15 Career development

Switch on

Look at the pictures. They show Sami Hassan at different stages in his career. Discuss with a partner what he is doing at each stage.

Listening

Interview with a Network Designer

1 Listen to Sami describing his career path to becoming a Network Designer. Complete the table with what Sami was doing at different ages.

16	Sitting exams at school
17	
18	
20	
23	
25	

2 Listen again and answer the questions.

1 What subjects did Sami study at school?
2 What does a Service Technician do?
3 What did he like about the job?
4 What were his responsibilities at the exchange?
5 What qualifications did he have by the time he was 20?
6 What did he learn when he joined the Network Design department?
7 What did he study at university?
8 What has he had to learn as a Network Designer?

3 Work in pairs, A and B.

Student A You are Sami.
Student B You are an interviewer.

Ask and answer questions about Sami's career.

EXAMPLE

A *What did you study at school?*
B *Maths and Physics.*
A *When did you leave school?*
B *When I was 16.*
A *What did you do next?*
B *I applied to do an apprenticeship with BT.*
A *Why?*

In this unit

- review how to talk about the future
- how to prepare for a job interview
- how to write a covering letter
- technology game reviewing language, career knowledge, and skills from Units 1 to 15

Language spot

Future review

I expect the interview won't be very difficult.
We're going to check the switching equipment at the exchange.
We're attending the conference in Milan on Thursday.
It'll probably take two hours to fix.
She's going to apply for a new job.
I'm moving to a new department next month.

1 Underline the verb forms used to talk about the future in the sentences above. Match verb forms a–c with their uses 1–3.

a	*will*	1	intentions and predictions based on evidence
b	*going to*	2	plans and arrangements
c	Present Continuous	3	expectations and predictions without evidence

» Go to **Grammar reference** p.123

2 Complete the sentences with the most suitable future form of the verb in brackets.

a We ______________ (start) the training course on Monday. I've got the details.
b Mary says she ______________ (look) for a job with more responsibility. Good idea!
c I know there ______________ (be) problems, there always are!
d ______________ you ______________ (discuss) the information storing project at the meeting?
e When do you think the company ______________ (introduce) the next generation of mobile phones?
f I ______________ (meet) the supplier tomorrow morning. We ______________ (discuss) technical specifications.

3 Make a list of three things you have arranged to do in the next few days and three things you intend to do in the future. One thing in each list should be untrue.

EXAMPLES
I'm not coming to the lesson next week.
I'm going to study Electronics at university.

4 Work in pairs. Read your sentences to your partner. Your partner should guess which sentence is untrue.

5 Work in pairs. Make predictions about life twenty years from now. Discuss these topics or choose topics of your own.

- your company activities
- your job
- telecommunications
- mobile phones
- communication technology

Vocabulary

Key skills

1 Match a word / phrase in A with a word / phrase in B.

	A	B
have	a good attendance technical good communication an industry	ability background record skills
be	a good team a good decision well good at	maker organized multitasking worker
want	promotion work job flexible	experience opportunities working hours satisfaction

2 Work in pairs. Write about people you know using phrases from the table in **1**.

EXAMPLE
Olaf has an industry background. He worked for Siemens for four years.

Make your point

Preparing for an interview

1 How would you prepare for an interview? Work in pairs and make a list of key points.

2 Look at the checklist Lee Avatar gives his clients. How many of these points did you think of?

3 Can you think of any other points that would be important in your culture?

4 Read the common questions he mentions again. Spend ten minutes thinking about how you would answer these questions in an interview.

- Find out who you will be talking to. The department boss will ask specific task-related questions and someone from Personnel will ask about your general skills.
- Find out about the company – their products and services, customers and competitors.
- Prepare for some common questions that are often asked during an interview.
  What are your strengths and weaknesses?
  Why do you want to work for us?
  What did you like most in your last job?
  How do you get on with other people?
  Do you work best on your own or in a team?
  How do you manage multitasking?
  How do you deal with stress?

Read more of these typical questions at www.jobcentreplus.gov.uk or by searching, for example, on Google.

- Be positive
- Give relevant answers
- Ask questions
- Wear smart, business-like clothes
- Get to the interview early

5 Work in pairs. Role-play an interview situation. One of you is the interviewer and the other the applicant. Ask and answer the questions you noted down in **4**. When you have finished, discuss each other's performance and how to improve.

Reading

Job ad and covering letter

When you apply for a job, you normally send an application form and your CV. You should also send a covering letter. This should get the employer's attention and make a positive impression.

1 Read the advertisement and answer the questions.

1 What job is being advertised?
2 Who should apply?
3 What should you do if you are interested?

Anglo Telecom is looking for a

NETWORK DESIGNER

AT is a multinational organization. Due to company expansion we now require a Network Engineer to work on our 21st-century development project. You will work on a wide range of networking technologies and be involved in all areas of the project.

The ideal candidate will have a university qualification in Telecommunications engineering or a related subject and some experience in switching and transmission. Strong communications skills are necessary and you will work effectively in a team. Experience of working with different cultures would be an advantage.

Please send your CV and covering letter to Dominik Abraham, Network Planning Department, Anglo Telecom, High Row, London, NW12 6PE.

2 Read and complete the letter on p.107 with these words.

ability	opportunity	responsibility
application	reference	team
experience	response	

3 Work in pairs and discuss the questions.

1 Does Anna have the right qualifications for the job?
2 Do you think Mr Abraham will be interested in her application? Why? / Why not?

milk round (n) a series of visits that large companies make each year to colleges and universities, to talk to students who are interested in working for them

234 Castle Rise
Kingston
AB9 6XX
0144 612398
mobile:1077986543
email:
as@home.co.uk

Mr D Abraham
Network Planning Department
Anglo Telecom
High Row, London
NW12 6PE

24 August 2008

_______________[1]: application for Network Designer

Dear Mr Abraham

In _______________[2] to the advertised position for a Network Designer in the Telecommunications Engineering Journal on 18 August 2008, I am writing to ask you to consider my _______________[3]. I am looking for the opportunity to gain experience in this field.

I gained hands-on _______________[4] in switching and transmission while studying for my NVQ in Manchester and was fortunate enough to spend six months in Sweden with Telia as part of an exchange programme. While there, I worked on maintenance and fault-finding at the exchanges as a Network Technician and was given _______________[5] for implementing new systems. I gained valuable experience of working as part of a _______________[6] and in communicating with others.

I am very interested in joining a leading telecoms company such as Anglo Telecom. My NVQ results show that my technical _______________[7] is excellent and I am very conscientious about meeting deadlines. I have excellent computing skills and a very positive attitude to learning new skills.

I would appreciate the _______________[8] to meet you to discuss my application and look forward to hearing from you.

Yours sincerely

Anna Suchard

Webquest

Visit *Milkround.com* and enter a sector that you are interested in, such as *Engineering*, in the *Search* box, then find a job you think is interesting and follow the link. When you have done your research, write a covering letter for the job.

www.milkround.com/s4/jobseekers/

Speaking

Second interview task

For some jobs you may be interviewed twice. After the first interview, the employer will produce a short-list of suitable candidates: usually no more than three. If you are invited to a second interview, you will probably be asked to prepare and perform a task.

1 Imagine you have been invited for a second interview. Make a poster of an ironing board with at least two drawings showing the ironing board set up and folded. Annotate the drawing with information about parts and materials used. You have 20 minutes to prepare.

2 Work in groups. Present your work to your group of students and listen to other students giving their presentations. When you have finished, discuss what you have done well and think about how you could improve in the future. Use the checklist in *Make your point*, Unit 14, p.103 to make constructive comments.

3 Decide on the best piece of work in your group. As a group, present it to the rest of the class.

Technology game

This game revises what you have learned in this book. Work in groups of six. Divide into three pairs. You need one dice for each group and a counter for each pair.

Rules

Decide who is going to start. Place your counters on the start square. The first pair throws the dice and moves their counter to the correct square. Read the instructions aloud. You are allowed one minute to discuss your answer. (The other pairs should also think about the answer.) Give your answer in no more than one minute. If you cannot answer, another pair can offer an answer.

If another pair thinks that the answer is incorrect they can challenge and offer another answer. If they get the correct answer, they can move their counter along one square. It is now their turn to throw the dice. If the answer is correct and there is no challenge, the pair rolls again.

The first pair to reach **Finish** is the winner.

Red squares give instructions

Yellow squares test your career skills and knowledge

Green squares test your speaking skills

Brown squares test your language knowledge (grammar, vocabulary)

a), b), c) squares

If there are a), b), or c) questions, the first pair to land on the square can choose which they want to answer. The next time a pair land on that square, they must answer a different question. If the square has only one question, the next pair to land on the square must give an answer that is different to the first pair.

Talk about squares

If the instructions tell you to *Talk about* ..., you must talk for 30 seconds.

Good luck!

1 **START** Name 3 different college courses where you could study Technology.	**2** Talk about a route you could follow to develop your future career.
5 Give 2 sentences you could use in a presentation.	**6** Talk about what **a** you have been doing. **b** you did yesterday. **c** experiences you have had.
9 Talk about **a** how a bridge is constructed **b** how a tunnel is constructed.	**10** Name 3 sources of renewable energy.
13 Describe a bridge you know – type, location, function.	**14** Talk about how one form of renewable energy works.
17 What can you say if you don't understand someone?	**18** Name 2 different forms of transport that use **a** water **b** air **c** rails.
21 Give 3 advantages to an earth home.	**22** Move forward 1 square.
25 Make 2 sentences about what you do and 2 sentences about what you are doing.	**26** Give 2 expressions you could use in a presentation to **a** start **b** finish.
29 Describe **a** 2 steps in water treatment **b** 2 features of an eco-city.	**30** Name 2 roles of an Environmental Scientist.
33 Take a break – miss a turn.	**34** Talk about a type of technology designed to save energy.
37 Draw and describe an electronic circuit symbol.	**38** Make a sentence that has **a** 2 prepositions of time **b** 2 prepositions of place **c** 2 prepositions of movement.
41 Give a noun that could follow the verb: **a** amplify **b** generate **c** modulate.	**42** Name 2 skills you have that you would mention in a letter of application.

3 What follows these verbs: -ing or to + infinitive? **a** avoid, suggest, enjoy **b** decide, learn, aim.	**4** **a** What is precision agriculture? **b** Name two ways of preserving food.
7 Go back to the start.	**8** Name 2 different types of bridge.
11 Make 2 sentences to say what manufacturers can/are able to do with plastics.	**12** **a** Name 2 different plastics and what they are used for. **b** Give 3 properties of plastics.
15 **a** Give 3 verbs that describe movement in mechanisms. **b** Give 3 adjectives that describe shape.	**16** Name 3 parts of an aeroplane and give their function.
19 Give 2 things you **a** must do **b** mustn't do if you want to build a house.	**20** Describe 3 features of a home of the future.
23 Make 2 sentences to compare **a** cars and bicycles **b** trains and buses.	**24** Name 2 parts of a drilling rig and give their function.
27 Give 2 examples of robots and say what they do.	**28** Make 2 phrases with the words **a** technology **b** waste **c** water.
31 Make 2 sentences with the words **a** cause **b** prevent.	**32** Name 3 domestic appliances.
35 Ask your partner to do something politely. Your partner must reply.	**36** When giving a presentation, give 2 pieces of advice about **a** organizing **b** visual aids **c** delivery.
39 Make 3 statements about **a** your plans for the rest of the week **b** your predictions for life in 20 years' time.	**40** Describe 2 forms of technology that have been developed to avoid warships being detected.
43 Give one way you can ask for clarification if you haven't heard someone clearly.	**44** Give 2 pieces of advice about how to prepare for an interview. **FINISH**

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I can talk about the future
- I know how to prepare for a job interview
- I know how to write a covering letter
- My reading and listening are good enough to understand most of each text in this unit

Key words

Nouns
ability
applicant
application
attendance record
candidate
covering letter
decision maker
multitasking
opportunity
promotion
reference
responsibility
skill
team

Verbs
apply

Note here anything about how English is used in technology that is new to you.

Pairwork activities

Unit 1 p.4

Student A

1 Transmission systems, Engine management systems, Diagnostics, including using electrical and electronic test equipment

4 Electric power, Materials and manufacture, Mathematics

5 Aeroplane aerodynamics, Gas turbine engines, Propellers

8 Audio recording, Sound creation and manipulation, Computer music production

Unit 6 p.39 Make your point

Student B

Boeing 747–8
Cruising speed: 913 km/h
empty weight: 185,972 kg
max take-off weight: 439,900 kg

Aviation weather report at 0800 UTC on 16 June
Temperature: 16°C
Dew point: 2°C
Pressure: 1024 hPa

Unit 2 p.12

Student A

Orange growers have always had the desire to make their oranges as orange as possible! Oranges grown in some parts of the world are dull and lack colour because there are no cold nights, while those grown in areas with cool nights are usually brighter in colour. Now, orange growers take their freshly-picked oranges to large buildings where ethylene gas is used to stimulate the chlorophyll in the oranges to bring out more natural colour. After that, each fruit is photographed from every possible angle using a digital camera. Computers use these pictures to record any undesirable marks on the skin at the same time as analyzing the size, colour, and shape of each orange. Depending on the demands of the market, the grower can set the required grade specifications in the computer. Any oranges which do not meet the required standards are removed from the production line and later used to produce juice.

Unit 11 p.83 Speaking

Student A

A

HeartLander is an experimental miniature robot designed to allow surgeons to treat damaged hearts without major surgery. It has been developed at Carnegie Mellon University in Pittsburgh. The robot is two centimetres long. It can be inserted into the body by a small incision in the chest. It moves by a combination of suction and push-pull movements provided by wires driven by motors outside the body. The movement resembles the way a caterpillar moves. It can travel at speeds of up to 18 cm per minute.

A computer monitors its position and controls its movements.

HeartLander can be directed to crawl over the surface of the heart while the heart is beating. Its inventors hope to use it to attach leads for pacemakers, to inject drugs straight to the heart, and to take samples from the surface of the heart for analysis.

To do this without major surgery would be an important advance in the treatment of heart problems.

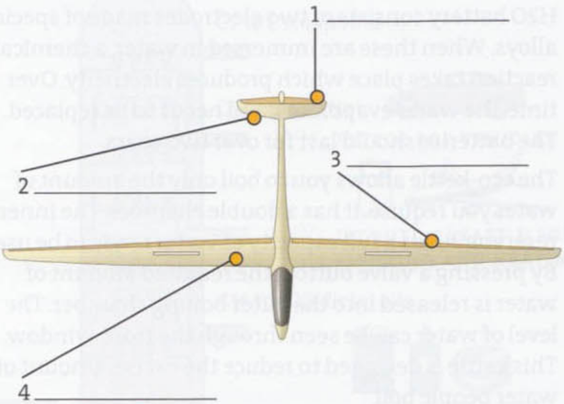
Unit 8 p.48

Student B

The Japanese Shinkansen network of high-speed railway lines extends for several thousand kilometres. The system was based on existing rail technology, but designers tested model trains in a wind tunnel to make them aerodynamic in design and so reduce air resistance. Because of the shape, the trains have been called 'bullet trains'. Electric or diesel engines power the trains which travel up to 300 km/h on standard gauge, purpose-built track. Certain constrictions had to be eliminated, such as level crossings, frequent stops, and some curves. Similar high-speed rail networks exist in other countries, for example the TGV in France. They allow travel from city centre to city centre, rapid boarding time, and comfort. They are considered environmentally efficient and are seldom affected by poor weather.

Unit 6 p.38

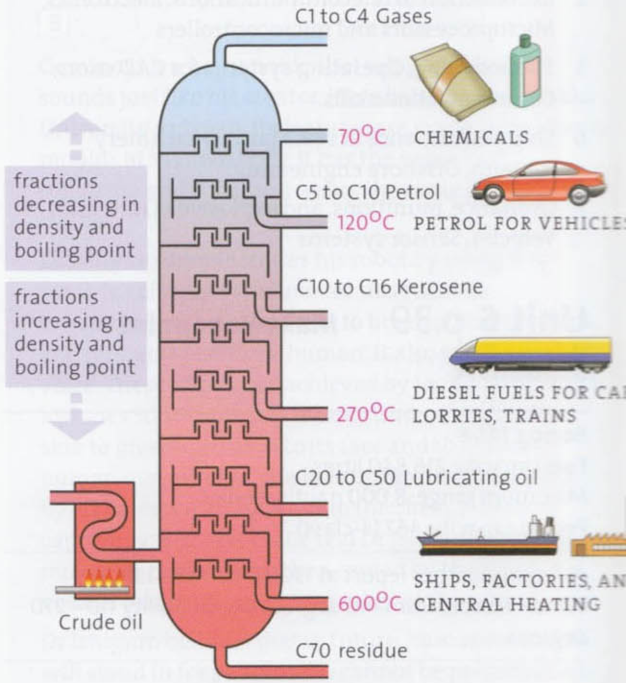
Student A



Helicopters are known as rotary-wing craft because of the rotating blades or wings. The main rotor is mounted on the top of the helicopter. The blades have an aerodynamic shape and as they spin they provide lift. A gas-turbine or petrol engine below the shaft provides power for the rotor, which also provides thrust. Most helicopters also have a tail rotor attached to a tail boom. This provides thrust in a sideways direction and prevents the helicopter from spinning. The pilot controls direction using both hands and feet. He / she can change the angle of each blade so that they produce more thrust on one side than on the other. This creates a difference in lift and so causes the helicopter to tip and move forward, backwards, and sideways.

Unit 9 p.71

Student B



Unit 12 p.89

Student B

The Wattson is an attractive-looking device that shows how much energy is being consumed at any point of time. A clip attaches a small transmitter around the electricity cable beside the electricity meter. This provides a wireless connection to the Wattson, which can be placed anywhere in the house. The device glows in blue or red electroluminescence. Blue indicates low energy use while red indicates high. It also provides hard data on energy consumption and can show how much it costs to leave a specific appliance on for a year!

Compact fluorescent bulbs (CFLs) are used in place of conventional incandescent light bulbs. A fluorescent tube is filled with mercury vapour. An electrical discharge through this mercury vapour emits ultra-violet light. This makes a coating inside the tube glow brightly, producing about four times as much light as a conventional bulb with the same wattage. The first energy-saving bulbs were long and large, but using electronics in the base of the bulb has reduced the size.

Pairwork activities

Unit 1 p.4

Student B

2 Introduction to telecommunications, Electronics, Microprocessors and microcontrollers
3 3D modelling, Operating systems for CAD users, Communication skills
6 Ship performance at sea, Marine machinery systems, Offshore engineering
7 Ordnance, munitions, and explosives, Guns and vehicles, Sensor systems

Unit 6 p.39 Make your point

Student A

Boeing 747-8
Fuel capacity: 216,840 litres
Maximum range: 8,000 nautical miles
People capacity: 467 (3-class)

Aviation weather report at 1300 UTC on 30 January
Wind – 5 knots from 140 degrees SE, variability 110 – 270 degrees

Unit 8 p.48

Student A

Shanghai has the first commercial Maglev line in the world. Trains can reach 350 km/h in two minutes and have a maximum speed of 431 km/h in normal operation. Maglev (magnetic levitation) trains use a combination of magnetic attraction and magnetic repulsion to provide lift and forward movement and can operate on 10° gradients. They travel on raised guideways above the city which are very expensive to build, but track maintenance costs are significantly lower than with conventional rail transport. There is no engine and there are no wheels or rails as with conventional trains, so no friction. Maglev runs on electricity, producing no pollution from the vehicle. The speed and the distance between trains are automatically controlled and maintained by the frequency of the electric power fed to the guideway. Bad weather or congestion have little effect on the running of these vehicles.

Unit 12 p.89

Student A

The water-powered calculator runs on H2O batteries, so it needs no electricity or conventional batteries. The H2O battery consists of two electrodes made of special alloys. When these are immersed in water, a chemical reaction takes place which produces electricity. Over time, the water evaporates, and needs to be replaced. The batteries should last for over two years.

The eco-kettle allows you to boil only the amount of water you require. It has a double chamber. The inner reservoir holds a full capacity of water ready to be used. By pressing a valve button, the required amount of water is released into the outer boiling chamber. The level of water can be seen through the front window. This kettle is designed to reduce the excess amount of water people boil.

Unit 13 p.96

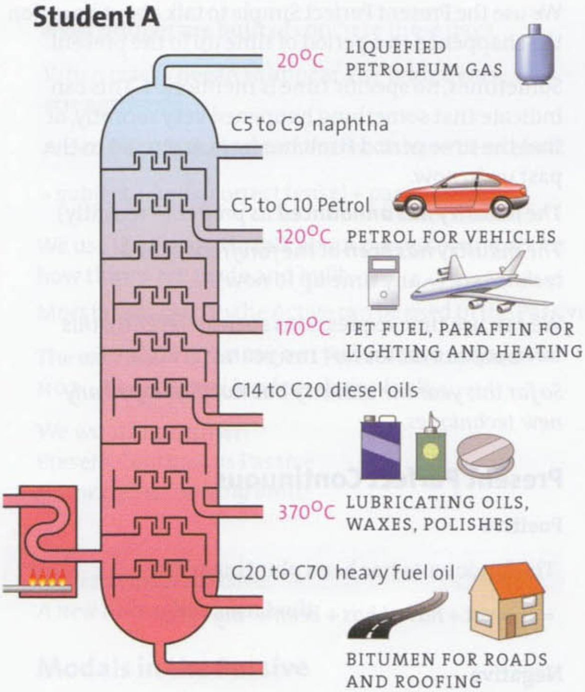
Student A

Silent Guardian

Raytheon, an American company, has developed a device which projects millimetre wave energy at a frequency of 94 GHz which it calls Silent Guardian. It heats the surface layer of skin causing protesters to move back quickly away from the pain source. It is effective up to 250 metres. It hurts but it does not kill. The waves only penetrate the surface layer of the skin, which is deep enough to cause pain, but not to injure, unless those targeted are exposed for more than four minutes. In practice, it is unlikely anyone would stay within range for so long, but the system also includes infrared scanners which check for any excessive skin heating. The system is intended for embassy protection, peacekeeping operations, and checkpoint security on sensitive installations such as nuclear power stations.

Unit 9 p.71

Student A



Unit 10 p.78

Student A

15 kilometres north of Shanghai lies the third largest island in China. The island is the location for a fully-sustainable eco-city called Dongtan.

The city is designed as small villages, each with its own character. This provides a community spirit, the base of Chinese society, so people walk and meet each other. The villages are connected by cycle routes, footpaths, and public transport corridors that use trams and buses. Solar-powered water taxis operate on the river. Zero-carbon public transport uses hydrogen-fuel technology or battery-power. Residential and business areas are mixed to reduce the need to commute. The buildings have been designed to be highly energy-efficient. They are angled to attract the maximum sun in winter and natural ventilation in summer. Local materials are being used with traditional and new construction technologies. Photovoltaic solar panel cells supply the buildings with energy. The city is self-sufficient in energy needs, using biomass from crops and rice residue as well as wind power from large wind turbines outside the city.

Unit 11 p.83 Speaking

Student B

B

Geminoid is a humanoid robot which looks and sounds just like his creator, Hiroshi Ishiguro of Osaka University in Japan. Its features are made from silicon moulds of his own body. It has the same hair colouring and style, and wears the same glasses and clothes.

Dr Ishiguro demonstrates his robot by using it to teach his classes. What makes this robot so convincing is that it appears to breathe, its eyes blink, and it fidgets just like a human. It also speaks with his voice. These effects are achieved by technology which includes 50 sensors and motors under Geminoid's skin to give expression to its face and to replicate human movements. The breathing effect is caused by compressed air forced into the chest. A motion capture system tracks the real Dr Ishiguro's mouth movements which are then copied by the robot. His voice is relayed through a speaker in the robot.

Dr Ishiguro believes that in future, humanoid robots will stand in for people who cannot be present at an event. We may have not only robot teachers, but robot politicians and singers.

Grammar reference

1 *-ing* form and *to* infinitive

-ing form

The *-ing* form is used directly after certain verbs.

These include: *admit, carry on, consider, delay, deny, enjoy, finish, give up, involve, keep (on), postpone, practise, resist, stop, suggest.*

*Students should **consider doing** a computer course.*
*The course **involves learning** about the manipulation of digital images.*

The *-ing* form is also used after prepositions.

*She **succeeded in finding** a post as a Research Engineer.*

to infinitive

The *to* infinitive is used directly after certain verbs.

These include: *agree, aim, attempt, begin, choose, continue, decide, expect, fail, hope, intend, learn, manage, mean, offer, prepare, promise, propose, want.*

*The planners **agreed to make** the proposed changes.*
*The Drillers **managed to dig** a new well.*

Note that we can use the negative infinitive *not to*.

*The company **decided not to develop** the new system.*

Verbs followed by *-ing* form or *to* infinitive

There are several verbs that can be followed by either the *-ing* form or the *to* infinitive, with very little change in meaning.

These include: *begin, continue, hate, intend, like, love, prefer, start.*

*We **continued practising** our communication skills throughout the course.*
*We **continued to practise** our communication skills throughout the course.*

Note that we do not generally use two *-ing* forms together.

*We are **starting to learn** about database systems.*

NOT *We are ~~starting learning~~ about database systems.*

2 Past Simple v Present Perfect

Past Simple

We use the Past Simple to talk about an action that happened in the past. We often use time expressions such as: *last month, yesterday, 250 years ago, in 1850.*

Present Perfect Simple

We use the Present Perfect Simple to talk about an action that happened in a period of time up to the present.

Sometimes, no specific time is mentioned. This can indicate that something happened very recently, or that the time period stretches from any point in the past up to now.

*The industry **has announced** its profits.* (= recently)
*The industry **has been** at the forefront of new technology.* (= any time up to now)

We can use time expressions such as: *recently, this week, so far, over the last two years.*

*So far this year the industry **has not developed** any new techniques.*

Present Perfect Continuous

Positive

The landowner **has been planting** trees.

= subject + *have / has* + *been* + *-ing* form

Negative

We **haven't been using** the new equipment.

= subject + *have / has* + *not (haven't/hasn't been)* + *-ing* form

Questions

How **have** manufacturers **been improving** the design?

= (question word +) *have / has* + subject + *been* + *-ing* form

Like the Present Perfect Simple, the Present Perfect Continuous is used to talk about an action that carries on up to the present. Sometimes, we can use either tense without much difference in meaning, especially when we refer to a longer-term situation.

*He **has worked** / **has been working** here for 20 years.*

In other cases, the Present Perfect Continuous emphasizes the fact that the action has continued up to the present and may not be finished. The Present Perfect Simple is often used to talk about quantity. Compare:

*He's **been planting** new trees.* (= he may or may not have finished)

*He's **planted** 500 new trees.* (= he has finished planting the trees)

3 The Passive

Most bridges **are built** of concrete these days.

When cracks began to appear, the bridge **was strengthened**.

A number of construction methods **have been used**.

= subject + *be* (in correct tense) + past participle

We use the Passive to talk about processes and about how things are made and built.
Most tenses used in the Active can be used in the Passive.

The exception is the Present Perfect Continuous.
NOT *A new tunnel ~~has been being~~ built.*

We would use either:
Present Continuous Passive
*A new tunnel **is being built**.*

or

Present Perfect Passive
*A new tunnel **has been built**.*

Modals in the Passive

We can use *will* or modal verbs in the Passive.

*The tunnel **must be finished** on schedule.*

*The bridge **will not / won't be finished** on time.*

= subject + *will* / modal verb (+ *not*) + *be* + past participle

Modal verbs are commonly used in the Passive in official signs. Such notices in the workplace are often connected with issues of health and safety, and tell us what we must and mustn't do.

*Safety equipment **must be carried** at all times.*
*Any incidents **should be reported** to the site manager.*

by

Passive forms are used to avoid mentioning who performed an action. This is either because the agent is irrelevant to the process described or is unknown. Sometimes, however, we may want to use a Passive form and mention the agent. In this case, we introduce the agent with *by*.
*The cables are supported **by** twin towers.*

4 Ability and inability

There are several ways of talking about ability, possibility, and opportunity.

Ability / inability in the present

- *can / can't* + infinitive

*Bioplastics **can help** reduce the amount of waste we produce.*
*We **can't recycle** conventional plastic food wrapping.*

We use *can / can't* to express ability, possibility, and opportunity. This structure can be used in the Passive.

*Conventional plastic wrapping **can't be recycled**.*

- *is / am / are able to* + infinitive

We use *is / am / are able to* to express ability or opportunity. This structure is slightly more formal than *can / can't*. We use *is / am / are able to* rather than *can* after a modal verb.

***We should be able to** reduce biowaste considerably by 2020.*

Ability / inability in the past

- *could / couldn't* + infinitive

could / couldn't are the Past Simple forms of *can / can't*.

*In the past, we **couldn't mould** plastic into complex shapes.*

- *was / were able to* + infinitive

was / were able to are the Past Simple forms of *is / am / are able to*. In many cases, *was / were able to* are used in exactly the same way as *could / couldn't*.

*In the past, we **weren't able to mould** plastic into complex shapes.*

However, when we want to talk about ability on an isolated occasion, rather than general ability, we can only use *was / were able to*.

*After doing a Google search, he **was able to find** the exact information he needed.*

Ability / inability in the future

- *will / won't be able to* + infinitive

*By using additives, **we will be able to** improve the properties of the plastic.*

However, note that it is very common to use *It will / won't be possible to* + infinitive instead.

*By using additives, **it will be possible to improve** the properties of the plastic.*

This is especially the case in the Passive, to avoid the awkward repetition of *be*.

***It will be possible to stop** chemical degradation.*

NOT *Chemical degradation ~~will be able to be stopped~~.*

- *can / can't* + infinitive

We can also use *can / can't* to talk about future ability or opportunity. This is less formal than *will / won't be able to*.

*We **can talk** to the Manager when he arrives.*

Note that we can't use *will can / will can't*.

NOT *We ~~will can~~ talk to the Manager …*

5 Past Continuous v Past Simple

Past Continuous

Positive

Wave energy **was causing** several problems.

= subject + *was / were* + *-ing* form

Negative

The generator **wasn't running** very smoothly.

= subject + *was / were not* (*wasn't / weren't*) + *-ing* form

Questions

What equipment **was** the controller **using**?

= (question word +) *was / were* + subject + *-ing* form

We use the Past Continuous to talk about an action in progress in the past.

Past Simple

We use the Past Simple to talk about a completed action, or a series of completed actions in the past.

*The rotor **turned** against the wind and **started** the turbine.*

when / while / as

The Past Continuous and Past Simple are often used together when one action comes in the middle of a longer one. We can use time expressions such as *when*, *while*, or *as* before the longer action. Note the position of the comma.

***When / While** I was studying at university, I became interested in alternative energy.*

We can reverse the order of the two clauses. In this case, there is no comma.

*I became interested in alternative energy **when / while** I was studying at university.*

When can also go before the Past Simple.

*I was studying at university **when** I became interested in alternative energy.*

Note that *when* can introduce two Past Simple actions to describe an immediate consequence of an action.

***When** the computer activated the yaw motor, the rotor turned against the wind.*

On the other hand, *as* is used to describe two actions that happen simultaneously.

***As** the generator was turning, the turbine broke down.*

6 First and Second Conditionals

First Conditional

Form

if-clause	main clause
If I finish the course,	I will earn more.

= *If* + subject + Present Simple / subject + *will* + infinitive

Note that in the result clause we can use a modal verb, e.g. *may*, *might*, *can*, *could*, *should* instead of *will*.

*If the tests go well, the project **might** start ahead of schedule.*

Note the position of the comma in the above example.

The *if*-clause normally comes first, but it can come after the main clause. In this case, there is no comma.

The project might start ahead of schedule if the tests go well.

Use

We use the First Conditional to talk about a possible scenario or action and the probable result.

Second Conditional

Form

if-clause	main clause
If I worked as an area controller,	I would earn more money.

= *If* + subject + Past Simple / subject + *would* + infinitive

Note that we can also use *could* or *might* in the result clause.

*If I had a calculator, I **might / could / would** work this out more quickly.*

With the First Conditional, the order of the clauses can be reversed.

I might / could / would work this out more quickly if I had a calculator.

Use

We use the Second Conditional to talk about an imaginary situation and to speculate on the result.

unless

We use *unless* as an alternative way of expressing a condition. *Unless* replaces *if* in the *if*-clause, and is always followed by a positive verb. The result clause can either be positive or negative. Compare:

***If** you **can't** take pressure, you won't be successful in this job.*
***Unless** you **can** take pressure, you won't be successful in this job.*

As with other conditional sentences, we can reverse the order of the clauses.

You won't be successful in this job unless you can take pressure.

7 Obligation and necessity

We use both *have* to and *must* to talk about obligation, but there are some differences.

have to

has / have to + infinitive can be used in other tenses, but not in continuous tenses.

Past Simple: *had to*

Present Perfect: *have had to*

Future: *will have to*

*I **had / 've had to** obtain planning permission before building the extension.*
NOT *I ~~was having to~~ obtain planning permission.*

We use *has / have to* when we talk about something that we can or cannot do because of the circumstances, or because of a legal requirement.

*I can't come tomorrow because I **have to** go to a meeting with the planning department.* (= circumstances)

*All appliances **have to** be earthed.* (= legal requirement)

The question form is *Do / Does* + subject + *have to* + infinitive.

*Does the extension **have to comply** with building regulations?*

don't have to

We use *don't / doesn't have to* + infinitive to talk about something that is not necessary. There is no sense of obligation.

*Your home **doesn't have to** have solar energy panels, but it would save you a lot of money on bills.*

*People **won't have to** worry about small rooms, as interior space will be more flexible.*

must / mustn't

We use *must / mustn't* + infinitive to talk about obligation. It has a similar meaning to the usage of *have to* for a legal requirement.

*All appliances **must** be earthed.*

We can also use *must / mustn't* to indicate personal authority.

*You **must** send me the plans by the end of this week.* (= I am telling you to do this)

*You **have to** send me the plans by the end of the week.* (= because of circumstances or a legal requirement)

Must / mustn't are only used in the Present Simple. Their forms never change.

*The new extension **must** comply with building regulations.*
*Fire exits **must** be accessible and **mustn't** be blocked.*

The question form is rarely used. Instead, we use *have to*.

***Does** the new extension **have to** comply with building regulations?*

Similarly, if we want to talk about obligation in the past or future, we use the appropriate form of *have to*.

*In some countries, any new buildings **must** be less than three storeys. But by 2020 all buildings **will have to** be earthquake resistant.*

8 Comparative and superlative review

We use comparative and superlative adjectives to talk about the differences between two or more things.

We use comparative adjectives to make a comparison between two things or situations.

Form	Adjective	Comparative	Superlative
One-syllable adjectives	fast	Add -er faster	Add the + -est the fastest
One-syllable adjectives ending in -e	wide	Add -r wider	Add the + -st the widest
Two-syllable adjectives ending in -y	happy	Change -y to -ier happier	change -y to -iest happiest
Adjectives with two or more syllables	efficient	more + adjective more efficient	the + most + adjective the most efficient
Irregular adjectives	good bad far	better worse farther/ further	the best the worst the farthest/ furthest

Comparative adjectives

Use

When we compare two things or situations directly, we use the comparative + *than*.

*I find journeys by plane a lot **more tiring than** journeys by ship.*

The opposite of *more* is *less*. We use *less* with adjectives with two or more syllables.

*Air travel is **less expensive than** it used to be.*

To make a comparison stronger, there are several adverbs that we can use before the comparative. The ones that emphasize large differences include: *much, far, considerably, substantially, a lot, a good / great deal.* Those that emphasize small differences include: *slightly, a little, rather, somewhat,* and, more informally, *a bit.*

*Maglev trains move passengers at a **much lower** cost compared to ships.*

*Passengers are **somewhat less concerned** with train décor than with speed.*

Note that we can use *really* or *absolutely* to make an adjective stronger but we cannot use these before a comparative.

NOT *Maglev trains move passengers at a ~~really lower cost~~ ...*

We also use adverb + comparative structure before a noun, e.g. *a lower cost, a better way, more speed, less fuel, a much higher profit, a far less efficient system*

Superlative adjectives

Use

We use superlative adjectives to make a comparison between more than two things.

The opposite of *the most* is *the least*. We use *the least* with adjectives containing two or more syllables.

*I think that the Maglev is the **least stressful** way to travel.*

We also use adverb + superlative structure before a noun, e.g. *the fastest method, the most interesting journey, the worst aspect, the least expensive option.*

9 Present tense review

Present Simple

Use

We use the Present Simple with:

- facts and things that are generally true.

*Production platforms **stay** in place for as long as the field is productive.*

- routines, especially with adverbs of frequency.

*I **come back** to the rig every few weeks.*

- verbs that describe thinking and feeling, e.g. *feel, look, smell, sound, taste.*

*Crude oil **feels** sticky.*

Present Continuous

Use

We use the Present Continuous to talk about:

- something that is happening at the time of speaking.

*We're **having** a fire drill.*

- something that is happening around now, although not necessarily at the time of speaking. We generally do not expect the action to continue for a long time.

*I'm **supervising** a new Driller this week.*

Note that with a continuous tense, such as the Present Continuous, we do not generally use non-action verbs such as: *be, believe, cost, feel, forget, hate, have, hear, know, like, mean, remember, smell, taste, understand, want.*

NOT *I'm ~~not knowing~~ these figures.*

There are exceptions to this when these verbs are used in an active sense. For example:

***I think** this is the best option.* (= this is my opinion)
***I am thinking** about the possibilities.* (= I am actively using my mind)

10 Reported speech

Reported statements

When we report a statement, we commonly use the Past Simple of the reporting verbs *say* and *tell*.

*Mr Bran **said** (that) we would have to change the filters.*

Note that the pronoun *that* is not essential.

Told must always be followed by an object (*me / us / the shareholders*, etc.).

*Mr Bran **told us** (that) we would have to change the filters.*

We can also use other reporting verbs such as: *admit, announce, confirm, explain, recommend, suggest, warn.*

*The director **announced** that our design team had won an award.*

Direct and reported speech

When we change direct speech into reported speech, there are several changes that need to be made.

- The tense of the original verb:

Direct speech: *'I generally spray the paint in a ventilated closed room,' said the engineer.*

Reported speech: *The engineer said (that) he generally sprayed the paint in a ventilated closed room.*

Note that in this case, we could keep the Present Simple form *sprays* in reported speech, if we want to emphasize a current routine.

In general, however, the original verb changes as follows:

Direct speech		**Reported speech**
Present Simple	→	Past Simple
Present Continuous	→	Past Continuous
Past Simple	→	Past Perfect
Present Perfect	→	Past Perfect
Modals: *will*	→	*would*
can	→	*could*
may	→	*might*
must	→	*had to*

- Pronouns:

Direct speech: *Ms Symons: 'Designing engineering systems gives me great satisfaction'.*

Reported speech: *Ms Symons said that designing engineering systems gave her great satisfaction.*

- Time expressions:

Direct speech	**Reported speech**
today	that day
yesterday	the previous day
this week / month / year	that week / month /year
(the) next week / month / year	the following week / month / year

*'The resulting sludge was disposed of **yesterday**.'*
*She said the resulting sludge had been disposed of **the previous day**.*

Reported questions

When we report questions, we use the verb *ask* + object instead of *say* or *tell*. In a reported question, the word order is the same as in a positive sentence.

- *Wh-* questions

Direct speech: *'How do you dispose of the waste paint?' the inspector asked us.*

Reported speech: *The inspector asked us how we disposed of the waste paint.*

- *Yes / No* questions

If a question does not begin with a question word such as *What?* or *How?*, we begin the reported question with *if*.

Direct speech:	*The Inspector: 'Do you add chlorine to the water?'*
Reported speech:	*The Inspector asked if we added chlorine to the water.*

Reported orders and instructions

When reporting an order or instruction, we can use the past tense of the reporting verbs *tell / ask* + object + (*not*) *to* + infinitive:

Direct speech:	*'**Check** the water pressure in the pipes.'*
Reported speech:	*He **told / asked** Keith **to check** the water pressure in the pipes.*
Direct speech:	*'**Don't forget** to check the water levels, John.'*
Reported speech:	*He **told / asked** John **not to forget to** check the water levels.*

11 Causing, preventing, and enabling links: *cause to, make, prevent, stop, allow to, enable to, let*

There are several ways to describe the relationship between actions.

Causing

cause + object + *to* + infinitive

make + object + infinitive

*Vibration or pressure can **cause a mine to explode**.*
*Vibration or pressure can **make a mine explode**.*

Preventing

prevent + object + *from* + *-ing* form

stop + object + *-ing* form

*The hard ground often **prevents the robot from uncovering** mines.*
*The hard ground often **stops the robot uncovering** mines.*

Enabling

allow / enable + object + *to* + infinitive

let + object + infinitive

*Digital cameras **allow / enable** the robot to navigate by itself.*
*Digital cameras **let** the robot navigate by itself.*

Sentence structure

There are two ways we can structure these ideas.

- Relative clause, using *which* + verb of causing / preventing / enabling

*Batteries run down quite quickly, **which causes** the robot to stop moving.*
*The Mars Rover is fitted with digital cameras, **which** prevents it from colliding with obstacles.*
*The robot is equipped with sensors that measure pressure, **which** enables it to handle delicate items.*

Note that the verb following *which* is in the third person singular, as it refers to the preceding action rather than to a singular or plural noun.

- Omitting *which* and using the *-ing* form of the verb that follows it. Compare:

*The robot has six legs, **which enables** it to walk delicately through mine fields.*
*The robot has six legs, **enabling** it to walk delicately through mine fields.*

12 Question review

There are two main types of question: those which require a *yes / no* answer, and *wh*-questions, which ask for specific information.

Yes / No questions

These begin with an auxiliary verb, such as *Do, Am / Is / Are, Have / Has, Can, Could, Will, Must, Was / Were, Did*, etc.

auxiliary + subject + main verb

Can solid wood be used for carcasses?
Will marble worktops be more expensive than granite?
Was melamine coated chipboard used?

Wh-questions

These begin with question words such as: *What, Who, When, Where, Why, Which*, and *How*. We can use *How* in other combinations such as: *How much, How many, How long, How far, How safe*, etc.

The question words *What, Which, How much, How many* can be followed by a noun.

Question word / question word and object + auxiliary + subject + main verb

***What does** a CNC cutter **do**?*
*How many eco-kettles **has** the company **made** so far?*

In the two sentences above, the question word is the object of the main verb. Note that *What, Who, Which, How much, How many* can also be the subject of a question. In this case, the word order is the same as in a positive sentence.
Question word / question word and subject + verb

***What types of door** are available?*
***How much** experience has he got in designing kitchens?*
***Who** invented the microwave oven?*

Requests

We make requests by using a polite question form. For requesting information, these include:
Could you tell me ... ?
I'd like to know ...

Note that these are followed by:

- Question word + positive word order, for *wh-* questions:

***Could you tell me** how the router works?*

- *If / Whether* + positive word order, for *yes / no* questions:

*Could you tell me **if / whether** solid wood can be used for carcasses?*

NOT ~~*Could you tell me how does the router work?*~~
~~*Could you tell me can solid wood be used for solid carcasses?*~~

Other structures used to make requests are:
I'd like you to + infinitive
I wonder if you could + infinitive
Would you mind + *-ing* form

***I'd like you to send** me a catalogue, please.* (no question mark needed)
***I wonder if you could help** me?*
***Would you mind giving** me a demonstration?*

Generally, we reply to requests by saying *Certainly* or *(Yes)* **of course**. However, it is common to respond to a request beginning *Would you mind* with *No, of course not.*

Note that the structure *I wonder if you could help me?* precedes a more specific request, especially one that may be quite complicated. Alternatively, *I wonder if you could* + infinitive can be used as a request on its own.

***I wonder if you could help me?** I'm interested in finding out more about your kitchen design service?*
***I wonder if you could send** me a catalogue, please?*

13 Prepositions review

There are many prepositions that we can use to talk about time, place, and movement. Some prepositions can belong to more than one category.

Prepositions of place and movement

Many prepositions of place can also describe movement, depending on the verb used. For example:

Place: *The multi-purpose gun **is under** a special cover.*
Movement: *The multi-purpose gun **is placed under** a special cover when not in use.*

Other examples are: *above, across, opposite, over.*

The common prepositions *in* and *on* generally express position. To express movement, we use *into* and *onto*.
*The army **moved into** the town.*

The preposition *at* is only used to express position, while *to* expresses movement.

In, at, and *on* have the following usages:

in enclosed spaces, e.g. rooms, buildings, vehicles, equipment
*There's a fault **in the drive**.*

in expressions such as *in front of*
*The microphone is **in front of** the robot so that it can pick up sounds immediately.*

on surfaces
*The amphibious personnel carrier is adapted for movement **on land** and **on water**.*

in expressions such as *on the left / right (of), on (the) top / back / side / front (of)*
*The camera is positioned **on top of** the mast, not halfway down it.*

at general location when it is not important exactly where something is
***at** the airport*
***at** the centre (of)*

in expressions such as *at the end / side / back / top (of)* – these give a much less specific indication of position than expressions such as *on the side of*
*There is an additional piece of equipment **at the side of** the robot.* (= but not necessarily attached to the robot)

There are many other prepositions of place and movement. We use *next to / beside* and *close to / near to* to talk about how close things or people are. However, *next to / beside* mean that one thing or person is at the side of another, while *near / close to* tell us only that one thing or person is not far away from another.

A *Is the folding boom* ***next to / beside*** *the mast?*
B *No, but it is* ***very near / close to*** *it.*

(not) far from is another expression used to talk about general proximity.

between means to have someone or something on each side.
Unmanned scout vehicles will patrol ***between*** *frontline soldiers and the enemy.*

opposite means that one thing or person is facing another.
The caterpillar tracks are on ***opposite*** *sides of the robot.*

Prepositions of time

The prepositions *in*, *at*, and *on* are also used to talk about time.

in parts of days, months, seasons, years: *in the morning, in March, in 2007*
to say how soon something is going to happen: *The test will start in two hours.*

at times of the day, mealtimes: *at 8 a.m., at breakfast, at night, at Easter*

on days of the week, special days, dates: *on Sunday, on my birthday, on 4 May*

Other prepositions of time include:

for to talk about how long something will last: *It will last for two days.*

until meaning up to a specific point or before a particular action takes place: *until 17.00, until the machine is proved in action*

Other prepositions

There are many prepositions that are not used to describe place, movement, or time. Common examples include: *with, without, by, as, about, of,* and *for.*

These are often used after certain verbs, adjectives, or nouns.
an advantage over, consists of, depends on, equipped with, filled with, known as.

14 Complex sentences

There are several structures we can use in order to link ideas within a sentence.

when, as, until

We use these time expressions to show clearly the order in which different events happened. The part of the sentence that begins with the time expression is called the time clause.

when

We use *when* to refer to actions that happen at almost the same time. One action is an immediate consequence of another. Note that when the time clause comes first, it must be followed by a comma.

When *the voltage rises, the relay is activated.*

We can change the two parts of the sentence around, but *when* must always come before the first action in the sequence of events.

The relay is activated ***when the voltage rises.***

When the time clause comes later in the sentence, we do not use a comma to separate the two clauses.

as

We use *as* to talk about two actions that happen at the same time. The position of the time clause can change, in the same way as for *when*.

As *the temperature falls, the resistance of R1 rises.*
The resistance of R1 rises ***as*** *the temperature falls.*

until

We use the preposition of time *until* to mean 'up to a certain point'.

The relay doesn't operate ***until*** *the trigger temperature is reached.*

if-clause

We can also use an *if*-clause to link cause and effect.

The *if*-clause normally comes first, but it can come after the main clause. In which case, there is no comma.

The transistor will overheat if excess current is passed.

Relative clauses

In relative clauses, we use the relative pronouns *who* when the subject is a person, or *which* when the subject is an object.

We can use a relative clause in two ways:

- to make a definition (defining relative clause)

*This is the battery **which** provides a high current.* (= there are other batteries, but this one provides a high current)

*He is the person at Bell Laboratories **who** pioneered the new technique.* (= there were several people at Bell Laboratories, but he pioneered the new technique)

- to add information (non-defining relative clause)

*This is a new type of battery, **which** can provide a higher current than standard ones.*
*That is Mr Hodgson, **who** pioneered the new technique.*

Note that in this type of relative clause we use a comma before *who* or *which*.

-ing form

When we talk about a process that causes, prevents, or permits another action, we can use the *-ing* form to replace *which* and the verb that follows it. Compare:

*This completes a circuit, **which generates** a series of pulses.* (non-defining relative clause)
*This completes a circuit, **generating** a series of pulses.*

15 Future review

There are several ways to talk about future events or situations.

will / won't + infinitive

We use *will* to talk about what we know or think we know about the future, including making predictions. We do not use *will / won't* to talk about intentions.

*The course **won't** last longer than about four months.*

When we are uncertain about the likely outcome of a situation, it is common to use *will* in combination with verbs such as *think, know,* or *expect.*

*I **think / know / expect** (that) the training will be difficult.*

Note that we do not tend to use the positive form of *think* with *won't*. Instead, we use *don't / doesn't think* + positive verb.

I don't think the course will be very interesting.
NOT ~~*I think the course won't be very interesting.*~~

We can also use adverbs such as *definitely* or *probably* to sound more or less certain about the future.

*It'll **probably** take two hours to fix.*
*I'll **definitely** get there before five o'clock.*

Another use of *will / won't* is when we decide to do something at that particular moment, e.g. in order to promise or offer to do something, and to make requests.

A *I've got to go out in a few minutes so I can't meet the supplier.*
B *OK, I'll meet him.*

going to + infinitive

We use *going to* + infinitive without *to* when we talk about our intentions. We have already decided what to do.

*I'm **going to** meet the supplier.*
*She's **going to** apply for a new job.*

We also use *going to* to make predictions about the future based on present evidence.

*Look at those big grey clouds. **It's going to rain.***

Present Continuous

We use the Present Continuous to talk about a pre-arranged event, but not one that is part of a regular programme or timetable.

*I'm **moving** to a new department.*

It is very common to use a time expression with the Present Continuous when talking about the future so that it is not confused with something that is happening now. Compare:

Present:	*He's **attending** the conference.*
Future:	*He's **attending** the conference on Thursday.*

Listening scripts

Unit 1

It's my job

When I left school, I started work for a plastics company, one of the biggest in the country. We make everything from small components for medical equipment to large water pipes – the blue ones which are replacing metal pipes everywhere.

My apprenticeship lasts for three years. I'm in my final year now. It's a good mix of work, which I get paid for, of course, on-the-job training, and study at the local college.

I've learned a lot of practical skills from the on-the-job training. It's supervised by skilled workers. There's quite a lot of paperwork as I have to complete forms to show I've reached the right standard.

I had day release to attend college one day a week in the first two years of my apprenticeship and I've got two days a week in my last year. I've learned things like working in teams, problem-solving, communication skills, and using new technologies at work, as well as engineering subjects. This year I'm completing an HNC, a Higher National Certificate, in Engineering.

I like learning while working, but it's quite hard work. There's a lot of studying to do – at home in the evenings and at weekends too. I'm doing about ten hours a week right now. It's quite hard when your friends are out having a good time.

Once I'm fully qualified and have a bit more experience, I hope to get promoted to team leader. That means I'll be in charge of a team of six – more responsibility and better pay.

Pronunciation – Unstressed syllables

transmission	development
performance	maintenance
propeller	specialist
electricity	qualification
installation	medicine
regulation	environment

Unit 2

Listening – Precision agriculture

B = Barry, S= Student

B As you know, when farmers grow crops, they use machines for ploughing and harvesting as well as chemicals, such as fertilizers and weed killers. Traditionally farmers have sprayed chemicals uniformly across the field so the same amount of fertilizer or pesticide is sprayed in each part of the field whether it was needed or not. But, of course, not all fields are the same. One end of a field may have lots of weeds, but the other end may have none at all. Or one area could need more fertilizer than another. So, spraying the field uniformly is really a waste of resources.

But by including IT in modern farm machinery we have been able to make farming far more efficient. Farmers can gather precise information about their fields and the computer can control the farming equipment allowing the correct amount of chemical to be applied. This is an example of precision agriculture.

S How does the farmer get the information?

B Well, there are two ways of gathering information about a field. One way is to use satellites or planes. These can then produce soil maps. Using these maps, the farmer can see on the computer what needs to be done. This method is quite cheap and very reliable but the drawback is that it's not very exact – it can be difficult to distinguish closely-related features in these maps. The other way of collecting information is using sensors mounted on a tractor. As the farmer drives across his field, information is fed into his onboard computer and this controls the amount of chemicals being applied. Because the tractor-mounted sensors are closer to the ground than the satellite technology, they can provide more detailed information. But this system costs more because the IT equipment has to be very responsive and make very fine adjustments quickly.

On the farms which now use this technology, there have been fantastic savings. With this precision equipment, farmers are able to use 50% less herbicides and fertilizers than before and, of course, that's a big saving and better for the environment.

Make your point – Beginning a presentation

Giving a presentation can make me very nervous, but I find that if I'm well prepared, I feel more confident. There are four things I ask myself before I even start. First of all, who am I going to talk to and what do they already know? Secondly, where am I speaking? What facilities are there? I have to consider the equipment, for example if I want to use PowerPoint, is there a screen? Thirdly, what is the purpose of my presentation? Do I want to inform, impress, or persuade the audience, or do I want to sell a product? And finally, how much time will I have?

The answers to these four questions have an important effect on what I include in my presentation and how I make it. I usually put ideas down on a piece of paper and then try to group these ideas under headings. Then I make some short notes on small cards that I can hold comfortably in my hand and use during my presentation. I like to use PowerPoint for my presentations, so I start preparing slides. I collect all the pictures, diagrams, photos that I want to use and put them in the correct order. Once I feel that I've got things well organized, I prepare the introduction.

Even if my audience know me, I still introduce myself and explain my position. I begin by saying, 'Most of you know who I am. I'm Lee Avatar and I'm responsible for training and communications'. Then I explain what I'm going to talk about, and in what order. I mention that I'll be using PowerPoint. I usually invite people to interrupt me if they have any questions during my talk, but sometimes I ask the audience to keep questions 'til the end. I give an outline of the main points in my first slide, and I find it's a good idea to tell the audience what handouts I am going to give them so that they can concentrate on what I'm saying instead of writing notes.

Unit 3

Listening – The Great Belt East Bridge

The Great Belt East Bridge is part of a link between Denmark and Sweden. The first design was made in 1965. It consisted of a box girder bridge with two central spans, each 400m in length. These were supported by piers. The idea was that ships sailing in one direction would pass under one span, and those sailing in the other direction would use the other span.

Because ships became larger and larger, this design was abandoned and a new design made in 1973. This had a much wider central span of 780m. This is greater than the limit for box girder bridges – around 500m. At this point even the strongest steel bends under its own weight. So a cable stay bridge was proposed. With cable stay bridges, the decks are built out from each pier until they meet in the middle. The longer the bridge, the more difficult it is to control the movement of the ends when it is windy – 1,000m is about the limit for such bridges.

Construction was further delayed and in the meantime ships grew larger than ever. Experiments showed that large ships could not safely pass each other under the bridge – even with the wider span. The risk of collision was too great. The only alternative was a suspension bridge. A new design was made in 1993 for a suspension bridge with a 1,600m span – at that time the longest bridge in the world. To support such a span, two huge towers, each 254m high, were built. The bridge deck is quite slender – only four metres deep. To prevent twisting in the wind, the deck was specially shaped. The suspension bridge was finally completed in 1998.

Unit 4

Listening – The history and properties of plastics

A = Antonia, F = Fatima

A I think that this assignment on the history and properties of plastics should be quite interesting.

F Yeah, I'm looking at the British Plastics Federation website, that's www.bpf.co.uk, it's got some good stuff about the history of plastics. You know plastics can be used to produce almost anything nowadays.

A Yes. Just look at your toothbrush, these files, the table lamp, the street lights outside, even the white lines on the road; they're all made of plastic.

F It says here that the first plastic was made of cellulose in the mid-eighteen hundreds and was used to make billiard balls! That was a great step forward in the world of science. Apparently, people were worried that there weren't enough elephants to provide ivory for making billiard balls so they had to find a substitute. The first balls were made of coated celluloid.

A Celluloid is the plastic made from cellulose, isn't it?

F Yes, and cellulose comes from plants. The problem was that this can be explosive. The inventor liked to tell stories of the early balls exploding when they were hit hard! Imagine that!

A I found a book in the college library called *Plastics*, and it says that another problem with the early plastics such as celluloid was that you couldn't make things to a high standard of quality. Apparently, it wasn't until they started using petroleum and natural gas in the mid-nineteen hundreds that plastics production was really able to take off!

F Yes, it says here that using petroleum and natural gas led to the development of so many different plastics: polyethylene, nylon, polyester, and they've all got different properties so you can always find one that's suitable for your product.

A Exactly! They're really versatile. Today, the plastics industry is mainly based on oil so we can produce household and industrial items cheaply. But we are running out of oil, what are we going to do then?

F Recycle! On this website, www.chemsoc.org there are loads of facts about plastics. Today, manufacturers have the technology to produce things such as rubbish bins, plastic sacks, and even clothes from recycled plastic and I'm sure we'll be able to extend this range of goods soon. I'm sure we'll be recycling large quantities of plastic in the future. But we'll have to find good systems for collecting plastic for recycling. That's not very effective at the moment.

A We'll also have to find alternative raw materials for producing new plastic. There are already new technologies available which allow us to use other raw materials.

F Yeah, look! I've just found in www.worldcentric.org that companies are now able to make bioplastics from the starch in wheat, and even oranges! Some manufacturers are already producing things like food wrapping from these bioplastics.

A I think they are still expensive to produce, so more research will have to be done to allow us to produce these plastics more cheaply. But I'm sure that these will be important for the future for plastics.

Make your point – Describing a pie chart

I'd like to show you a pie chart which represents the use of plastics by sector. If we take a look, we can see that the largest sector which uses plastic is the packaging industry. You will notice that over a third of all plastics are used here.

As you can see, the building and construction sector is the second biggest, using 23 per cent. You will notice that together with packaging, more than half of all plastics consumption is in these two sectors. Take a look at the electrical and electronics industry, which consumes eight per cent, and you will see that the same figure applies to the furniture and houseware sector, as well as the transport sector. Agriculture accounts for slightly less plastics consumption, seven per cent.

At the opposite end of the scale from packaging, you can see that the smallest sector is the footwear sector, using only one per cent. Both the medical and mechanical engineering sectors use slightly more plastic than footwear – two per cent, while the toys and sports sector accounts for one per cent more than this.

Pronunciation – Disappearing sounds and word linking

1

1 This is a thermoset plastic.
This is a thermoset application.
2 It's used in household items.
It's used in household products.
3 One process is blow moulding.
It's used to make hollow items.
4 It meets safety standards.
They must use safety equipment.
5 It's a softer material.
It's a softer option.

2

a Light stabilizers prevent light damage.
b Plasticizers are used to make plastics softer.
c Even the street lights are made of plastic.
d Plastics production was really able to take off.
e Polyester fibres are used a great deal in clothing.

Unit 5

Listening – Wave Energy Innovator

I = Interviewer, R = Richard Yemm

I Richard is Managing Director of Ocean Power Delivery Ltd. His company makes wave energy converters. They supplied converters for the world's first commercial wave farm five kilometres off the coast of northern Portugal. When complete, it will generate 22.5 megawatts from wave power.
Richard, how did you get into wave energy?

R I discovered wave energy when I was doing my PhD at Edinburgh University. I was working next door to Stephen Salter, the grandfather of wave energy, and I saw that people were doing something really important. So then I started going on about wave energy and a few years later, when a project came up, a few people said to me, 'All right, then, put your money where your mouth is.'

At the end of the day, there's no point just making clever things. They have to have an application in the modern world. I'm environmentally aware, I recycle my rubbish and all that, but goodwill alone doesn't get it done. Our object is to earn revenue for people and in so doing, come up with an energy that reduces carbon emissions. It's only going to be achieved if we make it commercially viable.

I What about the name, where did that come from?

R We weren't going to give the project a name. We were sick of all the silly biological names that people kept using for wave converters, such as Duck and Frog. We were just going to call it the OPD750. But then a journalist threatened to call it the Whiplash, so we did a quick Google search on sea snakes, because that is what it looks like, and found Pelamis, a sea snake that swims only on the surface. And we liked that.

Unit 6

Make your point – Making telephone calls

R = Receptionist, B = Francis Ball

R Guten Tag! Abat GmbH.

B Hello My name is Francis Ball. I'd like to speak to Mr Braun, please.

R I'm afraid Mr Braun isn't available at the moment. Can I take a message?

B Could you ask him to send the range in nautical miles for the MD-11F? That's the McDonnell Douglas freighter plane. I have the range for the MD-11, the passenger plane – that's six thousand, eight hundred and forty. Could you ask him to call me later today? I'll be out till four.

R What's your number, please?

B I'm in the USA so it's 001 (double oh one) 246 639 0001.

R That's fine. Thanks for calling.

M = Michael Braun

B Hello.

M Hello, Michael Braun here.

B Hello, Michael. Thanks for getting back to me.

M I'm sorry to call you on your mobile but there was a problem with the phone number you left. What range do you have?

B The MD-11 – the passenger plane range.

M The passenger plane. Oh, I see. What is it?

B Six thousand, eight hundred and forty.

M Did you say six thousand, eight hundred and forty? So, you need the freighter plane range.

B That's right.

M I think the freighter plane is about half that, but I'll get back to you.

B Thanks. But, I won't be in the office for the next three days. Could you give the range to my colleague, Ivor Teslenko?

M Could you spell that for me, please?

B That's IVOR TESLENKO.

M TESLENKO?

B That's right. His number is the same as mine but with 0053 at the end. So it's, 001 246 639 0053.

M Sorry, I didn't catch that.

B It's 001 246 639 0053.

M So, 001 246 639 0053. OK, I've got that.

B I'll speak to you next week. Thanks for calling.

Unit 7

Listening – Earth homes

I = Interviewer, P = Peter Carpenter

I What is an earth home?

P An earth home is any house which is built in part underground. Often earth houses are built into a hillside with earth on three sides and on the roof, in the northern hemisphere, we usually build them with the fourth side facing south to obtain the maximum light and heat.

I What are the advantages?

P Forget any idea that earth houses are cold, dark, and damp. That's a cellar, not an earth house. Earth homes are well-insulated. They're warm in winter and cool in summer. They're durable too. They're less exposed to the elements and can last for hundreds of years. Another big plus is that they make much less impact on the environment. They're less visible than ordinary homes so the landscape isn't spoilt and energy costs are very low. They're very low-maintenance. You don't have to paint them. You don't have to worry about roof repairs.

I What are the technical issues in building them?

P First of all, you can't build an earth house just anywhere. You must have planning permission, even though it's underground. The commonest construction method is to excavate a hillside and build a structure into the hill. The roof has to be strong enough to bear the weight of soil on top and the walls must support the roof and resist the pressure of earth around the building so concrete, bricks, and masonry are often used. Waterproofing is important. You have to prevent moisture seeping into the structure from the walls and roof and through the floor. Lighting and ventilation are also important. You can include roof panels to introduce natural light to all parts of the building and to permit ventilation.

Earth houses are usually very well insulated. The soil cover reduces any seasonal variation in temperature and in construction the whole building is lined with insulating materials so there's very little heat loss in winter. In summer, there's considerable heat gain through the south-facing windows.

Unit 8

Pronunciation – Showing enthusiasm

1 The story of the Airbus A380 is really fascinating.

2 When you stand near it, you realize it's absolutely enormous.

It's my job

I = Interviewer, M = Matt Haydon

I What's your job?

M I'm a Marine Engineer. Currently, I'm Second Engineer working on a passenger cruise ship.

I What are you responsible for in your job?

M Well, I'm in charge of everything on the ship which is mechanical, electrical, or structural. The Engineer's job is to keep everything working. That can be toilets, computers, doors, a crankshaft, whatever! If there's a problem with a piece of equipment, we have to decide if it has to be fixed or if we can manage without it for a while. We repair it, if possible, but sometimes we have to call in specialists.

I So, what sort of training did you have to become a Marine Engineer?

M Well I trained as a Marine Engineer Apprentice. I worked for a shipping company who sent me to college for four months a year. Once I had passed all the exams, I got my licence, which is issued by the government. Training is different now. Most Engineers have a degree in Engineering, usually Mechanical engineering. But they still have to get a licence to work on board ship.

I What's the most challenging part of the job?

M I suppose it's being with other people all the time. You have to learn to trust and respect others.

I Are there any risks?

M There certainly are! The sea is an unpredictable place to be. The ship is constantly moving and large machines have large parts that are moving fast. There's fuel that could easily ignite, chemicals that are dangerous, and also electromagnetic rays.

I How much time do you get off?

M Well, officers normally get one day off for each day worked. At the moment I'm on fourteen weeks, and I'm getting fourteen weeks off after that. It sounds a lot, but don't forget, when you're at work, you're away from your home and family.

I What hours do you work on the ship?

M Well, there are always two officers in charge of operations on the ship. One is called the Navigation Officer of the Watch – the NOW. He works on the bridge. Then, there's the Engineering Officer of the Watch – the EOW. That's me. I work in the control room monitoring the engines and ship's systems – fuel, temperature, water pressure, and so on. I do an eight-hour shift and then another three to four hours carrying out routine maintenance.

I Would you recommend this job to others?

M Of course, but you have to be tough. You have to be fit. There are lots of stairs to be climbed and small spaces to crawl into! There are lots of unknowns and upsets but you gain satisfaction and pride from working in a very challenging environment. But, it's still a man's job, there are very few women!

Make your point – Persuasion

J = Jo Illich, M = Man in the audience

J These traffic figures were collected two months ago on the main roads entering the city. As you can see, traffic congestion has increased considerably. It is my opinion that a six-lane motorway around the city would be an appropriate way to solve the problem. I'd like you to take a look at this map where I have outlined the proposed route. The main reason for choosing a motorway bypass is that most of the traffic, in fact, passes through our city en-route for Largetown 25 km to the south-east. We estimate that a motorway would reduce the traffic in the city centre by as much as 57%.

M How did you arrive at that figure?

J This was calculated from the traffic statistics and a computer model. I have details of the calculations to show you. I have also prepared a detailed costing of the project which I'd like to give you now. Could you pass these round, please? Thank you.

Unit 9

It's my job

I = Interviewer, M = Michael Lennon

I How did you get started in the oil industry?

M I left school at 16 and took a course in car maintenance at the local technical college. I finished the course, but being a motor mechanic wasn't the right career for me. I wanted something more adventurous so I got a job as a Roustabout on a North Sea rig.

I What's a Roustabout?

M It's about the lowest job you can get. A Roustabout is a labourer. You get jobs like painting and unloading supplies from the supply ships. Still, the money was good and the food was good too – hotel standard. Food's important when you're living on a rig in the middle of the sea in all kinds of weather for fourteen days at a time without a break.
After a year I was promoted to Roughneck.

I What does a Roughneck do?

M That's a skilled job. You need physical strength but you also need to know exactly what to do at any time. Often you're working with heavy drill pipes – adding pipes when you're drilling or removing pipes when you're breaking out the string.

I Breaking out?

M Removing the string of pipes from the borehole. You're part of a team and you need to know exactly what you're doing at any time to get the job done quickly and safely. Safety's an important issue on the rigs. Before I could start on the rig, I had to take a course on Off-shore safety and survival at Montrose College. They teach you all sorts of things, including how to escape from a helicopter just in case you come down in the sea.
I did quite well as a Roughneck and after a couple of years I was selected to do a diploma in Off-shore drilling at a drilling school in Aberdeen. There were people there from all round the world – Nigeria, Oman, Vietnam. It was a good course. They had a rig floor simulator so you got practice in dealing with situations such as blow outs.

I These can be dangerous.

M Yes, that's when you hit oil under high pressure and it's forced up through the borehole. And fishing – recovering from the borehole drill bits and tools which have become separated from the pipe.

I What did you do after the course?

M When I finished the course, I was qualified as an Assistant Driller. I worked on a North Sea rig for three years more then I moved to a warmer part of the world, the Gulf of Mexico, as a Driller with Texaco. I'm still working there but I'm married now with a family. I like the work but I'm hoping to get a shore-based job as a Drilling Superintendent.

Pronunciation – *be* with the Present Continuous

1

1 I'm looking for my goggles.
2 You're standing too close.
3 He's not wearing a helmet.
4 We're having a fire drill.
5 They're learning first aid.

3

1 We're studying to be Petroleum Engineers.
2 She's taking a safety course.
3 I'm working for a Dutch company at the moment.
4 They're planning to shut down the well.
5 You're not following the instructions properly.
6 Who's looking after this site?

Unit 10

Vocabulary – Reporting verbs

A What's happening at the water plant? Have you had time to look at the problem?

B Yes. I went up to the reservoir earlier today and there seemed to be a problem with the pipe from there to the microstrainer.

A Was it blocked?

B It was partially blocked.

A Why had that happened?

B I think it must have been due to the heavy rain on Monday which washed a lot of debris into the reservoir.

A It'll have to be cleared quickly.

B I know. We're working on it at the moment.

A Once you've done that, you need to finish the report on the proposal.

B I'm sorry, I just haven't had time. I'll get it finished this afternoon and let you have it tomorrow.

Pronunciation – Showing disbelief

1 A How much water will it save?
B Calum said it would save 30%.
C How much water will it save?
D Calum said it would save 30%.

Listening – Cleaning water

Well, we all need water and today I'd like to discuss how it's cleaned before it's piped into homes and offices. In Europe and North America, water comes from different sources, mainly lakes, aquifers, or rivers. Rivers are usually dammed to form reservoirs. But before they reach our homes, most of our water supplies have to be purified. This takes place in a water treatment works where impurities are removed to make the water clear, odour-free, and taste-free. So it should be perfectly transparent, smell of nothing, and taste of nothing.

First of all, water taken from a river or reservoir is screened to remove large bits of rubbish such as twigs, plastic bags, etc. This is done by passing it through a microstrainer. Then, it's pumped to a water treatment works. At this stage, grit and organic matter, for example pieces of plants, algae, and bacteria, are still present in the water. The water is fed into an aerator, which sprays the water in order to obtain a good oxygen balance. At the same time, this spraying releases any trapped gases that might otherwise give a bad taste or odour. Following this, chemicals called coagulants are added. The function of these is to cause particles to stick together to form larger particles. The chemical normally used is alum, aluminium sulphate. This takes place in large tanks called flash mixers.

From here, the water passes into a sedimentation tank, sometimes called a settling basin. Here, the large particles are allowed to settle to the bottom. A sludge builds up at the bottom of the tank and has to be removed and treated. By this stage, about 85% of all suspended matter has been removed so the water is now relatively clean and clear.

The next step is filtration, normally in a rapid sand filter. Water is fed in at the top. It passes first of all through a layer of carbon or anthracite coal and then through layers of sand. The carbon removes any remaining organic compounds that would affect the taste or odour and the sand removes any remaining particles.

The final step is the addition of chemicals to disinfect the water in large disinfection tanks. Usually, some form of chlorine is used to kill any pathogens – that's viruses or bacteria. Some processes use ozone. Disinfection not only kills pathogens in the treated water but also helps to protect against any new contamination from pipes and storage tanks. In some places, fluoride is also added to prevent tooth decay in a process known as fluoridation.

The water is now fit to drink and can be pumped directly to homes, offices, and factories.

Unit 11

Problem-solving

I am going to tell you about the five sensors that our domestic robotic vacuum cleaner contains. These sensors help it to navigate safely and to clean surfaces effectively.

The dimension sensors determine the size of the room. The robot cleaner sends an infrared signal in each direction in turn. These reflect from the walls and return to an infrared receiver. The processor calculates the dimensions of the room from the time taken for the signal to return.

Then there are object sensors – when the cleaner hits an object, such as a chair, the bumper, which goes right round the cleaner, is pressed in. This activates mechanical object sensors. These send signals to the processor which cause the cleaner to change direction to avoid the object.

There are also cliff sensors – under the cleaner there are infrared sensors directed downwards. If the time taken for the return infrared signal increases suddenly, the processor detects a 'cliff', for example, stairs or other sudden drops which the robot could fall down. This causes the robot to reverse away from the cliff.

The wall sensors let the cleaner follow walls and go round objects closely but without touching them.

And finally, and most importantly, dirt sensors – these are acoustic impact sensors. When the cleaner raises a lot of dirt from a carpet or other surface, some of the dirt hits the metal plates of the acoustic impact sensors. This causes vibration which the sensors detect. They pass a signal to the processor which causes the robot to clean the area again until there are no more vibrations – in other words, until the area is clean.

It's my job

I = Interviewer, J = Jaako Ikonen

I How did you get interested in technology?

J I started making radio-controlled model boats at the age of 13.

I That's how you got started?

J That's how I got started, yeah. I loved playing around with the electronics.

I Did you go on to college at the end of school?

J Yes, I went to college and did Mechanical engineering with one year of Electrical and electronic engineering.

I What was your first job?

J Designing and building automated manufacturing systems for a mobile phone company. They needed to automate because production was going through the roof. Their old system simply could not produce enough phones.

I I'm not clear about the distinction between mechanization and automation.

J Big difference. Mechanization is the old world of machines with no brains, they could do only one thing – like Henry Ford's assembly lines. Automation means you are using a combination of software, of mechanical engineering, electronics, electrical engineering – that's the mechatronics side of things. There's intelligence built in. That's why it's called automation.

I You then moved to your current job?

J Yes. I'm Senior Manufacturing Systems Engineer for a large health care company. That means I'm responsible for developing all new processes and process automation for manufacturing our products.

I What do you make?

J One of the main products is blood glucose monitors for diabetics. It uses biosensors, which are coated in enzymes to measure the blood glucose levels in a drop of blood. Basically how much sugar there is in the blood.

I Where does automation come in?

J You can't make these machines by hand. There can't be any contamination, they have to be perfectly clean, and there can't be any defects in the production. Peoples' lives are involved so you cannot afford to be wrong. Also the volume is huge so only machines can achieve this.

I Is it done by robots?

J We use incredibly fast, vision-driven robots. They don't simply pick up and place components blindly. They can see what they're doing, they can teach themselves, and they check every move they make to ensure there are no errors.

I What qualities do you need to be successful in your field?

J You must be innovative. You must be able to work across functions and be able to communicate with non-technical people.

I Can you give me any examples of communicating with non-technical people?

J I work in R&D and we have to constantly communicate with Marketing – they know what the customers want. We just have the ideas.

I They seem to be great ideas. Thanks very much for your time.

J A pleasure, thank you.

Unit 12

It's my job

When I left school I did an apprenticeship in Cabinet making. I was quite good at this and I enjoyed it so I went to university to study Wood technology and Business and then decided to set up my own company. I'm the Managing Director but as there are only five of us, I spend my time designing kitchens as well as running the company.

My company specializes in designing and installing kitchen units. We are finding that our customers want more and more high-tech appliances in their kitchens so my job involves a lot more than putting in cupboards and hanging doors.

I really like the changing technology used in kitchen appliances. Nowadays, cookers are no longer simple appliances. Using different technology, most modern ovens are self-cleaning. One company called Kuppersbusch has developed a catalytic system. The way it works is that the oven fan blows air from the oven through a catalytic converter which changes fat and food residue into water and carbon dioxide.

On top of the cooker, conventional hobs heat the ring which in turn heats the cooking pot. But modern induction hobs use magnetic induction to heat the metal base of the pot. They heat much more quickly than conventional electric rings, save energy, and are safer. The problem is that the pots must be magnetic – made of steel. People can't use aluminium pots or pots with a thick copper base.

Another feature of the modern kitchen is electronic entertainment systems. It's possible to install flip-down flat screens that can be used for watching TV or as a computer monitor to access the Internet for recipes. They can even be linked to security cameras.

The smart kitchen is on its way and I am doing everything to make sure my company is able to provide our customers with the kitchens of the future. The best place to follow the latest technologies is the Massachusetts Institute of Technology, they've got a section called Counter Intelligence. It's a department dedicated to inventing new gadgets and gizmos for the kitchen. Their current projects include an electronic spoon that teaches you how to cook!

Pronunciation – Polite requests

A Could you tell me how this oven works, please?

B Could you tell me how this oven works, please?

1 I wonder if you could send me a catalogue.
2 I'd like you to use solid wood for the units.
3 Could you set up the machine?
4 Would you mind changing the height?
5 Could you tell me what happens next?
6 Would you mind cleaning up the mess?
7 I'd like you to calculate the angle carefully.
8 I wonder if you could help me.

Listening – Refrigerator

L = Lecturer, S1 = student 1, S2 = student 2, S3 = student 3

L What do you feel when you put water on your skin?

S1 It feels cool.

L Yes, it makes you feel cool because the water absorbs heat from your skin as it evaporates. So, evaporation cools the surrounding area. Putting alcohol on your skin feels even cooler because alcohol has a lower boiling point than water, so evaporates at a lower temperature. In a fridge, we use a different liquid, called a refrigerant which evaporates at a very low temperature. So, this is how a fridge works. Really, it's the compressor that powers the whole process. It compresses the refrigerant. Can anyone tell me what happens when a gas is compressed?

S2 There's a rise in the temperature and pressure.

L Quite right! The heat-exchanging coils are positioned outside the fridge, so that this heat is lost to the surrounding area and as it cools, the gas condenses into a liquid. The liquid then flows through the expansion valve. This expansion valve reduces the pressure. As a result, the refrigerant expands and evaporates and then goes back inside the fridge. As we said earlier, evaporation absorbs heat. So, heat-exchange pipes inside the fridge allow heat to be absorbed and this makes the space feel cold. As the refrigerant leaves the fridge, it once again enters the compressor and the whole cycle starts again.

S3 Why do old refrigerators get ice on the freezer box?

L Well, that's because water vapour from food in the fridge condenses, but as it hits, the very cold icebox, the liquid water changes immediately to ice. But modern fridges are frost-free. They have a heating coil beside the freezer coils. It's switched on by a timer, once every six or seven hours. Then, a temperature sensor detects the rising temperature when all the ice around the freezer coils has melted, and switches the heater off. That way, there is no build-up of ice but of course the temperature in the fridge fluctuates slightly.

Unit 13

Listening – The future of defence

Presenter
The search for military superiority has been one of the driving forces in technology from the creation of the first weapons to the development of the nuclear bomb. I am joined by Francis Hodges and Giles Wigg-Smith, who are both Defence Analysts, to present two different views on the future of defence technology.

Francis Hodges
For countries with access to high technology, military strength will depend less on the number of soldiers, aircraft, and ships and more on the capacity and speed of their military computer networks. Constantly updated intelligence on the position and strength of the opposition is the key to success. Information will be fed into the network from UAVs, uncrewed aerial vehicles, robotic sensors, and robotic seekers which will act as scouts locating enemy positions. The soldier in the field as well as commanders at a distance will be linked into the network so that everyone is well-informed at all times.

The hardware used will be smaller and lighter so it can be moved easily by transport aircraft from one position to another. Many of the vehicles used will be unmanned and will have camouflage paint which can change its colour according to its location. The weapons will be smarter. Missiles will be programmed with target details and capable of staying in the air until the target is confirmed. There should be less damage to people and property.

Giles Wigg-Smith
I'm not totally convinced by this. There are problems with high-tech systems. Very complex electronics can fail. The transfer rate, a hundred megabytes per second, required to handle this much data is greater than anything we have to date. Any network is vulnerable to hackers. Your system could be turned against you by feeding false information into the network, or a virus could be introduced to cripple the system.

High-tech armies are vulnerable to low-tech weapons: a plane can be brought down by rifle fire; improvised devices can destroy armoured vehicles. A system designed to destroy the electronics of incoming missiles can't protect against such simple weapons.

Many conflicts today are policing operations in situations where there are large numbers of civilians present. These high-tech systems are designed for wars rather than peace-keeping operations like this. Often these operations involve soldiers from a number of countries working together under a UN mandate but if you don't share the same system as your allies, you can't fight together as a unified force and it's unlikely countries will wish to share technical secrets with each other.

Unit 14

It's my job

I = Interviewer, B = Brian

I Brian, how did you get interested in electronics?

B At school. The History Teacher was a radio amateur. He started an after-school electronics club. He showed us how to make simple radios, multimeters, that sort of thing. I learned more from him than the Physics Teacher. Another reason I was interested was one of my friends built model aircraft, large things with a wingspan well over a metre, and I used to make the transmitters and receivers for radio control. If you forgot to switch on the receiver, the plane flew off into the distance until the fuel ran out. That happened more than once.

I What did you do after school?

B I took a certificate course in Electronics at the local college.

I What subjects did you study?

B I can't remember them all. Ehh, DC and AC circuits, Solid state devices, Applied maths.

I All technical subjects?

B Yes, apart from Technical communications. That's speaking and writing about technology. About half the time was spent in the lab, which was good. I liked the practical side. We had time to work on a project of our own. I designed a device to tell people who were fishing when a fish was biting the bait.

I What did you do when you finished college?

B With another student I started my own company repairing computers and other electronic items. But we gave it up after a couple of years. The price of things like DVD-players kept falling. It became cheaper to buy new than have them repaired.

I What kind of work do you do now?

B I work for the Northern Lighthouse Board. I help look after communications equipment at headquarters and in lighthouses as well as navigation equipment on buoys and radio beacons. There's not much on a buoy – just a light and a radar reflector. We also look after the transmission stations for the Marine GDPS. There are four in Scotland.

I What's the Marine GDPS?

B It's the Marine Global Differential Positioning System. It's a system which allows ships to plot their position very accurately.

I How is it different from GPS?

B It combines GPS signals with land-based signals to give a really accurate position. It's important in busy shipping lanes.

I What's the best part of your job?

B All the lighthouses are automated now. There are no lighthouse keepers these days. We monitor them 24 hours a day to make sure everything's working. When something goes wrong, you have to go out there and fix it. Some of them are quite remote. That can mean a helicopter ride in winter out into the Atlantic. I love going to places that very few people have ever visited, including the Flannan Isles.

I What will you do next?

B I like this job too much to think of looking for something else.

Pronunciation – Reading component values

a ten-microfarad electrolytic capacitor
a five-hundred-picofarad variable capacitor
a ten-kilohm variable resistor
a nine-volt battery
a one-milliamp milliammeter
a sixty-microhenries inductor
a six-volt sixty-milliamp bulb

Unit 15

Listening – Interview with a Network Designer

I = Interviewer, S = Sami

I Tell me a little about your professional history and what you do now.

S At school I used to enjoy Maths and Physics, so when I left school at sixteen I wanted a job working in technology, and outdoors if possible. I got good marks in my school exams. A friend told me that BT had an apprenticeship scheme, so I applied. There was an interview and I was accepted. I was seventeen and a Service Technician, climbing poles and fixing lines. It was great. BT is a company that is constantly changing and there are always opportunities to study and learn new things. I passed my BTEC in Telecommunications with 100%!

At eighteen I became a Data and Networks Technician and studied for an NVQ. It was my job to install new networks at the exchanges. I was responsible for the exchange switch and transmission. I was out on work placements a lot to get experience and did loads of courses. We got days off work to study.

I got more and more interested in actually designing the network. The new 21st-Century Network was about to be developed so I decided to become a Network Designer when I was twenty, and joined the Network Design Department. The 21st-Century Network was to be a completely new IT network to replace the old phone-based one. It was a massive challenge to BT. In the office I learned how to design and plan networks as well as how to predict future growth and trends using modelling techniques. At the same time the company sponsored me to do a university degree. Now I was designing the systems that BT's technology runs on. When I was 23 I graduated from university with a BSc in Computer and network engineering and have worked as a Network Designer since then. I've worked as Project Manager on a range of really interesting projects. I've had to learn different skills really quickly and learn how to prioritize. New projects make you think about what exactly needs to be done and which parts are important. I have to give presentations to senior management within the company, major customers, and at international conferences.

Glossary

Vowels

iː	media	ʊ	goods	aɪ	high-tech
i	ability	uː	lubricate	aʊ	outer
ɪ	impact	u	well-insulated	ɔɪ	spoilers
e	reservoir	ʌ	oven	ɪə	pier
æ	amplify	ɜː	turbine	eə	aeronautical
ɑː	barge	ə	sewer	ʊə	durable
ɒ	cockpit	eɪ	radar		
ɔː	platform	əʊ	sonar		

Consonants

p	panel	f	filtration	h	hacker
b	bacteria	v	vessel	m	modulate
t	track	θ	stealth	n	navigate
d	diode	ð	deal with	ŋ	wingspan
k	cable	s	span	l	lift
g	grain	z	carbon emissions	r	rig
tʃ	switch	ʃ	shear	j	yield
dʒ	generator	ʒ	decision maker	w	welded

ability /ə'bɪləti/ *n* having the skill and intelligence to do a particular job

access /'ækses/ *n* a way of entering a place

accommodation /əˌkɒmə'deɪʃn/ *n* a place to live or stay in

accuracy /'ækjərəsi/ *n* the quality of being exact or correct

acoustic /ə'kuːstɪk/ *adj* (used about a sensor, etc.) responding to sound or vibrations

activate /'æktɪveɪt/ *v* to make a device start working

adaptable /ə'dæptəbl/ *adj* able to be changed in order to deal with new situations

aeronautical /ˌeərə'nɔːtɪkl/ *adj* relating to the study or practice of building and flying aircraft

amplify /'æmplɪfaɪ/ *v* to increase the strength of a signal or an electrical wave

apologize /ə'pɒlədʒaɪz/ *v* to say sorry for doing something wrong or causing a problem

appliance /ə'plaɪəns/ *n* a machine designed to do a task in the home, such as preparing food, cleaning, etc.

applicant /'æplɪkənt/ *n* a person who applies for a job

application /ˌæplɪ'keɪʃn/ *n* a formal written request for a job

apply /ə'plaɪ/ *v* to make a formal written request for a job

apprentice /ə'prentɪs/ *n* a young person who works for an employer for a fixed period of time to learn the particular skills needed in the job

approach /ə'prəʊtʃ/ *v* to move closer to something

armoured /'ɑːməd/ *adj* (used about a military vehicle) protected by metal covers

assembly /ə'sembli/ *n* the process of putting parts together in order to make something

attach to /ə'tætʃ tə/ *v* to fasten or join to something

attendance record /ə'tendəns ˌrekɔːd/ *n* an account of how often someone has been present at or absent from their work

automation /ˌɔːtə'meɪʃn/ *n* the use of machines to do work that was previously done by people

bacteria /bæk'tɪəriə/ *n* very small living things, made of a single cell

barbed wire /ˌbɑːbd 'waɪə(r)/ *n* strong wire with short sharp points on it, used for fences

barge /bɑːdʒ/ *n* a large boat with a flat bottom, used for transporting things on canals and rivers

biodegradable /ˌbaɪəʊdɪ'greɪdəbl/ *adj* able to be broken down by bacteria and not damage the environment

bit /bɪt/ *n* the cutting part of a drill

cable /'keɪbl/ *n* thick, strong metal rope, used for supporting bridges

candidate /'kændɪdət/ /-deɪt/ *n* a person who is applying for a job

canning /'kænɪŋ/ *n* the process of putting food or drink in cans

capacitor /kə'pæsɪtə(r)/ *n* a device used to store an electrical charge

carbon emissions /ˌkɑ:bən i'mɪʃnz/ *n* harmful gases containing carbon, that are sent out into the air
cargo /'kɑ:gəʊ/ *n* the goods carried on a ship or aircraft
caterpillar tracks /'kætəpɪlə ˌtræks/ *n* metal belts fastened around the wheels of a vehicle or robot so that it can travel over rough or soft ground
cellulose /'seljuləʊs/ *n* a substance that forms the walls of plant cells and which is used in making plastics
cockpit /'kɒkpɪt/ *n* the area at the front of a plane where the pilot sits
collapse /kə'læps/ *v* (used about a building, etc.) to fall down or fall in suddenly
commercially viable /kəˌmɜ:ʃəli 'vaɪəbl/ *adj* (used about a business plan, etc.) capable of making a profit
component /kəm'pəʊnənt/ *n* one of the parts of a device or machine
compression /kəm'preʃn/ *n* the act of pressing or squeezing something into a smaller space
condensation /ˌkɒnden'seɪʃn/ *n* water that forms on a cold surface when steam or warm air becomes cool and changes into a liquid
conduct /kən'dʌkt/ *v* (used about a substance) to allow heat or electricity to pass along it
confirm /kən'fɜ:m/ *v* to state that something is definitely true or correct
congestion /kən'dʒestʃən/ *n* the state of being crowded and full of traffic
constituent /kən'stɪtjuənt/ *n* one of the parts of something that combine to form the whole
construct /kən'strʌkt/ *v* to build or make something
consumer /kən'sju:mə(r)/ *n* a person who buys goods or uses services
container ship /kən'teɪnə ˌʃɪp/ *n* a ship designed to transport goods that are packed in large metal boxes (= containers)
contamination /kənˌtæmɪ'neɪʃn/ *n* the presence of dirty or harmful substances in food, water, etc.
convert /kən'vɜ:t/ *v* to change something from one form to another
converter /kən'vɜ:tə(r)/ *n* a device that changes one form of energy to another form
convertible /kən'vɜ:təbl/ *adj* able to be changed to a different form or use
countermeasure /'kaʊntəmeʒə(r)/ *n* a course of action taken to protect against something bad or dangerous
covering letter /ˌkʌvərɪŋ 'letə(r)/ *n* a letter that you send with something to give extra information
crop /krɒp/ *n* a plant that is grown in large quantities for food
current /'kʌrənt/ *n* the flow of electricity through a wire
deal with /'di:l wɪð/ *v* to take action to solve a problem
decision maker /dɪ'sɪʒn ˌmeɪkə(r)/ *n* a person who can make difficult or important decisions
degree /dɪ'gri:/ *n* the qualification obtained by students who successfully complete a university course
dehydration /ˌdi:haɪ'dreɪʃn/ *n* the process of removing the water from something
diode /'daɪəʊd/ *n* an electronic device which allows electric current to pass in one direction only
dispose of /dɪ'spəʊz əv/ *v* to get rid of something that you do not want
distortion /dɪ'stɔ:ʃn/ *n* a change in the shape or structure of something that makes it less efficient, less strong, etc.
drag /dræg/ *n* the force of the air that acts against the movement of an aircraft
drawer /drɔ:(r)/ *n* a part of a piece of furniture such as a desk, that slides in and out and is used for keeping things in
drill /drɪl/ *n* a tool or machine used for making holes
durable /'djʊərəbl/ *adj* able to last for a long time without breaking or getting weaker
earn money /ˌɜ:n 'mʌni/ *v* to receive money for working
energy-saving /'enədʒi ˌseɪvɪŋ/ *adj* (used about a machine, etc.) using less energy than is usual
environment /ɪn'vaɪrənmənt/ *n* the natural world in which people, animals, and plants live
environmental /ɪnˌvaɪrən'mentl/ *adj* connected with the natural world and the effect of human activity upon it
environmental impact /ɪnˌvaɪrənmentl 'ɪmpækt/ *n* the effect that a particular action will have on the environment
evaporate /ɪ'væpəreɪt/ *v* (used about a liquid) to change into a gas
exert /ɪg'zɜ:t/ *v* to put force or pressure on something
explosive /ɪk'spləʊsɪv/ *n* something that could cause an explosion
extreme /ɪk'stri:m/ *adj* (used about physical conditions) not ordinary or usual; serious or severe
fascinating /'fæsɪneɪtɪŋ/ *adj* extremely interesting
fermentation /ˌfɜ:men'teɪʃn/ *n* a process in which a substance is chemically broken down by bacteria, etc., during which alcohol is produced
filtration /fɪl'treɪʃn/ *n* the process of passing a liquid through a filter (= a device that removes any materials that are not wanted)
find faults /faɪnd 'fɔ:lts/ *v* to find things that stop a machine from working correctly
flaps /flæps/ *n* a part of the wing of a plane that can be moved up or down to control upward movement
flue gas treatment /ˌflu: gæs 'tri:tmənt/ *n* a process for removing harmful substances from the smoke that is produced by factories
fossil fuel /'fɒsl ˌfju:əl/ *n* fuel such as coal or oil, formed from the remains of animals or plants
foundations /faʊn'deɪʃnz/ *n* the solid base of a building

frequency /ˈfriːkwənsi/ *n* the rate at which a sound or an electrical wave moves up and down

gearbox /ˈɡɪəbɒks/ *n* a metal case containing the gears of a vehicle; the system of gears of a vehicle

germinate /ˈdʒɜːmɪneɪt/ *v* (used about the seed of a plant) to start to grow

global warming /ˌɡləʊbl ˈwɔːmɪŋ/ *n* the increase in the temperature of the earth's atmosphere, caused by increased amounts of gases such as carbon dioxide

goods /ɡʊdz/ *n* things that are made to be sold

grain /ɡreɪn/ *n* the seeds of food plants, such as corn or rice

hacker /ˈhækə(r)/ *n* a person who gains access to a computer system without permission in order to steal data, etc.

harvesting /ˈhɑːvɪstɪŋ/ *n* the act of cutting and gathering crops

high-tech /ˌhaɪ ˈtek/ *adj* using the most modern electronic technology

hinge /hɪndʒ/ *n* a movable joint on a door, or lid, by which it opens or closes

hull /hʌl/ *n* the main, bottom part of a ship, that goes in the water

hydraulic system /haɪˈdrɒlɪk ˌsɪstəm/ *n* a mechanical system that is operated by liquid moving under pressure through an arrangement of cylinders and pistons

hydrocarbon /ˌhaɪdrəˈkɑːbən/ *n* a chemical made up of hydrogen and carbon, that is found in petrol, coal, and natural gas

immerse /ɪˈmɜːs/ *v* to put something into a liquid so that it is covered completely

impact /ˈɪmpækt/ *n* the act of one object hitting another; the force with which this happens

impurities /ɪmˈpjʊərətiz/ *n* substances that are present in small amounts in another substance, making it dirty or of poor quality

induce /ɪnˈdjuːs/ *v* to produce an electric current

infrared /ˌɪnfrəˈred/ *adj* using electromagnetic waves which are longer than those of red light

inner /ˈɪnə(r)/ *adj* on the inside of something

irrigation /ˌɪrɪˈɡeɪʃn/ *n* the process of supplying water to an area of land so that crops will grow

know-how /ˈnəʊ haʊ/ *n* knowledge and experience of how to do something

landing gear /ˈlændɪŋ ˌɡɪə(r)/ *n* the wheels and other parts of an aircraft that support it when it is on the ground

lift /lɪft/ *n* the upward pressure of air on an aircraft when it is flying

lining /ˈlaɪnɪŋ/ *n* a layer of material used to cover the inside surface of something

location /ləʊˈkeɪʃn/ *n* the place where something exists or happens

lower /ˈləʊə(r)/ *v* to make something go down

lubricate /ˈluːbrɪkeɪt/ *v* to put oil, grease, etc. on the parts of a machine so that they move smoothly

magnetic /mæɡˈnetɪk/ *adj* able to attract iron objects towards it

marketing /ˈmɑːkɪtɪŋ/ *n* the activity of presenting, advertising, and selling a company's products

media /ˈmiːdiə/ *n* the main forms of public communication, such as TV, radio, newspapers, etc.

minimize /ˈmɪnɪmaɪz/ *v* to reduce something to the lowest possible level

modulate /ˈmɒdjuleɪt/ *v* to change the characteristics of a signal or a wave, by altering its frequency, amplitude, etc.

molecule /ˈmɒlɪkjuːl/ *n* the smallest group of atoms into which a substance can be divided without changing its chemical nature

motorway /ˈməʊtəweɪ/ *n* a wide road, with several lanes in each direction, where traffic can travel fast for long distances

movable /ˈmuːvəbl/ *adj* able to be moved from one place or position to another

multitasking /ˌmʌltiˈtɑːskɪŋ/ *n* the ability to do several different things at the same time

navigable /ˈnævɪɡəbl/ *adj* (used about a path or an area of land) that a robot can move across without falling over, etc.

navigate /ˈnævɪɡeɪt/ *v* to find and follow a path through an area

non-lethal /ˌnɒnˈliːθl/ *adj* not causing death

offshore /ˌɒfˈʃɔː(r)/ *adv* in the sea, not far from the land

opportunity /ˌɒpəˈtjuːnəti/ *n* a chance to do something

oscillator /ˈɒsɪleɪtə(r)/ *n* an electrical device that produces an alternating current (= electrical current that changes direction many times a second)

outer /ˈaʊtə(r)/ *adj* on the outside of something

oven /ˈʌvn/ *n* a large device shaped like a box with a door on the front, in which food is cooked

packaging /ˈpækɪdʒɪŋ/ *n* materials used to wrap or protect goods that are sold in shops

panel /ˈpænl/ *n* a flat piece of wood, glass, or metal that forms part of a door, wall, etc.

paperwork /ˈpeɪpəwɜːk/ *n* the part of a job that involves writing letters, filling in forms, etc.

parallel to /ˈpærəlel tə/ *adv* in a straight line, while maintaining an equal distance from another object or surface

passenger /ˈpæsɪndʒə(r)/ *n* a person who is travelling in a vehicle

pasteurization /ˌpɑːstʃəraɪˈzeɪʃn/ *n* the process of heating and then cooling a liquid, such as milk, in order to kill harmful bacteria

pier /pɪə(r)/ *n* a column or a support for a bridge

pigment /ˈpɪɡmənt/ *n* a substance that adds colour to something

pitching /'pɪtʃɪŋ/ *n* the upward and downward movement of the front of a plane

plasticizer /'plæstɪsaɪzə(r)/ *n* a substance added to a plastic so that it becomes easy to bend

platform /'plætfɔ:m/ *n* a large raised structure in the sea that provides a base for a rig when drilling for oil

power source /'paʊə ˌsɔ:s/ *n* the place or device that supplies the electrical energy for something

preservation /ˌprezə'veɪʃn/ *n* the process of treating food so that it does not rot or decay

pressurize /'preʃəraɪz/ *v* to increase the pressure inside something

production costs /prə'dʌkʃn kɒsts/ *n* the amount of money that a business needs to spend in order to make something

program /'prəʊgræm/ *v* to give a computer a set of instructions to make it do a particular task

project /'prɒdʒekt/ *n* a planned piece of work that is designed to produce something new

promotion /prə'məʊʃn/ *n* a move to a more important job or position in a company

proposed /prə'pəʊzd/ *adj* (used about a plan, etc.) suggested for people to think about and decide on

public transport /ˌpʌblɪk 'trænspɔ:t/ *n* a system of buses, trains, etc. which people use to travel from one place to another

pulse /pʌls/ *n* a single short increase in the amount of energy, electricity, etc. produced by a device

qualification /ˌkwɒlɪfɪ'keɪʃn/ *n* an exam or a course of study that you have successfully completed

qualified /'kwɒlɪfaɪd/ *adj* having the necessary qualifications to do a particular job

quality assurance /'kwɒləti əˌʃʊərəns/ *n* the practice of making sure that goods or services are kept at a high standard

radar /'reɪdɑ:(r)/ *n* a system that uses radio waves to find the position and movement of planes, ships, etc.

rail /reɪl/ *n* one of the two metal bars that form the track that trains run on

raise /reɪz/ *v* to lift or move something to a higher level

raw materials /ˌrɔ: mə'tɪəriəlz/ *n* basic materials that are used to make a product

recommend /ˌrekə'mend/ *v* to advise a particular course of action

reference /'refrəns/ *n* a statement that is written by someone who knows you, giving information about your character and skills

refine /rɪ'faɪn/ *v* to make a substance pure by taking other substances out of it

refrigerant /rɪ'frɪdʒərənt/ *n* a substance used in cooling devices, such as fridges and freezers

refrigeration /rɪˌfrɪdʒə'reɪʃn/ *n* the process of making something cold in order to preserve it

reinforced concrete /ˌri:ɪnfɔ:st 'kɒŋkri:t/ *n* concrete with metal bars or wires inside to make it stronger

relay /'ri:leɪ/ *n* a device, usually containing an electromagnet, which is made active by a flow of current in one circuit in order to open or close another circuit

remediation /rɪmi:dɪ'eɪʃən/ *n* the removal of harmful chemicals and industrial waste from an area of land

remind /rɪ'maɪnd/ *v* to help somebody remember to do something

renewable energy /rɪ'nju:əbl ˌenədʒi/ *n* energy, such as wind and wave energy, which is replaced naturally

reservoir /'rezəvwɑ:(r)/ *n* a natural or an artificial lake, used as a store of water

resist /rɪ'zɪst/ *v* to not be damaged by something

resistor /rɪ'zɪstə(r)/ a device that reduces the flow of current in an electronic circuit

responsibility /rɪˌspɒnsə'bɪləti/ *n* the duty of being in charge of a particular activity

rig /rɪg/ *n* a large piece of equipment, used for taking oil or gas from the ground or under the sea

rolling /'rəʊlɪŋ/ *n* the movement of a plane in which one wing rises while the other wing falls

rotor /'rəʊtə(r)/ *n* a part of a machine which turns around, for example one of the blades of a helicopter

seabed /'si:bed/ *n* the floor of the ocean

seed /si:d/ *n* a small hard part produced by a plant, from which a new plant can grow

self-sufficient /ˌself sə'fɪʃnt/ *adj* able to produce everything that you need without the help of other people

sensory system /'sensəri ˌsɪstəm/ *n* the equipment in a robot that notices changes in the environment, concerning heat, light, pressure, etc.

sewage /'su:ɪdʒ/ *n* waste matter produced by human bodies and carried away through sewers

sewer /'su:ə(r)/ *n* an underground pipe, used for carrying away waste matter from human bodies

shear /ʃɪə(r)/ *n* movement in which two surfaces slide past each other; the force or pressure that causes this to happen

shore-based /'ʃɔ:beɪst/ *adj* done or happening on land rather than at sea

skill /skɪl/ *n* a particular ability

skilled /skɪld/ *adj* having the ability, knowledge, and experience to do something well

sonar /'səʊnɑ:(r)/ *n* a system for finding objects underwater using sound waves

span /spæn/ *n* the part of a bridge between one vertical support and another; the distance between these supports

spoilers /'spɔɪləz/ *n* parts of a plane's wing that can be raised in order to interrupt the flow of air over it and reduce lift

stabilizers /ˈsteɪbəlaɪzəz/ *n* devices that keep an aircraft level and stop it from rolling to one side

statistics /stəˈtɪstɪks/ *n* collections of information shown in numbers

stealth /stelθ/ *adj* (used about an aircraft, a ship, etc.) designed with technology that prevents it from being seen by radar, sonar, etc.

structure /ˈstrʌktʃə(r)/ *n* a thing that is made of several parts, such as a building

suggest /səˈdʒest/ *v* to recommend something that may be suitable for a particular purpose

suspension bridge /səˈspenʃn ˌbrɪdʒ/ *n* a bridge that hangs from steel cables that are fixed to towers at each end

switch /swɪtʃ/ *n* a device that opens or closes an electric circuit

team /tiːm/ *n* a group of people who work together at a particular job

tension /ˈtenʃn/ *n* the state of being pulled tight

thermoplastic /θɜːməʊˈplæstɪk/ *n* a type of plastic that can be melted and cooled repeatedly without becoming different in quality

thermoset /ˈθɜːməʊset/ *adj* (used about a type of plastic) treated so that it will not melt or become soft again when heated

thrust /θrʌst/ *n* the force produced by an engine that pushes a plane forward

tolerance /ˈtɒlərəns/ *n* the amount by which a value or measurement is permitted to vary

trailing edge /ˌtreilɪŋ ˈedʒ/ *n* the thin, rear edge of a wing

transformer /trænsˈfɔːmə(r)/ *n* a device used for changing the voltage of an electrical current

transistor /trænˈzɪstə(r)/ *n* an electronic device, used in computers, radios, etc., which controls current by acting as a switch or as an amplifier (= a device for increasing an electrical signal)

transmit /trænsˈmɪt/ *v* (used about a device or substance) to allow heat, energy, etc. to pass through

trigger /ˈtrɪgə(r)/ *v* to cause a device to start functioning

turbine /ˈtɜːbaɪn/ *n* a motor with blades that are turned around by the air, water, etc. in order to generate electricity

uncrewed /ˌʌnˈkruːd/ *adj* (used about an aircraft, etc.) without any people on board to operate it

underground /ˈʌndəgraʊnd/ adj under the surface of the ground

unmanned /ˌʌnˈmænd/ *adj* (used about an aircraft, etc.) without a person on board to operate it

ventilation /ˌventɪˈleɪʃn/ *n* the flow of air in and out of a room or building

versatile /ˈvɜːsətaɪl/ *adj* (used about a material) able to be used for many different purposes

vessel /ˈvesl/ *n* a ship or a boat

vibrate /vaɪˈbreɪt/ *v* to move from side to side very quickly and with small movements

visible /ˈvɪzəbl/ *adj* able to be seen

warship /ˈwɔːʃɪp/ *n* a ship used in war

waste /weɪst/ *n* material that is no longer needed and is thrown away

water purification /ˈwɔːtə pjʊərɪfɪˌkeɪʃn/ *n* the process of making water clean by removing substances that are dirty, harmful, etc.

wave /weɪv/ *n* a raised line of water that moves across the surface of the sea, etc.

weaken /ˈwiːkən/ *v* to make something less strong

welded /ˈweldɪd/ *adj* (used about two pieces of metal, etc.) joined together by heating the edges and pressing them together

well-insulated /ˌwel ˈɪnsjuleɪtɪd/ *adj* (used about a house, room, etc.) protected with a material that reduces the loss of heat, sound, etc. as far as possible

wind /wɪnd/ *n* the natural movement of the air

wingspan /ˈwɪŋspæn/ *n* the distance from the end of one wing to the end of the other

work experience /ˈwɜːk ɪkˌspɪəriəns/ *n* the work or jobs that you have done in your life so far

wrapping /ˈræpɪŋ/ *n* paper, plastic, etc. used for covering something in order to protect it

yawing /ˈjɔːɪŋ/ *n* the movement of a plane in which it turns to one side, away from a straight course

yield /jiːld/ *n* the total amount of crops, etc. that is produced