

Thursday 24 May 2012 – Morning

**GCSE GATEWAY SCIENCE
SCIENCE B**

B712/01 Science modules B2, C2, P2 (Foundation Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour 30 minutes



| | | | |
|--------------------|--|-------------------|--|
| Candidate forename | | Candidate surname | |
|--------------------|--|-------------------|--|

| | | | | | | | | | | | |
|---------------|--|--|--|--|--|--|------------------|--|--|--|--|
| Centre number | | | | | | | Candidate number | | | | |
|---------------|--|--|--|--|--|--|------------------|--|--|--|--|

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- A list of equations can be found on page 2.
- The Periodic Table can be found on the back page.
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **85**.
- This document consists of **28** pages. Any blank pages are indicated.

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

efficiency = $\frac{\text{useful energy output} (\times 100\%)}{\text{total energy input}}$

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

average speed = $\frac{\text{distance}}{\text{time}}$

distance = average speed × time

$$s = \frac{(u + v)}{2} \times t$$

acceleration = $\frac{\text{change in speed}}{\text{time taken}}$

force = mass × acceleration

weight = mass × gravitational field strength

work done = force × distance

power = $\frac{\text{work done}}{\text{time}}$

power = force × speed

$$\text{KE} = \frac{1}{2}mv^2$$

momentum = mass × velocity

force = $\frac{\text{change in momentum}}{\text{time}}$

GPE = mgh

$$mgh = \frac{1}{2}mv^2$$

resistance = $\frac{\text{voltage}}{\text{current}}$

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Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

Section A – Module B2

1 Look at the picture of Arabian Oryx.



(a) The Arabian Oryx are all the same species.

Write about the ways they show **variation** within the species.

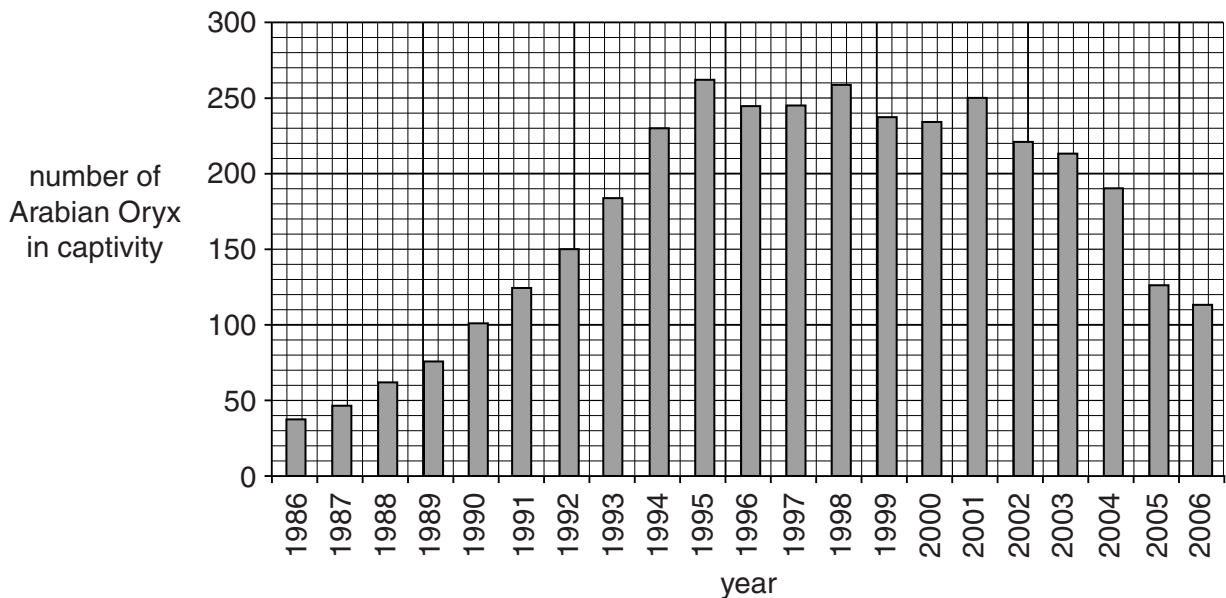
.....

..... [2]

(b) In the 1960s the Arabian Oryx became an endangered species.

In 1986 Saudi Arabia started a breeding programme to reintroduce the Arabian Oryx.

The graph shows the change in population from 1986 to 2006.



- (i) The graph shows a change in population between 2001 and 2006.

One conclusion from the data is that the population has dropped by more than 50% in five years.

Show by calculation, whether this conclusion is correct.

.....
..... [2]

- (ii) The Arabian Oryx are kept in a national park.

The park has fences all around.

The fences protect the Arabian Oryx from hunters.

Suggest reasons for the change in population between 2001 and 2006.

.....
.....
..... [2]

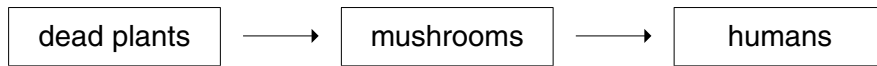
- (iii) It is important to conserve species such as the Arabian Oryx.

Explain why.

.....
.....
..... [2]

[Total: 8]

2 Look at the food chain.



(a) Put a ring around the phrase which describes the stages of a food chain.

- binomial system**
- cyclic fluctuations**
- pyramid of numbers**
- trophic levels**

[1]

(b) Mushrooms are decomposers.

Mushrooms are important in a woodland habitat.

Explain why.

.....

.....

..... [2]

(c) Energy flows through this food chain to the humans.

(i) Suggest how energy is lost from this food chain.

..... [1]

(ii) One year a disease kills most of the mushrooms.

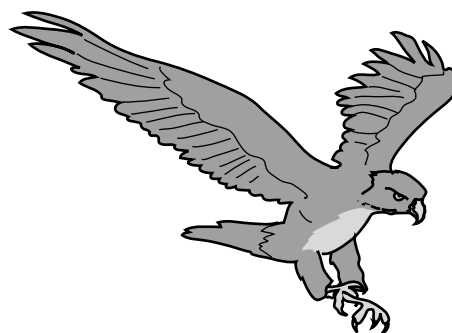
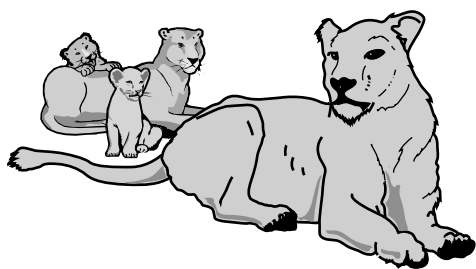
This does **not** change the population of humans in the area.

Explain why.

..... [1]

[Total: 5]

3 Look at the picture of some lions and an eagle.



(a) They are both predators. They are adapted to hunt and kill prey.

Write about and explain the similarities and differences between the ways eagles and lions are adapted to hunt and kill prey.



The quality of written communication will be assessed in your answer to this question.

..... [6]

(b) Lions prey on animals called antelopes.

What happens to a prey population when predator numbers increase?

..... [1]

[Total: 7]

4 One species of giant tortoise evolved to have a long neck.

People have had different views about why the tortoise evolved a long neck.

Read these two views.

View A
 One tortoise stretched its neck to reach some food. Its neck stayed stretched. This allowed the tortoise to reach food higher in the tree. The long neck meant it was more likely to survive.



View B
 One tortoise was born with a longer neck. This allowed it to reach more food higher in the tree than the other tortoises. The tortoise was better adapted to survive.

(a) Both views say that the tortoise eats the food higher in the tree.

(i) Write down **one other** way view **A** and view **B** are the same.

..... [1]

(ii) Write down **one** way view **A** and view **B** are different.

..... [1]

(b) Many theories have been put forward to explain how a species evolves.

Most scientists accept view **B**.

This theory is called natural selection.

(i) Who first put forward the theory of natural selection?

Choose from this list.

Darwin

Fleming

Hawkins

Pasteur

answer..... [1]

(ii) Explain why the theory of natural selection is now widely accepted.

.....

 [2]

[Total: 5]

Section B – Module C2

5 Look at the table. It shows some information about materials used for making cars.

| material | appearance | density in g/cm ³ | melting point in °C | relative strength | cost per tonne in £ |
|-----------|------------------------|------------------------------|------------------------|-------------------|---------------------|
| aluminium | shiny grey | 2.7 | 660 | 240 | 1350 |
| copper | shiny red/brown | 8.9 | 1083 | 220 | 3800 |
| glass | colourless transparent | 2.5 | 730 | 100 | 800 |
| perspex | colourless transparent | 1.2 | 160 | 60 | 1290 |
| resin | brown transparent | 1.4 | decomposes when heated | 50 | 480 |
| steel | dull grey | 7.7 | 1510 | 250 | 440 |

(a) Which material could be used to make a container to hold melted copper?

..... [1]

(b) Which material is the best for making car windscreens?

Explain your answer.

.....

 [2]

(c) Look at the picture of a wheel rim.

Which material is the best for making wheel rims?

Explain your answer.



.....

 [3]

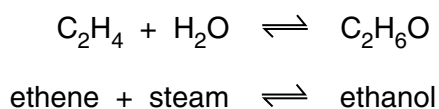
[Total: 6]

Turn over

6 This question is about **reversible reactions**.

Ethanol (alcohol) is made by reacting ethene with steam.

A catalyst of phosphoric acid is used.

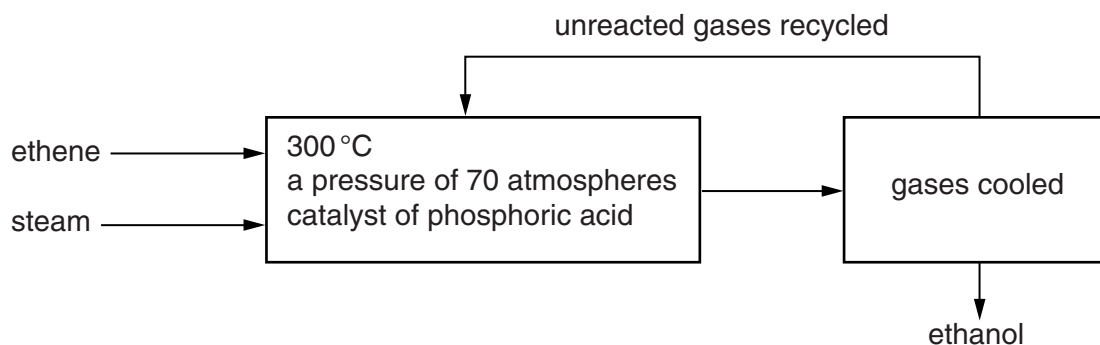


(a) The reaction is **reversible**.

What is meant by a reversible reaction?

..... [1]

(b) Look at the flow chart of the process.



Look at the table. It gives some information about the percentage yield of ethanol at different temperatures and pressures.

| temperature | percentage yield of ethanol at a pressure of | | | | |
|-------------|--|----------------|----------------|----------------|-----------------|
| | 20 atmospheres | 40 atmospheres | 60 atmospheres | 80 atmospheres | 100 atmospheres |
| 250 | 32% | 40% | 43% | 46% | 50% |
| 300 | 30% | 38% | 42% | 44% | 45% |
| 350 | 28% | 34% | 38% | 42% | 43% |
| 400 | 22% | 28% | 33% | 38% | 40% |

(i) What happens to the percentage yield of ethanol as the **pressure** increases?

..... [1]

(ii) What happens to the percentage yield of ethanol as the **temperature** increases?

..... [1]

(iii) The conditions used in the process do **not** give the highest yield.

The conditions used in the process are

- 300 °C
- a pressure of 70 atmospheres
- phosphoric acid catalyst.

Using the table, write down the conditions that give the highest yield.

pressure atmospheres

temperature °C

[1]

(iv) Suggest why the actual conditions used are different.

.....

.....

.....

.....

..... [2]

[Total: 6]

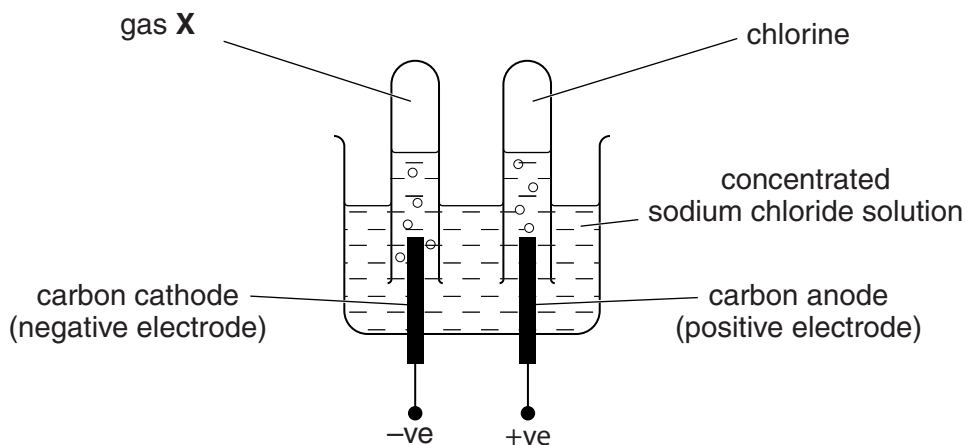
13
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Question 8 begins on page 14.

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8 Salt is sodium chloride.

Look at the diagram. It shows the electrolysis of concentrated sodium chloride solution.



(a) Chlorine is made at the anode (positive electrode).

What is the chemical test for chlorine?

.....
 [2]

(b) What is gas X?

..... [1]

(c) Write down **two** uses of sodium chloride (salt).

.....
 [2]

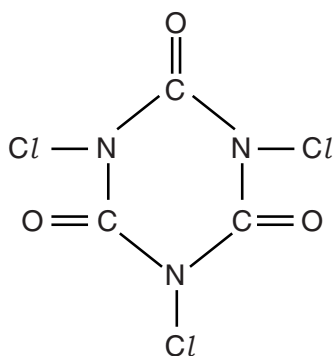
(d) Sodium chloride (salt) is electrolysed in an industrial process.

Where does the sodium chloride come from?

..... [1]

- (e) Trichlor (trichloroisocyanuric acid) is a chlorine compound used to kill bacteria in swimming pools.

The formula of trichlor is



What is the total number of **atoms** in this formula?

answer.....

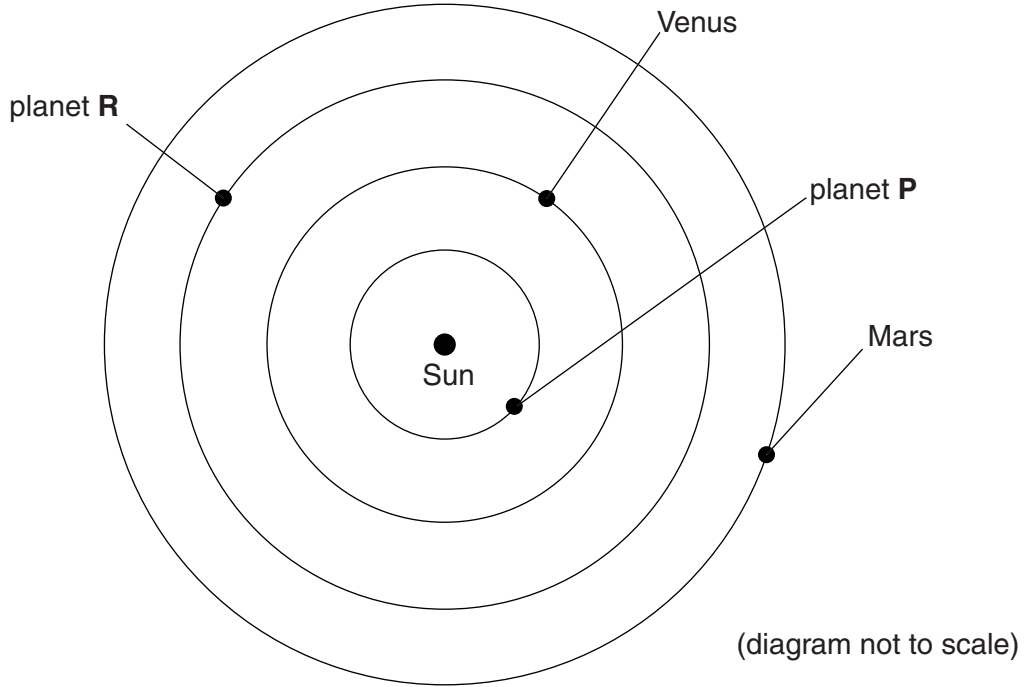
[1]

[Total: 7]

Section C – Module P2

9 (a) The diagram shows part of the Solar System.

The Sun and two planets are named.



Write down the names of planets **P** and **R**.

Planet **P** is

Planet **R** is [2]

(b) It is much easier and cheaper to use unmanned spacecraft rather than manned spacecraft for exploring the Solar System.

Explain why.

.....
.....
.....
..... [2]

- (c) There have been several models of the Universe in history. One important early model was developed by Ptolemy.

Describe how Ptolemy's model is similar and different to the diagram shown in part (a).

.....

.....

.....

.....

..... [2]

[Total: 6]

10 Ocrashire Council needs to illuminate a road sign in a remote part of the county.

The Council decides to use a panel of photocells to provide power for a lamp.

A photocell panel with an area of 200cm^2 produces 1 W of power.



Look at the information about lamps that could be used to light up the sign.

| lamp | lifetime in hours | power in W | amount of light given out in lumens | cost in £ | time taken for light to come on |
|-------------|--------------------------|-------------------|--|------------------|--|
| LED lamp | 50 000 | 8 | 60 | 50 | immediate |
| filament | 800 | 60 | 800 | 3 | immediate |
| fluorescent | 15 000 | 9 | 800 | 40 | 5 seconds |

Write about the advantages and disadvantages of using each type of lamp to light up the sign and explain which one the council should use.



The quality of written communication will be assessed in your answer to this question.

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.....

..... [6]

[Total: 6]

11 This question is about generating electricity.



Anna tells her friend Ben that the electricity in her house comes from coal.

Ben asks how this can happen.

(a) Write about the main stages in the production and distribution of electricity to her home.

.....
.....
.....
..... [2]

(b) Converting the chemical energy in coal into electrical energy is not very efficient.

600 J of electricity are produced for every 2400 J of energy stored in the coal.

Calculate the efficiency of the process.

.....
.....
.....

answer.....

[2]

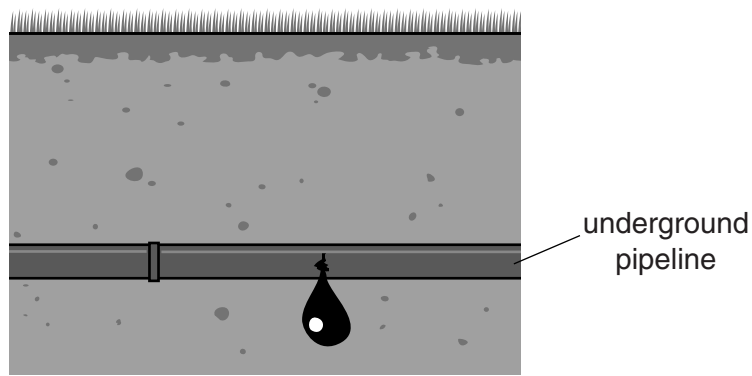
[Total: 4]

12 This question is about nuclear radiation.

(a) Look at the information below.

| type of nuclear radiation | range in air | range in oil | range in soil |
|---------------------------|--------------|--------------|---------------|
| X | 30 cm | 1 cm | 0.3 cm |
| Y | 10 000 cm | 5000 cm | 300 cm |
| Z | 5 cm | 0.001 cm | 0.001 cm |

An oil company knows that there is a leak in an underground pipeline, but does not know exactly where the leak is.



They use a radioactive tracer to find the position of the leak.

Use the information in the table to suggest which type of nuclear radiation the company should use as a tracer and explain how they could use it to find the position of the leak.

.....

.....

.....

.....

.....

..... [3]

(b) The use of nuclear radiation for medical purposes has increased over the last few years.

The use of nuclear radiation has risks.

(i) Write down one risk of using nuclear radiation for the hospital staff.

.....
..... [1]






(ii) Suggest how this risk can be minimised.

.....
..... [1]

[Total: 5]

13 Katrina uses electricity as an energy source for her house.

Look at the information about some of the appliances she uses.

| appliance | | voltage in volts | current in amps | power in watts | use each week in hours |
|------------------|---|---------------------|--------------------|-------------------|---------------------------|
| electric fire |  | 230 | 8.7 | 2000 | 30 |
| kettle |  | 230 | 13 | 3000 | 1 |
| low energy light |  | 230 | 0.03 | 7 | 50 |
| television |  | 230 | 0.7 | 160 | 30 |
| washing machine |  | 230 | 11 | | 2 |

(a) Complete the table by calculating the power for the washing machine.

.....

.....

..... [2]

(b) Katrina says that the kettle will cost the most to use each week because it has the highest power rating.

Is she correct?

Use the data to justify your answer.

.....

.....

..... [2]

[Total: 4]

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Section D begins on page 24.

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Section D

In this section you will need to interpret data.

14 Some scientists are worried about global warming.

They say that we are burning too much fossil fuel.

They say that more **renewable energy** sources should be used.

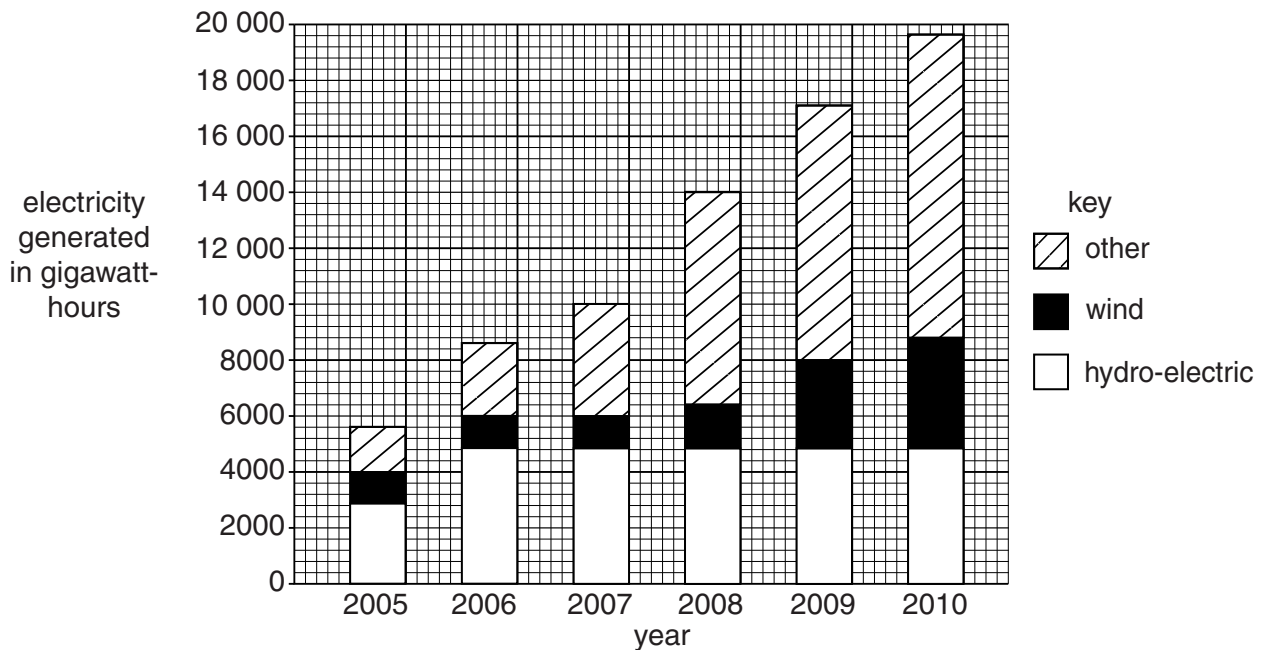
Renewable energy sources include

- wind power
- hydro-electric power
- others, eg tidal power.

(a) Sophia researches renewable energy sources on the internet.

The bar chart shows her findings.

It shows the energy generated using renewable energy sources between 2005 and 2010.



(i) How has the amount of energy generated by

- wind power
- hydro-electric power

changed between 2005 and 2010?

wind power

.....

hydro-electric power

..... [2]

- (ii) Suggest how energy generated from renewable sources is likely to change between 2010 and 2014.

Use the bar chart and your answer to part (i) to help you.

.....

.....

.....

..... [3]

- (b) Another possible way to reduce global warming is to use **bio-fuels**.

One bio-fuel is bio-ethanol.

Bio-ethanol is made from sugar cane.

Look at the table. It shows some information about bio-ethanol production in the USA.

The energy is measured in relative energy units.

| year | energy content of bio-ethanol | energy used during growth and manufacture | net amount of energy supplied |
|------|-------------------------------|---|-------------------------------|
| 2000 | 238 | 101 | 137 |
| 2001 | 259 | 110 | 149 |
| 2002 | 313 | 133 | 180 |
| 2003 | 410 | 174 | 236 |
| 2004 | 497 | 210 | 287 |
| 2005 | 570 | 241 | 329 |
| 2006 | 712 | 301 | 411 |
| 2007 | 924 | 378 | 546 |

- (i) What is happening to the **net amount of energy** supplied by bio-ethanol between 2000 and 2007?

..... [1]

- (ii) Suggest what your answer to part (i) could mean for the amount of **fossil fuels** used in the USA in the future.

.....

..... [1]

(c) Look at the photograph of a wind farm.



There are plans for a new UK wind farm to produce power for the National Grid.

Look at the data about average wind speeds in different places in the UK.

| place | average wind speed at 10 m above ground level for each month in m/s | | | | | | | | | | | |
|------------|---|------|------|-------|------|------|------|------|------|------|------|------|
| | Jan | Feb | Mar | April | May | Jun | July | Aug | Sept | Oct | Nov | Dec |
| Bedford | 5.64 | 5.35 | 5.45 | 4.99 | 4.57 | 4.43 | 4.01 | 4.16 | 4.47 | 4.78 | 5.09 | 4.40 |
| Blackpool | 6.32 | 6.07 | 5.96 | 5.14 | 5.04 | 5.09 | 5.09 | 5.14 | 5.55 | 5.81 | 5.91 | 6.12 |
| Durham | 4.27 | 3.80 | 3.75 | 3.08 | 2.62 | 2.62 | 2.52 | 2.57 | 3.03 | 3.24 | 3.70 | 3.96 |
| Manchester | 4.83 | 4.73 | 4.78 | 4.32 | 4.16 | 3.80 | 3.60 | 3.60 | 3.86 | 4.11 | 4.27 | 4.58 |
| St. Mawgan | 7.14 | 6.89 | 6.58 | 5.71 | 5.54 | 5.14 | 4.99 | 4.93 | 5.50 | 6.37 | 6.63 | 7.09 |

(i) Based on wind speed, which place would be best to build the wind farm?

.....

Explain your answer.

.....

 [2]

(ii) Suggest **another** factor that engineers would need to consider when they decide where to build a wind farm.

.....
 [1]

[Total: 10]

END OF QUESTION PAPER

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The Periodic Table of the Elements

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | | | | | | | | | | |
|--|--------------------------------------|------------------------------------|--|--|--------------------------------------|---|---------------------------------------|-------------------------------------|---|---|--|---|------------------------------------|------------------------------------|------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------|
| | 7 Li lithium 3 | 9 Be beryllium 4 | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> 1 H hydrogen 1 </div> | | | | | 19 F fluorine 9 | 4 He helium 2 | | | | | | | | | |
| | 23 Na sodium 11 | 24 Mg magnesium 12 | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> Key relative atomic mass atomic symbol name atomic (proton) number </div> | | | | | 16 O oxygen 8 | 20 Ne neon 10 | | | | | | | | | |
| | 39 K potassium 19 | 40 Ca calcium 20 | 45 Sc scandium 21 | 48 Ti titanium 22 | 51 V vanadium 23 | 52 Cr chromium 24 | 55 Mn manganese 25 | 56 Fe iron 26 | 59 Co cobalt 27 | 59 Ni nickel 28 | 63.5 Cu copper 29 | 65 Zn zinc 30 | 70 Ga gallium 31 | 73 Ge germanium 32 | 75 As arsenic 33 | 79 Se selenium 34 | 80 Br bromine 35 | 84 Kr krypton 36 |
| | 85 Rb rubidium 37 | 88 Sr strontium 38 | 89 Y yttrium 39 | 91 Zr zirconium 40 | 93 Nb niobium 41 | 96 Mo molybdenum 42 | [98] Tc technetium 43 | 101 Ru ruthenium 44 | 103 Rh rhodium 45 | 106 Pd palladium 46 | 108 Ag silver 47 | 112 Cd cadmium 48 | 115 In indium 49 | 119 Sn tin 50 | 122 Sb antimony 51 | 128 Te tellurium 52 | 127 I iodine 53 | 131 Xe xenon 54 |
| | 133 Cs caesium 55 | 137 Ba barium 56 | 139 La* lanthanum 57 | 178 Hf hafnium 72 | 181 Ta tantalum 73 | 184 W tungsten 74 | 186 Re rhenium 75 | 190 Os osmium 76 | 192 Ir iridium 77 | 195 Pt platinum 78 | 197 Au gold 79 | 201 Hg mercury 80 | 204 Tl thallium 81 | 207 Pb lead 82 | 209 Bi bismuth 83 | [209] Po polonium 84 | [210] At astatine 85 | [222] Rn radon 86 |
| | [223] Fr francium 87 | [226] Ra radium 88 | [227] Ac* actinium 89 | [261] Rf rutherfordium 104 | [262] Db dubnium 105 | [266] Sg seaborgium 106 | [264] Bh bohrium 107 | [277] Hs hasium 108 | [268] Mt meitnerium 109 | [271] Ds darmstadtium 110 | [272] Rg roentgenium 111 | Elements with atomic numbers 112-116 have been reported but not fully authenticated | | | | | | |

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.