

Thursday 24 May 2012 – Morning

**GCSE GATEWAY SCIENCE
SCIENCE B**

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

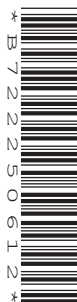
Candidates answer on the Question Paper.
A calculator may be used for this paper.

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.

2

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

3

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Question 1 begins on page 4.

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4

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.

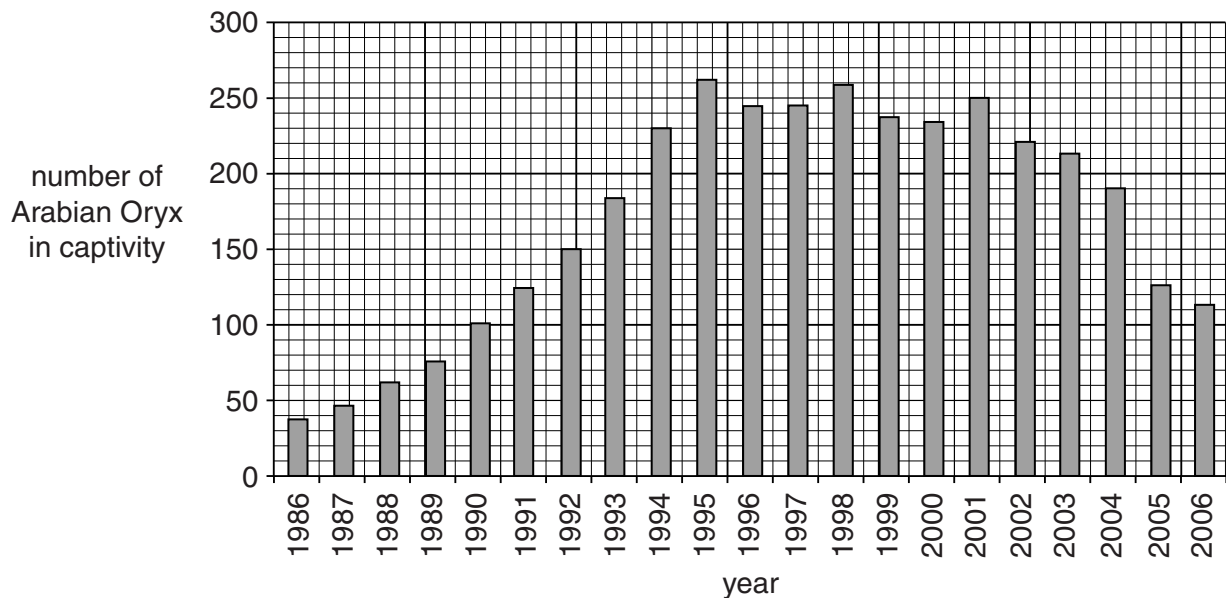
Write about the ways they show **variation** within the species.

.....
 [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.



5

- (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]

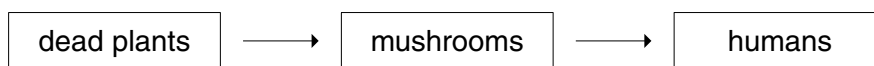
- (iii) It is important to conserve species such as the Arabian Oryx.

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]

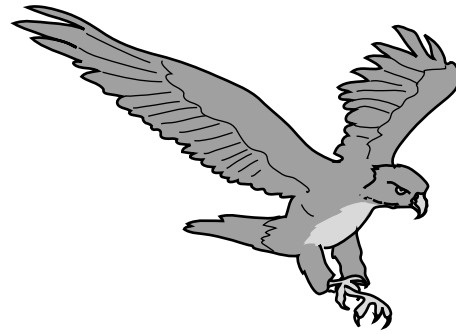
(ii) One year a disease kills most of the mushrooms.

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

Explain why.

..... [1]

[Total: 5]



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



..... [6]

What happens to a prey population when predator numbers increase?

..... [1]

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Turn over

- 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.



- (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.

wheel
rim



.....

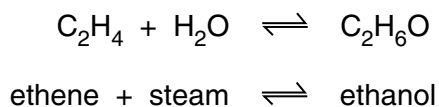
 [3]

[Total: 6]

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

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

A catalyst of phosphoric acid is used.

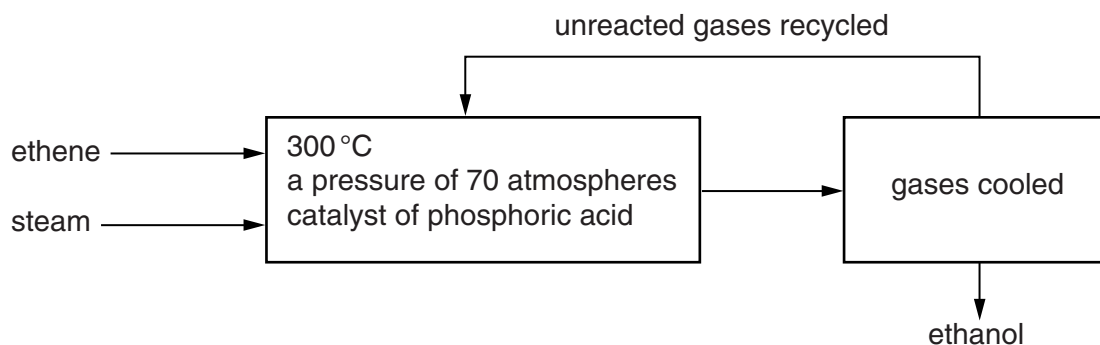


(a) The reaction is **reversible**.

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]

11

- (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]

acid + alkali $\rightarrow$ salt + water



..... [6

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13

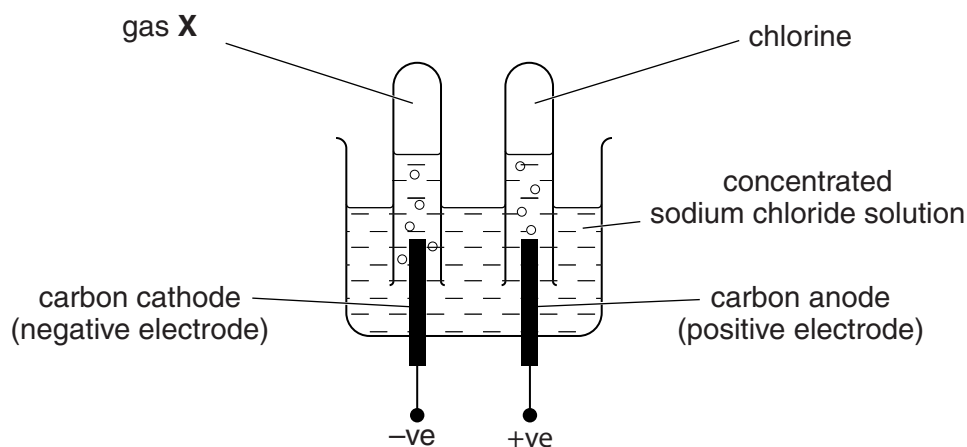
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Question 8 begins on page 14.

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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.

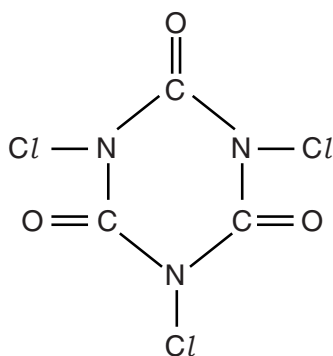
Where does the sodium chloride come from?

..... [1]

15

- (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.....

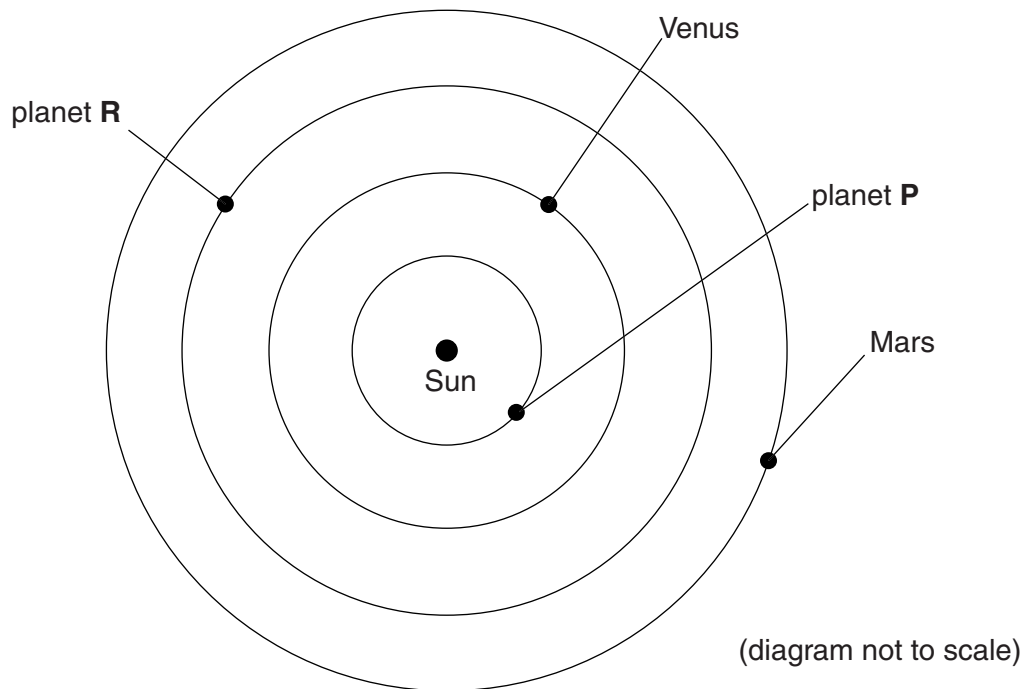
[1]

[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]

17

- (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]

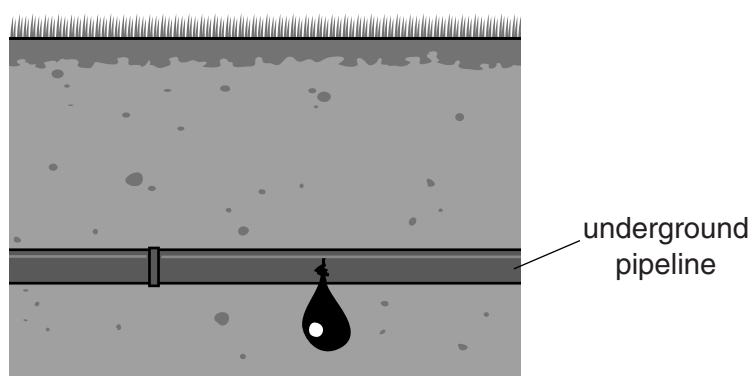
[Total: 4]

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]

21

- (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 Catrina 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) Catrina 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]

23

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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.

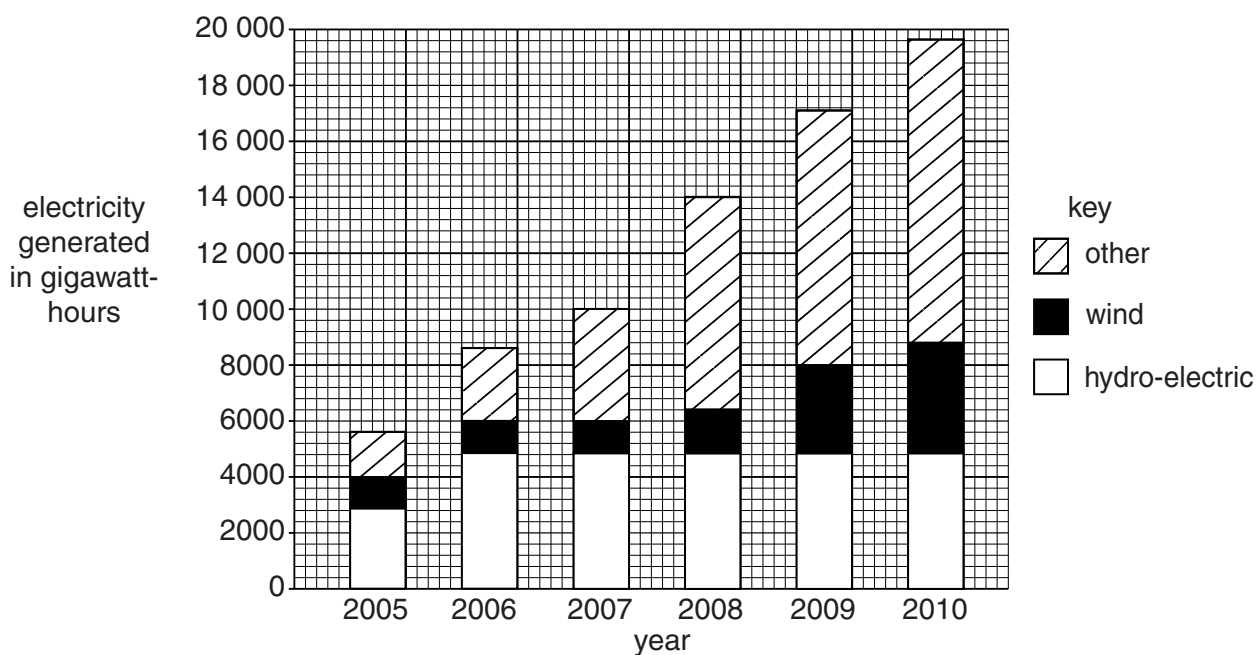
Renewable energy sources include

- 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	Key					3	4	5	6	7	0					
		relative atomic mass atomic symbol name atomic (proton) number															
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
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 hassium 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						