OCR

H

Monday 19 May 2014 – Afternoon

GCSE GATEWAY SCIENCE
SCIENCE B

B711/02 Science modules B1, C1, P1 (Higher 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 15 minutes

* B 7 1 1 0 2 *

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

- The 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 **75**.
- This document consists of **28** pages. Any blank pages are indicated.

EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

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

distance = average speed × time

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

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

force = mass × acceleration

weight = mass × gravitational field strength

work done = force × distance

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

power = force × speed

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

momentum = mass × velocity

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

GPE = mgh

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

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

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Question 1 begins on page 4

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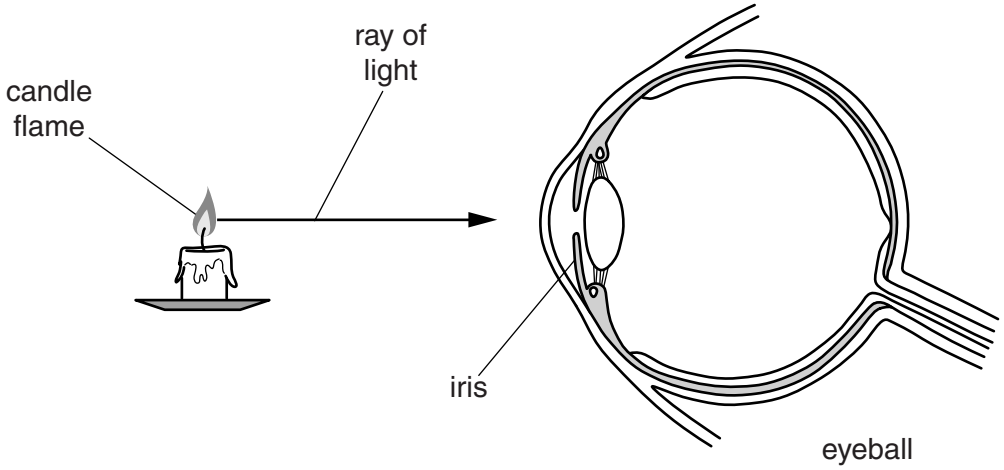
Answer **all** the questions.

SECTION A – Module B1

1 Look at the diagram.



(a) Write down the job of the iris.

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

(b) The flame can be seen because rays of light enter the eye and travel to the back of the eyeball.

Describe what happens to the light rays as they travel to the back of the eyeball.

Include the parts of the eye in your answer.

.....

.....

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

(c) Look at the picture of a tiger.

Tigers have binocular vision.

Explain how binocular vision helps tigers judge how far away their prey is.

.....

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

[Total: 5]

2 Peter is investigating growth in shoots.

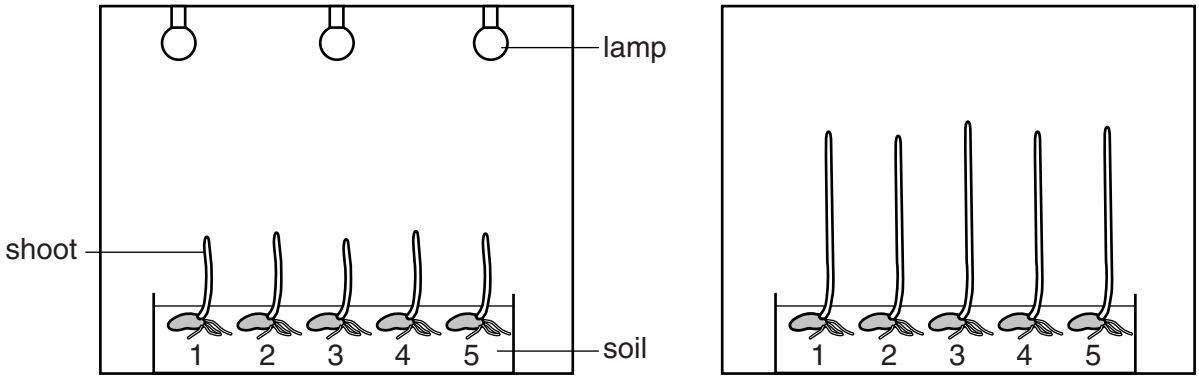
He places some seeds into two trays, **A** and **B**.

Tray **A** is kept in the light.

Tray **B** is kept in the dark.

The seeds are left to germinate and grow.

The diagrams show his results after one week.



Tray **A** in the light

Tray **B** in the dark

(a) The apparatus is used to investigate the effect that light has on growth in shoots.

Which group of hormones controls the direction of growth in shoots?

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

(b) **(i)** Use your knowledge of these hormones to explain the results.

.....

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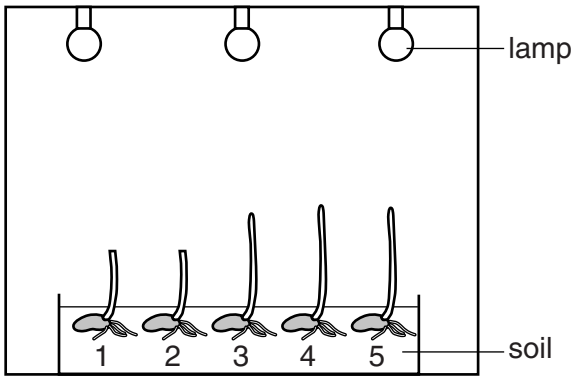
..... **[2]**

(ii) Peter wants to extend his investigation.

He cuts the tips off shoots 1 and 2 in tray **A**.



Tray **A** in the light

He then leaves them for another week.

Predict what will happen to the growth of shoots 1 and 2 compared to the other shoots.

Justify your answer.

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

[Total: 5]

3 People with Type 1 diabetes need to inject insulin.

Insulin regulates blood sugar levels.

Some people take a combination of two kinds of insulin, **A** and **B**.

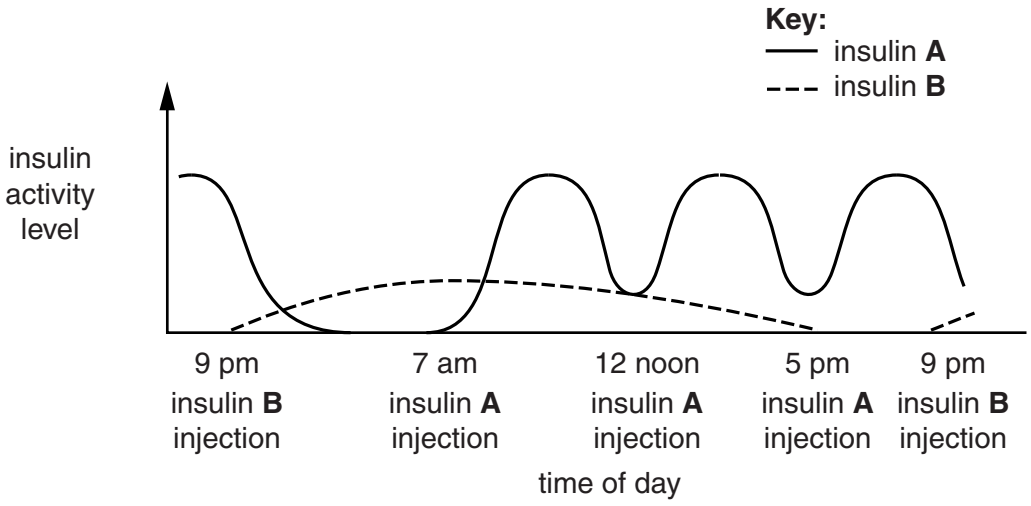
The time of day when the injections are taken is shown in the table.

Time of day	Insulin taken
9 pm before bed	**B**
7 am before breakfast	**A**
12 noon before lunch	**A**
5 pm before main evening meal	**A**

Look at the graph.

A person takes four injections in a 24 hour period.

The graph shows the activity level of insulin **A** and **B** in the person's blood.



Explain how **insulin** regulates blood sugar levels and compare how the activity level of insulin **A** is different from insulin **B**.

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

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..... **[6]**

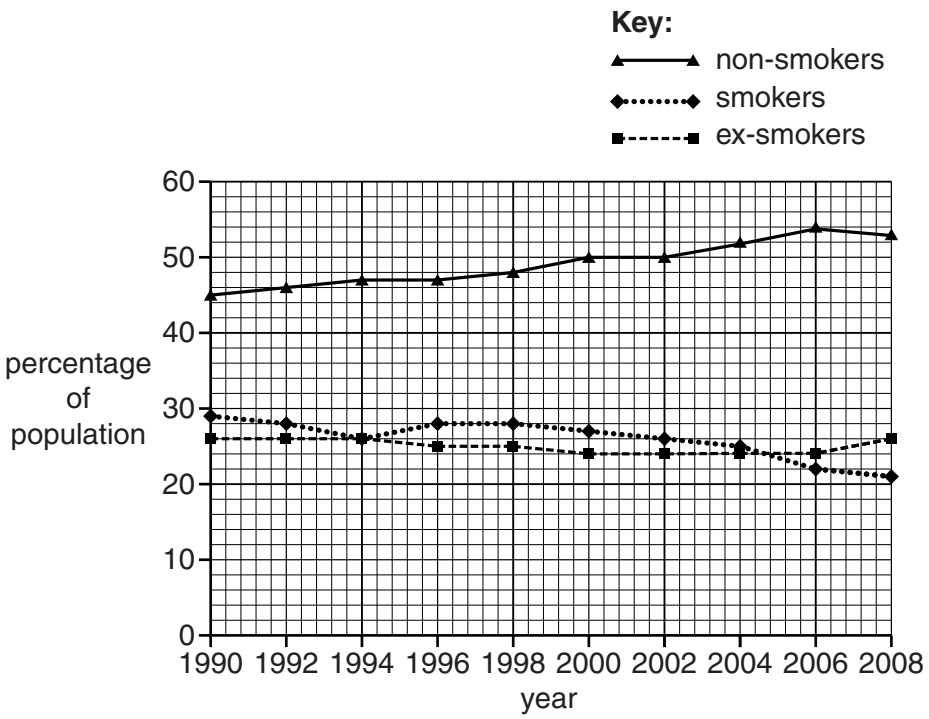
[Total: 6]

4 Look at the graph.

It shows how the percentage of:

- non-smokers
- smokers
- ex-smokers

has changed from 1990 to 2008.



(a) Compare the patterns for the different groups shown in the graph.

.....

.....

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

(b) In the past, scientists tested the effects of cigarette smoke on animals.

Many people objected to using animals in this way.

However, humans have benefited from these tests.

Explain how humans have **benefited** from these tests.

.....

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

(c) People who smoke often have high blood pressure.

Explain how smoking causes high blood pressure.

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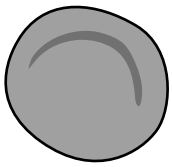
..... **[2]**

[Total: 6]

5 Some people have a genetic disorder called sickle cell anaemia.

Their red blood cells have a different shape.

normal red blood cell



sickle-shaped red blood cell

(a) Haemoglobin in the sickle-shaped red blood cells is less effective.

Suggest **one** way this could affect the health of the individual.

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

(b) Wesley and Lucy are both heterozygous for sickle cell anaemia.

This means they have sickle cell trait but do not have full sickle cell anaemia.

They decide to have a baby.

What is the probability their child will have full sickle cell anaemia?

Use a genetic diagram to work out your answer.

A = allele for normal red blood cells

a = allele for sickle-shaped red blood cells

probability of child having full sickle cell anaemia ..... **[2]**

[Total: 3]

SECTION B – Module C1

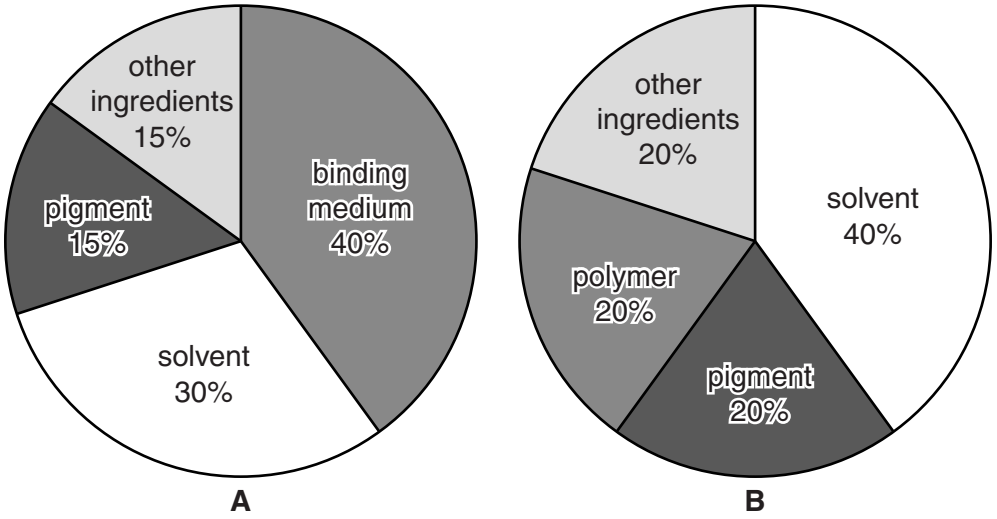
6 This question is about paints.

(a) Paint contains a mixture of pigment particles dispersed in a liquid.

What is the name for this **type** of mixture?

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

(b) Look at the pie charts showing the ingredients in two types of paint.



Which paint would you expect to dry faster?

.....

Explain your choice.

.....

.....

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

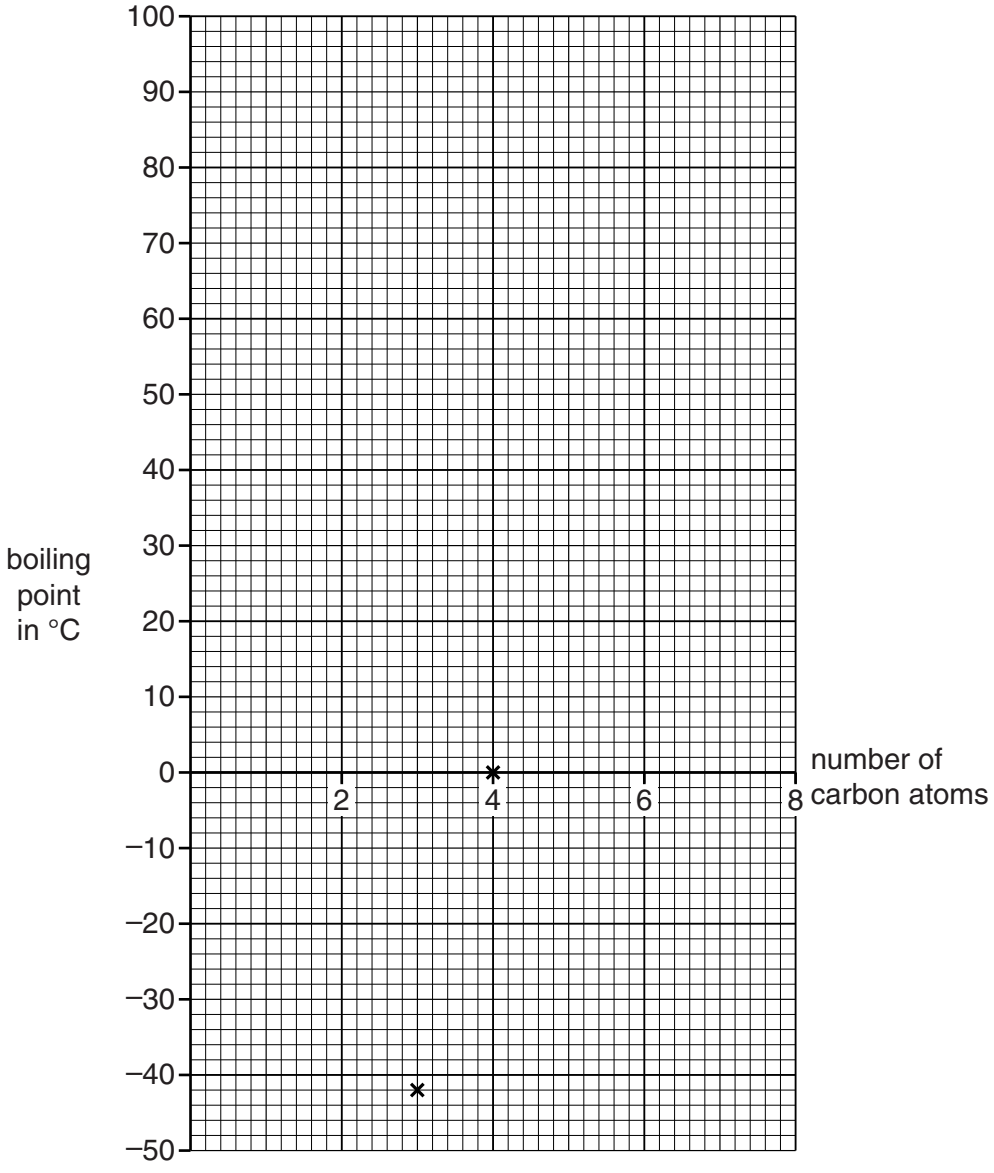
[Total: 3]

7 Duncan is using the internet to find out about alkanes.

Alkanes are hydrocarbons found in crude oil.

Name	Number of carbon atoms	Boiling point in °C
propane	3	–42
butane	4	0
hexane	6	69
heptane	7	98

Duncan plots the data for propane and butane on the grid.



(a) (i) Plot the data for hexane and heptane on the grid. **[1]**

(ii) Duncan could not find a value for the boiling point of **pentane**, $\mathbf{C_5H_{12}}$.

Use the graph to estimate the boiling point of pentane.

answer..... °C **[1]**

(iii) Using ideas about forces between molecules, explain the trend in the boiling points of the alkanes.

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.....

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

(b) Butane, C_4H_{10}, burns in oxygen, O_2.

Carbon dioxide and water are made.

Write a **balanced symbol** equation for this reaction.

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

(c) Some of the fractions from crude oil are cracked.

Look at the table.

It gives information about some of these fractions.

Fraction	Number of carbon atoms in a molecule	Percentage found in North Sea crude oil	Percentage required for use
LPG	1 – 5	2	4
petrol	5 – 10	8	22
naphtha	8 – 12	10	5
paraffin	16 – 24	14	8

Suggest why molecules from the **naphtha** fraction are cracked. Use information from the table.

.....

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

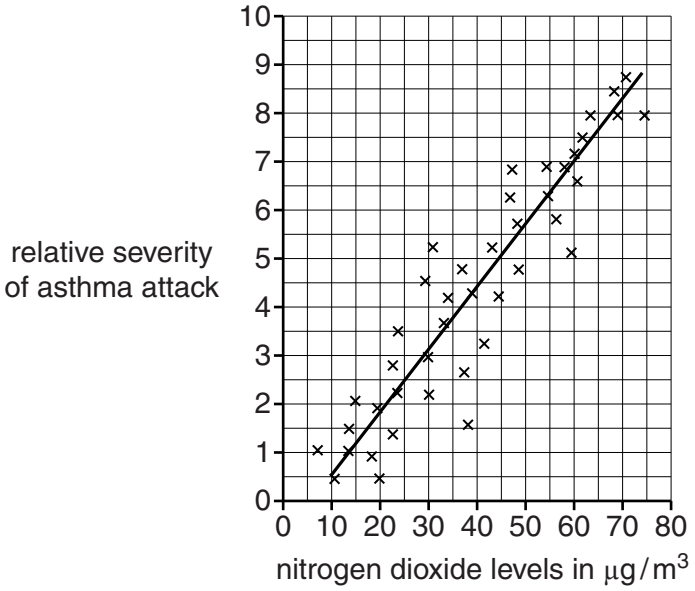
[Total: 8]

8 Nitrogen dioxide is a pollutant found in air.

Scientists think that there is a link between nitrogen dioxide levels and the severity of asthma attacks.

Look at the graph.

It shows data about the severity of asthma attacks in young men.



(a) What conclusion can you draw about the link between nitrogen dioxide levels and the severity of asthma attacks?

.....

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

(b) The data is for men aged between 20 and 40 who live in a city centre.

Nick thinks you can use the graph to draw a firm conclusion about nitrogen dioxide levels and the severity of **all** asthma attacks.

Phil thinks more evidence is needed.

Suggest who is correct. Explain your answer.

.....

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

[Total: 2]

9 Sue prepares a meal.

(a) She cooks some meat.

Sue notices that the **texture** of the meat changes when it is cooked.

Explain why the texture of the meat changes.

.....

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

(b) Sue serves mayonnaise with the meal.

The mayonnaise contains an **emulsifier** to stop the oil and water from separating.

Using a **labelled** diagram, explain how an emulsifier stops oil and water from separating.

.....

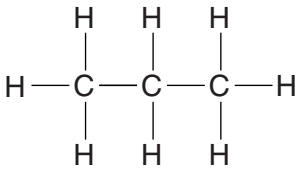
.....

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

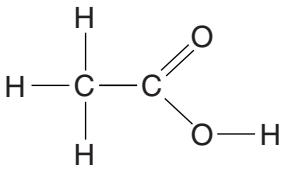
[Total: 3]

10 This question is about carbon compounds.

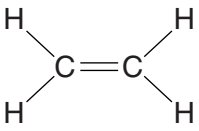
(a) Look at the displayed formulas of some compounds.



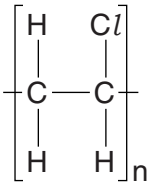
compound **A**



compound **B**



compound **C**



compound **D**

(i) Compounds **A** and **C** are **hydrocarbons**.

Explain why.

.....

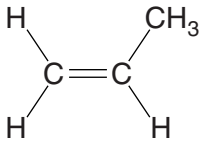
..... **[2]**

(ii) Which compound will decolourise bromine water?

Choose from **A**, **B**, **C** or **D**.

answer..... **[1]**

(b) Look at the displayed formula of **propene**.



Propene molecules can join together to form **poly(propene)**.

Describe and explain how propene molecules join together.

Include an equation and the structure of the polymer in your answer.

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

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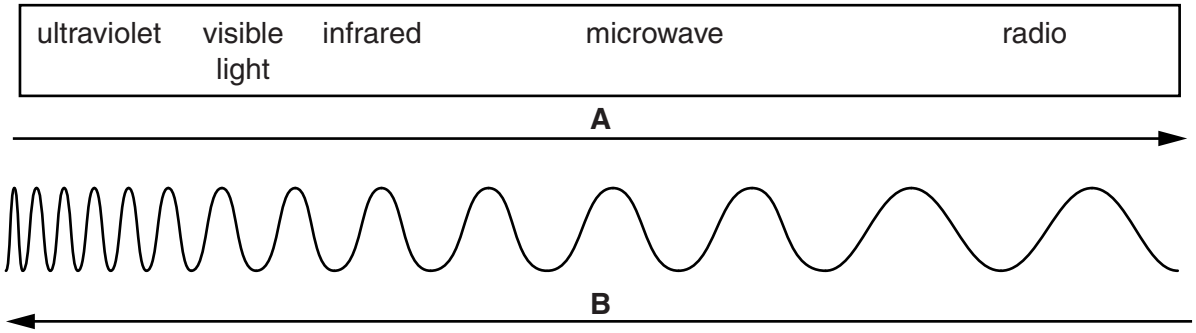
..... **[6]**

[Total: 9]

SECTION C – Module P1

11 Electromagnetic waves are **transverse** waves.

(a) Look at the diagram of part of the electromagnetic spectrum.



(i) What does the direction of the arrow labelled **A** show?

Choose from

increasing energy

increasing speed

increasing frequency

increasing wavelength

answer ..... **[1]**

(ii) What does the direction of the arrow labelled **B** show?

Choose from

increasing energy

increasing speed

increasing wavelength

decreasing frequency

answer ..... **[1]**

Radio waves can have different frequencies and wavelengths.

(b) What is meant by the **frequency** of a wave?

.....

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

(c) The table shows typical frequency and wavelength for different radio waves.

Radio wave	Frequency in Hz	Wavelength in m
extremely low frequency	3	1×10^8
ultra low frequency	3×10^2	1×10^6
low frequency	3×10^4	1×10^4
medium frequency	3×10^5	1×10^3
very high frequency	3×10^7	10

(i) Calculate the wave speed of **ultra low frequency** radio waves.

.....

.....

.....

Speed of wave ..... m/s **[2]**

(ii) How do the data in the table show that these different radio waves all travel at the same speed?

.....

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

[Total: 6]

12 Anton and Ben like to sunbathe.

Anton has **fair** skin. His skin burns after 5 minutes without sunscreen.

Ben has **dark** skin. His skin burns after 20 minutes without sunscreen.

Anton and Ben want to sunbathe for 180 minutes. They do not want their skin to burn.

They have two different sunscreens.

Name of sunscreen	Sun Protection Factor (SPF)
Bronzer	15
Toptan	45

They choose one of the sunscreens and apply it only once before sunbathing.

Ben can use either Bronzer or Toptan

Anton must use Toptan

Explain why Ben can use either Bronzer or Toptan, but Anton must use Toptan.

Use information about the sunscreens and their skin types in your answer.

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

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..... **[6]**

[Total: 6]

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Question 13 begins on page 24

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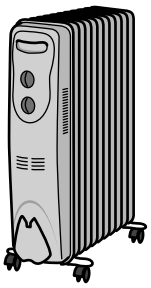
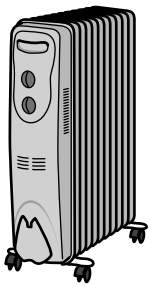
13 Melissa has two identical radiators.

One contains water and the other contains oil.

		
Contents of radiator	25 kg of **water**	25 kg of **oil**
Power of electric heater in radiator	1000 W	1000 W

(a) The heater in the **water** radiator supplies 3 150 000 J of energy to the water.

The specific heat capacity of water is 4200 J/kg °C.

The initial temperature of the water is 20 °C.

Use a calculation to predict the temperature rise of the water.

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.....

.....

Temperature rise ..... °C **[2]**

(b) The temperature inside the radiator does not actually rise by this amount.

Explain why.

.....

.....

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

(c) The specific heat capacity for **water** is 4200 J/kg °C.

The specific heat capacity for **oil** is 1670 J/kg °C.

Melissa thinks that the radiator filled with oil is the best.

Her reasons are:

A It will heat up quickly when I switch it on.

B It will cool down slowly when I switch it off.

(i) One of her reasons is **not** correct.

Which reason is **not** correct?

.....

Explain why.

.....

.....

.....

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

(ii) Why would the radiator be more useful if it heats up quickly and cools down slowly?

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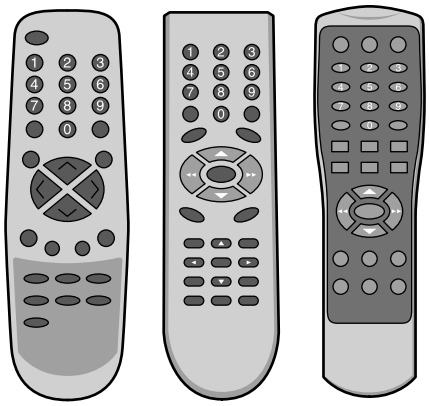
..... **[1]**

[Total: 7]

14 Sanjay uses infrared remote controls for his TV, DVD player and CD player.



(a) The remote control for the TV does not work for the CD player or the DVD player.

What type of infrared signal is used and why does this remote control only operate the TV?

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

(b) Sanjay is worried about the harmful effects of infrared radiation from his remote controls.

He searches the internet and finds the following:

- Infrared is not as harmful as ultraviolet.
- Doctors use infrared lamps to treat sore muscles.
- Industry uses infrared ovens to dry paints, paper and leather.
- Spacecraft have gold film on the windows to reflect infrared rays from the Sun. This is very expensive, but it protects astronauts.

Explain why these statements do not provide **scientific** reasons to stop Sanjay worrying.

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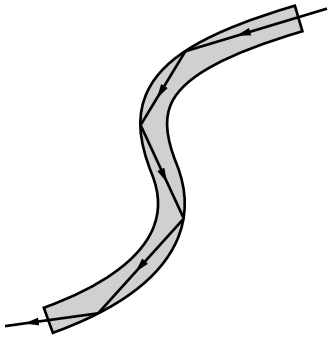
..... **[2]**

[Total: 4]

15 Optical fibres are used for communication.

Light travels along an optical fibre by total internal reflection (TIR) from the sides of the fibre.



Older TV and internet cables are being replaced by optical fibres.

Describe the advantages of using optical fibres for TV and internet signals.

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

[Total: 2]

END OF QUESTION PAPER

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
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						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** 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.