hence (formal) • so • that's why (informal) • that's (the reason) • therefore
 thus (formal)

C Uses

Look at the following dialogue which demonstrates the use of expressions of cause and effect:

A: Why are we reviewing our quality control practices?

B: Because management is thinking of introducing a zero defect production initiative.
 So we are starting a project group to look at current practices in production.

A: So, that's why everyone has been called to the meeting.

B: Exactly. We've scheduled a preliminary meeting on account of this new initiative.

B: But I thought productivity levels had increased.

A: Yes, but because of this it seems that the reject rate has risen, too.

TASKS

- 1 Match one part of a sentence from A and one from B to form sentences of cause and effect.

A

The reject rate has fallen
 There is now a backlog of orders
 They want to understand why customers buy a product.
 We have developed an improved product
 Computer software has been made easier to use
 They have set up a computer network.
 We are having to increase our prices
 This is a very dusty environment,
 He was not following safety regulations.

B

owing to extensive research and development, due to more effective quality control.
 Consequently, users can share files and resources.
 therefore, all workers should wear masks.
 That's why they're studying customer attitudes.
 That's the reason he had an accident.
 as a result of machinery breakdowns, so more people use computers daily.
 as a consequence of increased carriage charges.

- 2 The following sentences contain a mistake. Find the mistake and correct it.

- Owing a danger of falling objects, workers must wear a hard hat.
- The driver wasn't badly injured in the accident on account from the airbag.
- The car is cheap but reliable and that's the result for its popularity.
- The manufacture of paper uses bleach and other chemicals. Consequently of this, the waste must be treated before it can be disposed of.
- Due to oil is used in the manufacture of so many useful substances, it is a valuable raw material.
- Optical fibres carry more information more quickly than copper wires, since copper wires are being replaced by optical fibres.

- 3 Here is part of a dialogue between an architect and someone who is interested in a local housing development. Fill in the blanks with words from the box.

result • because (2) • why
 consequence • due • account
 consequently • reason • so

A: So, these are the finished plans for the housing development. The site was previously used by heavy industry and (a) _____ of this we will have to remove a thick layer of soil. As a (b) _____ of this, costs will be higher than expected. As far as building design is concerned, the houses will all have a regular shape as you can see here on the plan on (c) _____ of cost considerations.

B: Why does that affect cost?

A: If you measure the surface area of the walls, you'll see that buildings with an irregular shape have a greater surface area. As a (d) _____, more materials will be required and, (e) _____, it will cost more.

B: I see. Now what about the foundations?

A: Well, the soil is very stable, (f) _____ shallow concrete foundations will be sufficient. The walls will be wooden frame walls. That's the (g) _____ the houses can be erected very quickly. The external wall cladding will also be made of wood.

B: But won't the wind and rain damage the wood?

A: That's (h) _____ we will use pre-treated wood. As for the roofs – well, (i) _____ to local planning regulations, the roofs will have to be made of blue slate. It's the traditional stone from this area and (j) _____ of this we have to use it.

40 Ability and inability

A Sample sentences

With the new version of Web Discoverer you can specify better search criteria.
 Applications are computer programs and systems which enable people to interface with the computer.
 Anti-virus software is designed to prevent programs from damaging your data or halting operations on your system.
 You can't make this type of jacket out of wool. It'll crease too easily.
 This cloth is capable of being dyed; but this one doesn't dye well.

B Form

We can view the concepts of ability and inability in terms of:

- 1 making someone able or something possible
*The database **allows** you to search for client names and addresses.*
- 2 being able
*This new monitor **can** display more than two million colours.*
- 3 making someone unable or something impossible
*The climate **stops** people from wearing this type of heavy jacket – it's just too hot.*
- 4 being unable
*You **can't** press this material with a hot iron as it is too sensitive.*

Let's look at the use of language for the concepts 1–4 above:

| 1 | 2 | 3 | 4 |
|-----------|------------|-------------|--------------------|
| make able | be able | make unable | be unable |
| enable | can | prohibit | cannot |
| allow | able to | prevent | not able/unable to |
| permit | capable of | stop | incapable of |

C Uses

Now look at the following short text which demonstrates the use of these verbs.

Now you *can* create your own website. So simple, anyone is *capable of* producing a quality site in minutes. You'll be *able to* add graphics and photos. This new software *allows* you to work with all types of graphic files. The text editing function *enables* you to work directly from your word processor. Remember: only one registered user is *permitted* to use this software.

Note:

- 1 We use the infinitive with *to* after *able/unable*, e.g.
*You'll be **able to** add graphics and photos.*
*Synthetic fibre is **unable to** replace natural fibre.*
- 2 After *capable/incapable* we use *of + verb ...ing*, e.g.
*Anyone is **capable of** producing a quality site in minutes.*
*They are **incapable of** producing these shirts in a wider range of colours.*
- 3 After *prohibit, prevent* and *stop*, we use the following constructions:
*Local regulations **prevent/stop** us from importing tee shirts from certain countries. (from + verb...ing)*
*Local regulations **prevent/prohibit** the importation of tee shirts from certain countries. (noun)*

TASKS

- 1 Match one part of a sentence from A and one from B to form sentences of ability and inability.

A

Improving quality control will enable us
 Shortage of space prevents us from
 Regulations prohibit
 A machine breakdown means that we can't
 Old copper cables are incapable of
 Using a videophone allows you to
 Mobile phones can
 A firewall is used to stop

B

the storage of chemicals in plastic containers.
 carrying the volume of data required today.
 see the person you are talking to.
 producing more product lines.
 now be used to send emails.
 to become more profitable.
 unauthorized users accessing a network.
 finish the order this week.

- 2 There is a mistake in each of the following sentences. Underline the mistake and correct it.

- 1 All unauthorized personnel are prohibited to entering this area.
- 2 Building regulations do not allow of the use of asbestos in public buildings.
- 3 Only fully qualified electricians should be permitted repairing these appliances.
- 4 Deep pile foundations are capable to support a high building.
- 5 Water is unable to passing through the vapour barrier.
- 6 Designers can to design complex structures using computer-aided design tools.
- 7 Scientists are not yet able of curing cancer.
- 8 Aspirin is known to prevent people of having a heart attack.

- 3 Read the following extract from a brochure advertising car features. Look at the prompts in bold and change them for a verb or verb phrase from the opposite page, changing the grammar to fit the sentence.

One feature common to all our models is the airbag. If the driver is involved in a crash, the airbag inflates and ~~make unable stops/prevents~~ the driver or the passenger hitting the steering wheel or front panel. It (a) **make unable** serious injury.

The anti-lock brake system equips the vehicle with speed sensors. If a driver brakes hard, this system (b) **make unable** wheel lockup. Valves control the brake pressure and (c) **make able** the driver to steer the car safely. All our models are fitted with disc brakes, which means the car (d) **be able** operate more efficiently in wet weather. Disc brakes also (e) **make able** better performance at high temperatures.

The catalytic converter is part of the car's exhaust system and (f) **make able** the exhaust gases to be converted into less harmful

products. With a catalyst the car (g) **be able** of meeting new international pollution levels.

A very popular feature is four-wheel drive. In this range of vehicles the driver (h) **be able** select two or four wheel drive. Together with these off-road tyres, the vehicle (i) **be able** perform well on rough ground.

But if you are more concerned about economical driving, you may be interested in the overdrive facility. Here the highest gear ratio is less than a one-to-one ratio. This (j) **make able** you to save fuel and as a result also (k) **make unable** the engine wearing out so quickly.

The turbocharger forces more air into the cylinder than it can normally draw and (l) **make able** the engine to burn more fuel. As a result, the car is capable of greater speed and faster acceleration.