GCSE

WJEC GCSE in

APPLIED SCIENCE (SINGLE AWARD)

APPROVED BY QUALIFICATIONS WALES

SAMPLE ASSESSMENT MATERIALS

Teaching from 2016

This Qualifications Wales regulated qualification is not available to centres in England.

For teaching from 2016
For award from 2018

GCSE APPLIED SCIENCE (Single Award)

SAMPLE ASSESSMENT MATERIALS

Contents

Candidate Name	Centre Number					Candidate Number				
						0				

GCSE

APPLIED SCIENCE (Single Award)

UNIT 1: (Single Award) SCIENCE IN THE MODERN WORLD FOUNDATION TIER

SAMPLE ASSESSMENT MATERIALS

(1 hour 30 minutes)

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**12**	
3.	**8**	
4.	**9**	
5.	**9**	
6.	**14**	
7.	**15**	
Total	**75**	

ADDITIONAL MATERIALS

In addition to this paper you will require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.
Question 7(a) is a quality of extended response (QER) question where your writing skills will be assessed.

*Answer **all** questions*

1. The tables below show tests that can be carried out by a technician.

Tests for negative ions

Negative ion	Solutions added	Results
carbonate	dilute hydrochloric acid	carbon dioxide gas given off
chloride	dilute nitric acid then silver nitrate	white precipitate
iodide	dilute nitric acid then silver nitrate	yellow precipitate
nitrate	iron(II) sulfate then concentrated sulfuric acid	brown ring forms
sulfate	barium chloride	white precipitate

Test for positive ions

Positive ion	Flame test colour
barium	yellow-green
calcium	brick red
copper	green
lead	blue
lithium	red
potassium	lilac
sodium	yellow

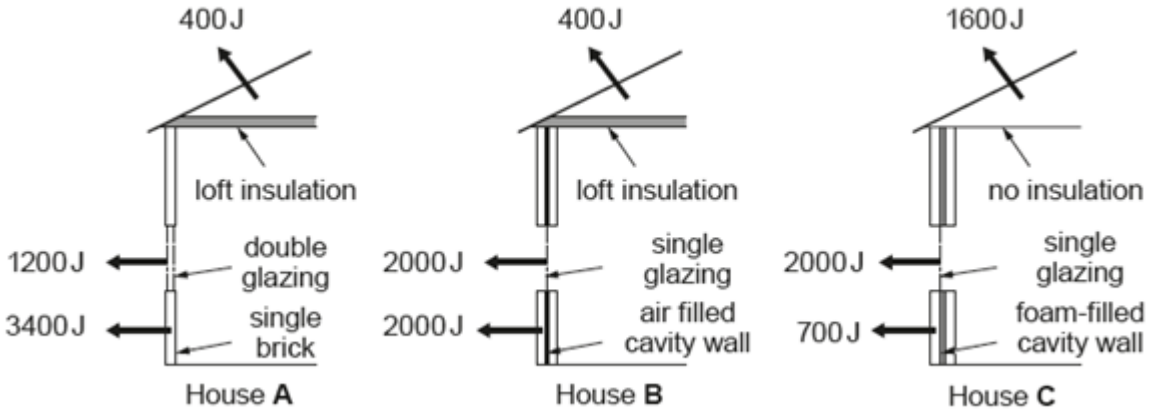
The table below shows the tests carried out by the technician on four compounds, **A, B, C** and **D**, and the results of those tests.

Compound	Test used to identify the positive ion		Test used to identify the negative ion	
	Test using the solid form of compound	**Result**	**Test using a solution of compound**	**Result**
A	Flame test	Lilac coloured flame	Add dilute nitric acid followed by silver nitrate solution	Yellow precipitate
B	Flame test	Red coloured flame	Add dilute hydrochloric acid Bubble gas given off into limewater	Fizzing occurs Gas given off turns limewater milky
C	Add sodium hydroxide solution and warm mixture Test gas given off with damp litmus paper	Pungent smelling gas given off which turns damp red litmus paper blue	Add barium chloride solution	white precipitate
D	Flame test	Yellow coloured flame	Add dilute nitric acid followed by silver nitrate solution	white precipitate

Use the information to complete the table below. [8]

Compound	Positive ion	Negative ion	Name of compound
A	……	iodide	……
B	lithium	……	……
C	ammonium	……	ammonium…….....
D	……	……	……

2. The diagram shows three houses of identical size. None of the houses are fully insulated. It also shows how much heat is lost per second from the windows, walls and roof of each house when there is a temperature difference of 20°C between the inside and the outside.



The cost of each type of insulation is shown in the table below.

Type	**Cost (£)**
Loft	250
Double-glazing	4 000
Cavity wall insulation	1 200

(a) Answer the following questions using the information above.

(i) Arrange the houses **A**, **B** and **C** in order, starting with the one that loses the **least** heat per second. [2]

(space for working)

…… → ……. → ……

least energy lost *most energy lost*

(ii) Determine which type of insulation reduces heat loss by the smallest amount. [1]

(space for working)

……

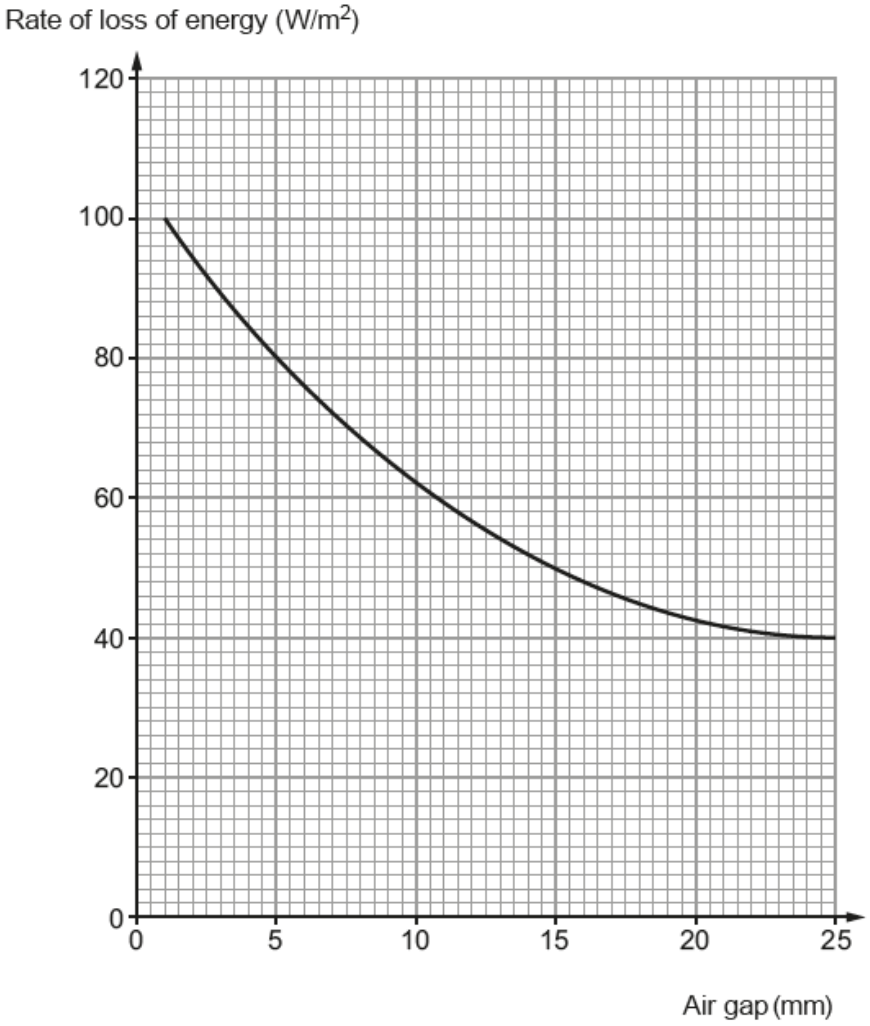
(iii) Which type of insulation would you recommend that homeowners install first? Give **one** reason for your answer. [1]

……

……

(b) The graph below shows the results of an investigation into how heat loss from a double glazed window is affected by the width of the gap between the two panes of glass.

The investigation used a window of area 1 m^2 and kept a temperature difference of 20°C between the inside and the outside.



Refer to the previous information to answer the following questions.

(i) State how the rate of loss of energy changes as the size of the air gap increases. [1]

……..……

(ii) Use the graph to find the rate of loss of energy for an air gap of 15 mm. [1]

……W/m^2

(iii) A flat has a window area of 10 m^2. The air gap used in the windows is 15 mm. There is a 20 °C temperature difference between the inside and outside of the house.

Calculate the rate of loss of energy through the windows of the flat. [2]

rate of loss of energy = …….. W

(c) A heating system uses 2 kW of electrical power to keep a house at constant temperature.

(i) Calculate the units used if the heating runs for 24 h using the equation: [2]

units used = power (kW) x time (h)

units used = ……. kWh

(ii) Calculate the cost of heating the house for 24 h if one unit costs 14 p. [2]

Use the equation:

total cost = cost of one unit x units used

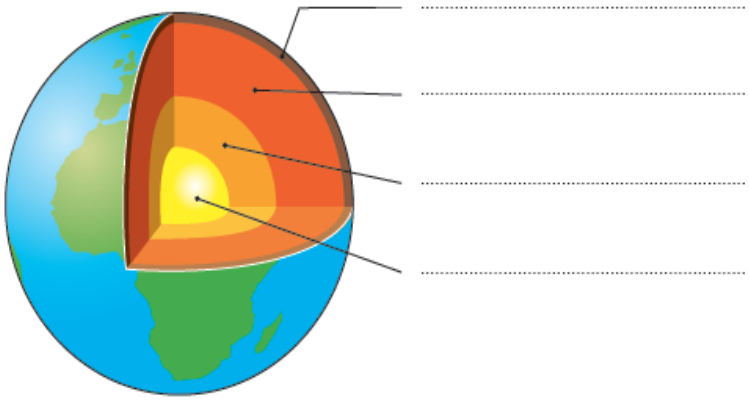
cost = …… p

12

3. The diagram below shows the structure of the Earth.

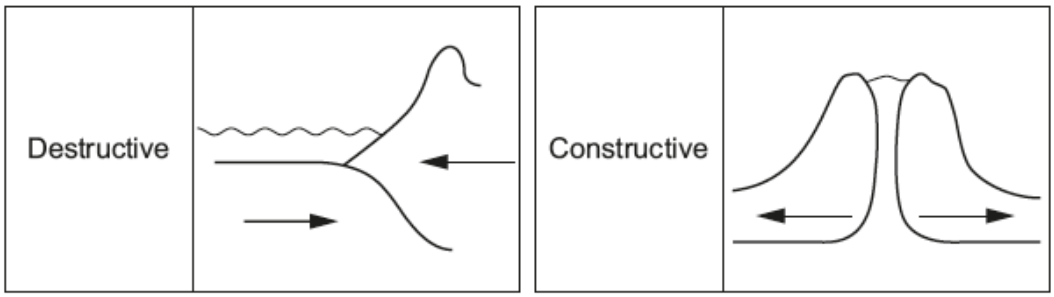
(a) Label the four parts shown using words from the box. [4]

tectonic plate	crust	outer molten core	solid inner core	mantle



(b) The point where two or more tectonic plates meet is known as a plate boundary.

There are four main types of plate boundary. These are conservative, destructive, constructive and collision boundaries. Two of these are shown in the diagrams below.



Complete the sentences below that describe the formation of new rock at each boundary. [4]

At a constructive boundary, …… plates move apart and …… rises to fill the gap.

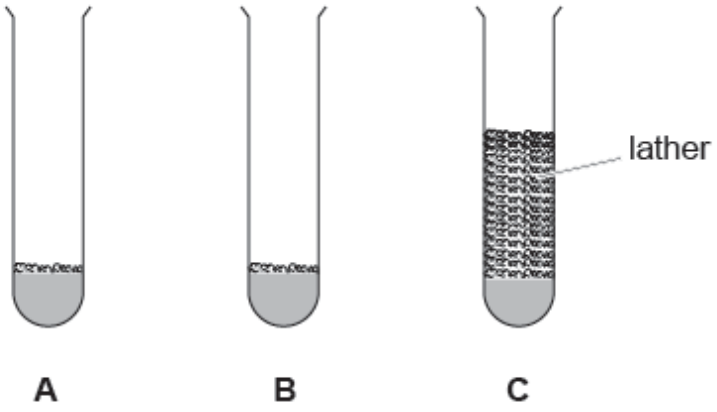
At a destructive boundary, the denser plate is pushed down which melts to form …… . When it cools, …….. rock is formed.

8

4. (a) An investigation was carried out to compare the hardness of three water samples **A**, **B** and **C**.

(i) 1 cm^3 of soap solution was added to 5 cm^3 of **A, B** and **C**.

Each tube was shaken for 1 minute. The results are shown in the diagram below.



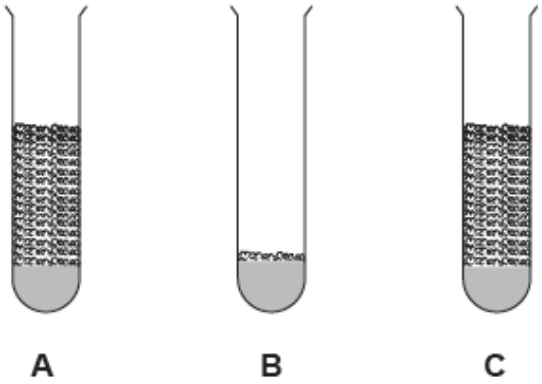
State which of the samples contain hard water. Give **one** reason for your answer. [2]

……

……

(ii) The hardness of water can be described as temporary or permanent. Temporary hardness can be softened by boiling.

1 cm^3 of soap solution was added to 5 cm^3 of boiled samples of **A**, **B** and **C**. Each tube was shaken for 1 minute. The results are shown below.

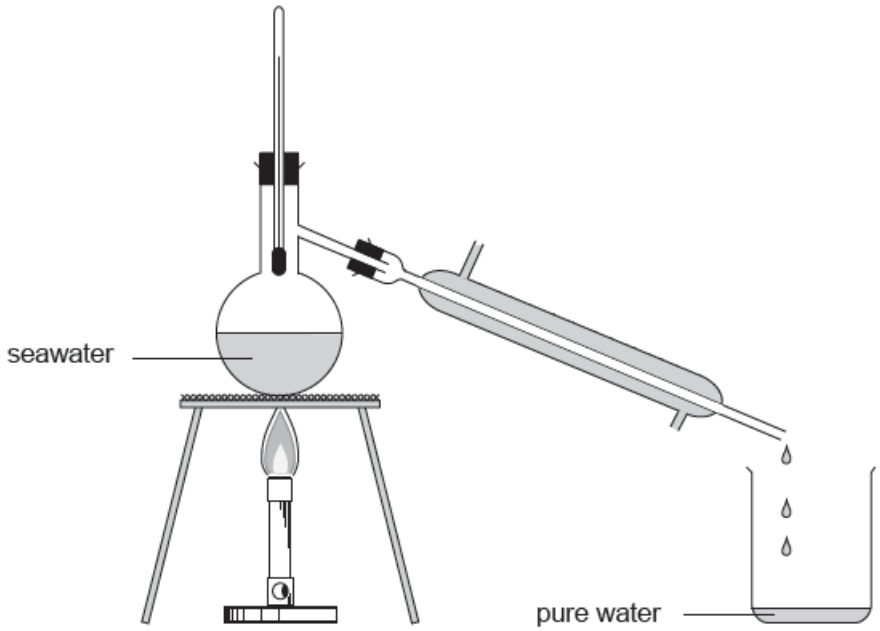


State what these results tell you about samples **A**, **B** and **C**. Include your reasoning. [2]

……

……

(b) The diagram below shows apparatus that can be used to obtain pure water from seawater.



(i) Describe how pure water is separated from seawater. [3]

……

……

……

……

(ii) Some of the water collected in the beaker above was placed in a test tube. Suggest what you would observe if soap solution was added and the test tube shaken for 1 minute. Give **one** reason for your answer. [2]

……

……

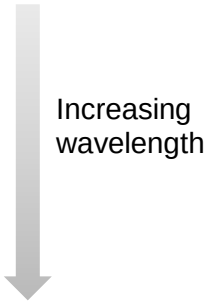
……

9

5. Infra-red (I-R) radiation from the Sun travels through space at a speed of 3×10^8 m/s (300 000 000 m/s).
I-R radiation is one part of the electromagnetic (em) spectrum. Other regions of the em spectrum include **visible light, ultraviolet, radio waves** and **microwaves**.

(a) (i) Complete the **first column only** to show the missing regions of the em spectrum in order of increasing wavelength. [2]

Region of em spectrum	**Typical wavelength (m)**
visible light	……
I-R	4×10^{-6} (0.000004)
……	……
……	……



(ii) Typical wavelengths (in metres) for each region of the em spectrum are listed below in a random order.

0.02	5×10^{-7} (0.0000005)	600

Use these values to complete the wavelength column in the table. [2]

(iii) State the speed of visible light through space. [1]

…….....…m/s

(iv) State which region of the em spectrum, **in the table**, has the highest frequency. [1]

…….

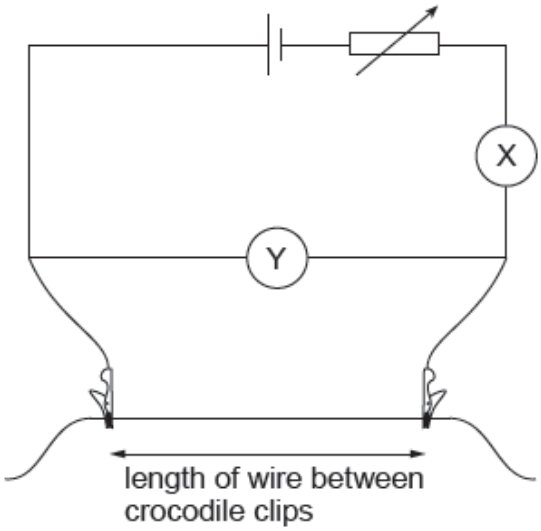
(b) Using the wavelengths above, calculate the lowest frequency of radiation that arrives at Earth, using the equation: [3]

$$\text{frequency} = \frac{\text{wave speed}}{\text{wavelength}}$$

frequency = …… Hz

9

6. The circuit shown is used to investigate how the current changes for different lengths of a wire. Each wire has the same thickness and is made from the same material.



The results from the experiment are displayed.

Length of wire (cm)	Voltage (V)	Current (A)
10	1.80	0.90
20	1.80	0.45
30	1.80	0.30
50	1.80	0.18
60	1.80	0.15
75	1.80	0.12

(i) The student carrying out the experiment cannot say if these results are repeatable. Explain what she should do to enable her to judge the repeatability of her data. [2]

……

……

……

(ii) The student correctly suggests that the resistance of the wire is directly proportional to its length. Explain how the results in the table agree with this statement. [3]

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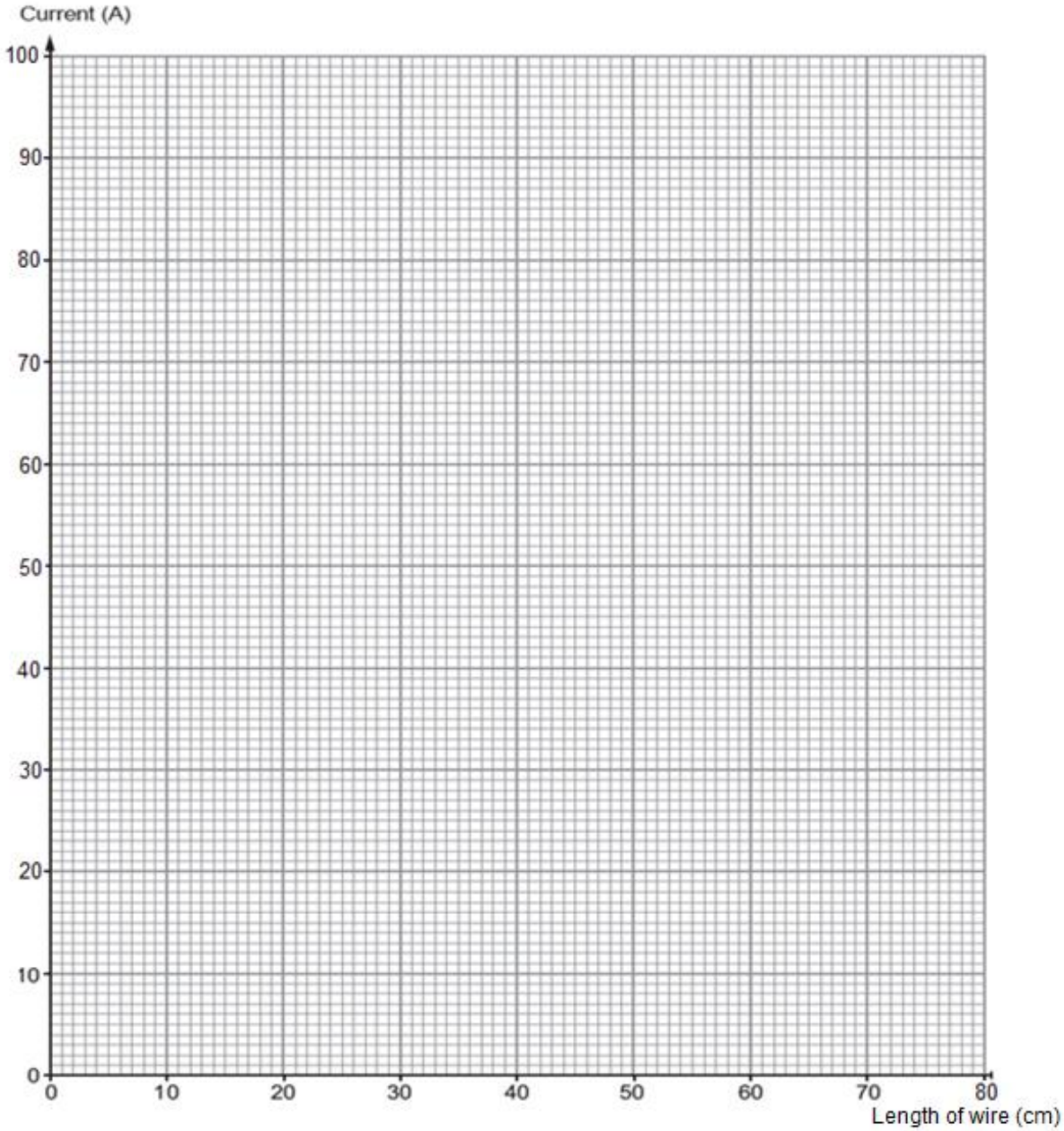
(iii) Use the data to plot a graph on the grid below [3]



(iv) Describe the relationship between the length of the wire and the current. [2]

……

……

……

……

(v) The wire used in the experiment had been labelled by the science technician as 0.2 Ω/cm.

Using the results for a wire of length 10 cm and the equation R= V/I, explain if your results agree with the information on the label. [4]

……

……

……

……

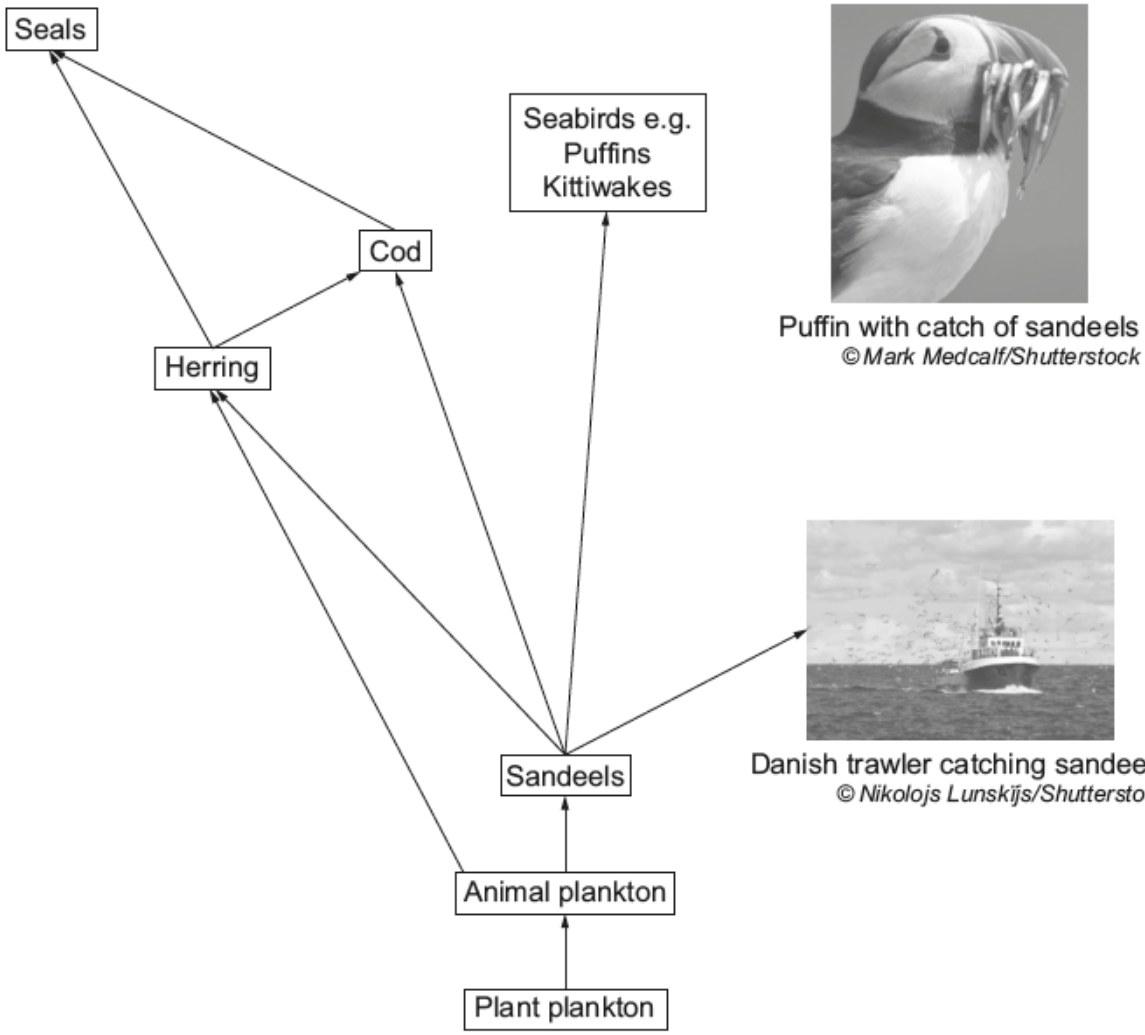
14

7. Many of the UK's 4 million seabirds of the North Sea are at risk because there are not enough sandeels for them to feed on.

Key facts about the North Sea

- herring stocks are increasing after years of decline.
- many of the puffins and kittiwakes are feeding their young on thin, starving sandeels.
- there are many trawlers in the North Sea fishing for sandeels. Sandeels are turned into fishmeal which is used to feed livestock and farmed salmon.
- sea surface temperatures have risen by 2 ºC in the last 25 years. This is causing a decrease in the quantity of plant plankton available.

The diagram below shows a small part of the North Sea food web.



Puffin with catch of sandeels
© Mark Medcalf/Shutterstock

Danish trawler catching sandeels
© Nikolojs Lunskijs/Shutterstock

(a) Using the information in the diagram and the key facts explain the effect of global warming on the food web. [6 QER]

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(b) (i) Read the statements below and place a tick (✓) next to each correct statement about this North Sea food web. [3]

Animal plankton are the producers ☐

Herring are primary consumers ☐

Cod are carnivores ☐

Sandeels are herbivores ☐

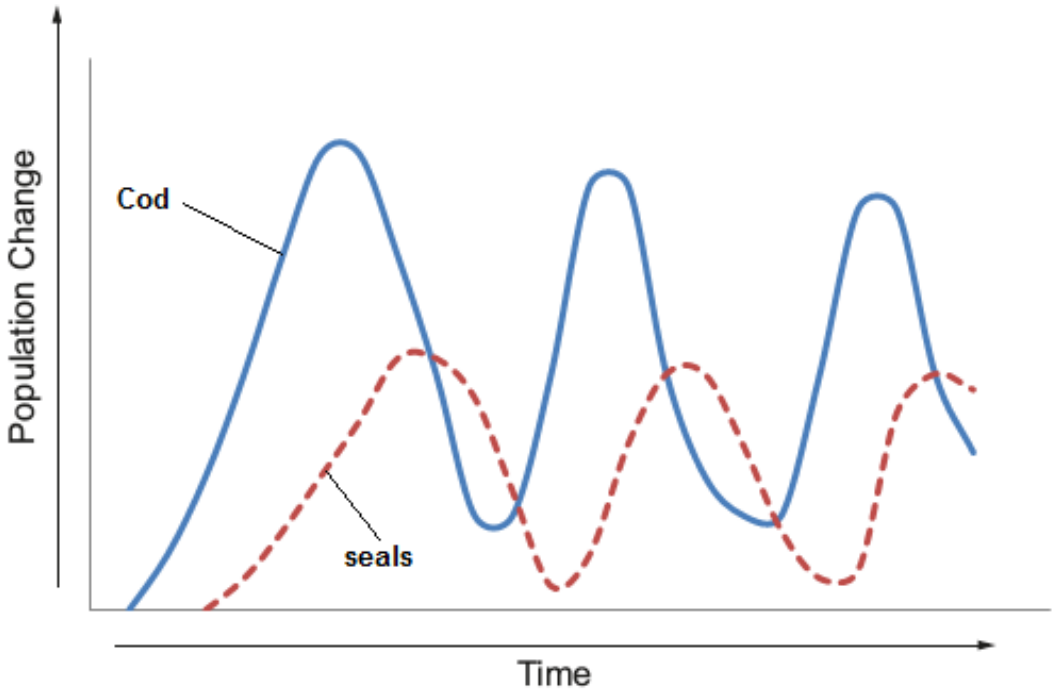
Seals have no predators ☐

Cod are tertiary consumers ☐

(ii) Construct and label a pyramid of numbers for the food chain below: [3]

plant plankton → animal plankton → herring → cod → seals

(iii) The population of cod and seals changes according to a typical predator prey relationship as shown in the graph.



Explain why the population change of seals lags behind that of the cod. [3]

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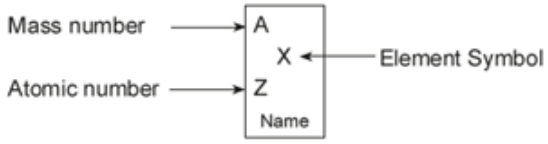
15

END OF PAPER

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulfur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key:



UNIT 1: (Single Award) SCIENCE IN THE MODERN WORLD
FOUNDATION TIER

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td></td><td></td><td></td><td>1 mark for each correct answer (shown in bold)

<table><tr><th>Compound sample</th><th>Positive ion</th><th>Negative ion</th><th>Name of compound</th></tr><tr><td>A</td><td>potassium</td><td>iodide</td><td>potassium iodide</td></tr><tr><td>B</td><td>lithium</td><td>carbonate</td><td>lithium carbonate</td></tr><tr><td>C</td><td>Ammonium</td><td>sulfate</td><td>Ammonium sulfate</td></tr><tr><td>D</td><td>sodium</td><td>chloride</td><td>Sodium chloride</td></tr></table>
Allow: sulphate instead of sulfate
Row D max of 2 marks</td><td></td><td>8</td><td></td><td>8</td><td></td><td>8</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 1 total</td><td>0</td><td>8</td><td>0</td><td>8</td><td>0</td><td>8</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		**C → B → A** All correct – 2 marks One correct – 1 mark			2	2	2	
		(ii)		Double-glazing			1	1	1	
		(iii)		Loft insulation is the cheapest to install			1	1	1	
	(b)	(i)		The (rate of) energy loss decreases		1		1	1	
		(ii)		Reading from graph of 50 (W/m.)		1		1	1	
		(iii)		50 x 10 (1) = 500 W (1) (correct answer only - 500 W (2))		2		2	2	
	(c)	(i)		units used = 2 x 24 (1) = 48 kWh (1)	1	1		2	2	
		(ii)		cost = 48 (ecf) x 14 (1) = 672 p (1)	1	1		2	2	
				Question 2 total	**2**	**6**	**4**	**12**	**12**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			1 mark for each correct label: crust mantle outer molten core solid inner core	4			4		
	(b)			tectonic (1) magma (1) magma (1) igneous (1)	4			4		
				Question 3 total	**8**	**0**	**0**	**8**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		**A** and **B** - both needed (1) little / poor / no lather (1) second mark alone may be awarded if only **A** *or* **B** given	2			2		2
		(ii)		**A** is temporary hard water and **B** is permanent (1) **any 1 x (1) from**: • temporary is softened by boiling • permanent is not softened by boiling • temporary forms lather after boiling • permanent doesn't form lather after boiling	1	1		2		2
	(b)	(i)		Water boils and steam enters condenser (1) Salt remains in flask (1) Steam condenses back into water (1)	3			3		3
		(ii)		a lot of lather / froth / bubbles / foam (1) **any 1 x (1) from:** • (pure water) contains no dissolved solids • (pure water) contains no Ca^{2+} • (pure water) contains no Mg^{2+}			2	2		2
				Question 4 total	**6**	**1**	**2**	**9**	**0**	**9**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>5</td><td>(a)</td><td>(i)</td><td></td><td>microwaves (1)
radio waves (1)</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td><table><tr><th>Region of em spectrum</th><th>Wavelength (m)</th></tr><tr><td></td><td>5 x 10⁻⁷ (0.0000005)</td></tr><tr><td></td><td></td></tr><tr><td></td><td>0.02</td></tr><tr><td></td><td>600</td></tr></table>All correct – 2 marks
1 or 2 correct – 1 mark</td><td>2</td><td></td><td></td><td>2</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>3 x 10⁸ / 300 000 000 m/s</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iv)</td><td></td><td>Visible light</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>Use of 600 m (1)
Substitution 300 000 000/600 (1)
= 500 000 or 5 x 10⁵ Hz (1)</td><td>1</td><td>1

1</td><td></td><td>3</td><td>3</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 5 total</td><td>6</td><td>3</td><td>0</td><td>9</td><td>5</td><td>0</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6		(i)		Repeat the experiment / gather more data (1) and if the current values or results are close to the first set of readings (the results are repeatable) (1)	2			2		2
		(ii)		As the length doubles the current is halved (1) V is constant (1) so the resistance doubles (1) **Alternative solution:** For a length of e.g. 10 cm, R = 2 Ω (1) and for a length of e.g. 30 cm, R = 6 Ω (1) therefore tripling l, triples R (1)			3	3	3	
		(iii)		All points plotted within ± small square division (2) (five correctly plotted points (1)) Curved line of best fit ± one small square division of each point within the range 20 - 75 cm (1)		3		3	3	3
		(iv)		inversely (1) proportional (1) **Note the following responses:** As the length increases current decreases (1) If length doubles, current is halved (2) Decreases at a decreasing rate (1)		2		2		
		(v)		R = 1.8/0.9 (1) = 2 Ω (1) 2/10 (1) = 0.2 Ω/cm which agrees with the table (1) ***or*** 10 x 0.2 (1) = 2 Ω (1) 2 x 0.9 (1) = 1.8 V which agrees with the table (1)			4	4	3	
				Question 6 total	**2**	**5**	**7**	**14**	**9**	**5**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			**Indicative content**: Rise in sea temp (global warming) is affecting plant plankton distribution or numbers. This causes a reduction in animal plankton. Therefore sandeels do not have enough food / animal plankton so their numbers decrease. There is not enough food for birds, cod or herring. As a result their numbers will decline. Herring will decline quicker than cod since cod will feed on herring instead of sandeels. Finally, food sources for seals will decline so their numbers reduce also. **5 – 6 marks** Detailed description of effects on prey and predators linked with consequential effects on seals and birds. *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3 – 4 marks** Detailed description of some effects on direct prey and predator relationships and the consequences. *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1-2 marks** A basic description of some effects is given. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.*		4	2	6		

				0 marks *No attempt made or no response worthy of credit.*						

7	(b)	(i)		Ticks in boxes 3, 5 and 6 (3) If all boxes ticked – (0) If 5 boxes then maximum of (1) If 4 boxes ticked then maximum of (2)	3			3		
		(ii)		Pyramid shape for top three layers (1) Narrow box at bottom (1) Correctly labeled (1)		3		3		
		(iii)		If the population of cod increases, there will be more food so seal population will increase. (1) As the population of seals increases more food is needed so eventually the population of cod will decrease. (1) Less food for the seals so their population falls again (1)	3			3		
				Question 7 total	**6**	**7**	**2**	**15**	**0**	**0**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	0	8	0	8	0	8
2	2	6	4	12	12	0
3	8	0	0	8	0	0
4	6	1	2	9	0	9
5	6	3	0	9	5	0
6	2	5	7	14	9	5
7	6	7	2	15	0	0
TOTAL	30	30	15	75	26	22

Candidate Name	Centre Number					Candidate Number				
						0				

GCSE

APPLIED SCIENCE (Single Award)

UNIT 1: (Single Award) SCIENCE IN THE MODERN WORLD
HIGHER TIER

SAMPLE ASSESSMENT MATERIALS

(1 hour 30 minutes)

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**12**	
2.	**15**	
3.	**8**	
4.	**14**	
5.	**9**	
6.	**9**	
7.	**8**	
Total	**75**	

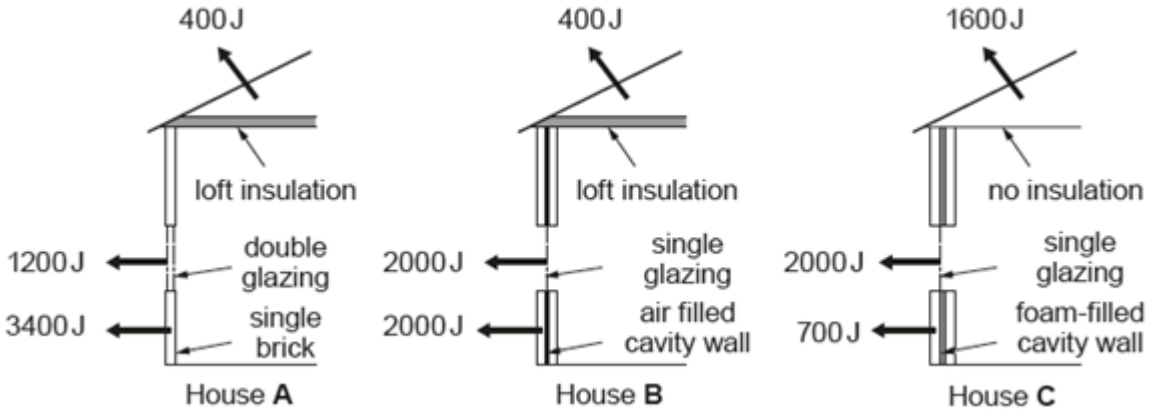
ADDITIONAL MATERIALS
In addition to this paper you will require a calculator.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES
The number of marks is given in brackets at the end of each question or part-question.
Question 2(b) is a quality of extended response (QER) question where your writing skills will be assessed.

Answer **all** *questions*

1. The diagram shows three houses of identical size. None of the houses are fully insulated. It also shows how much heat is lost per second from the windows, walls and roof of each house when there is a temperature difference of 20 °C between the inside and the outside.

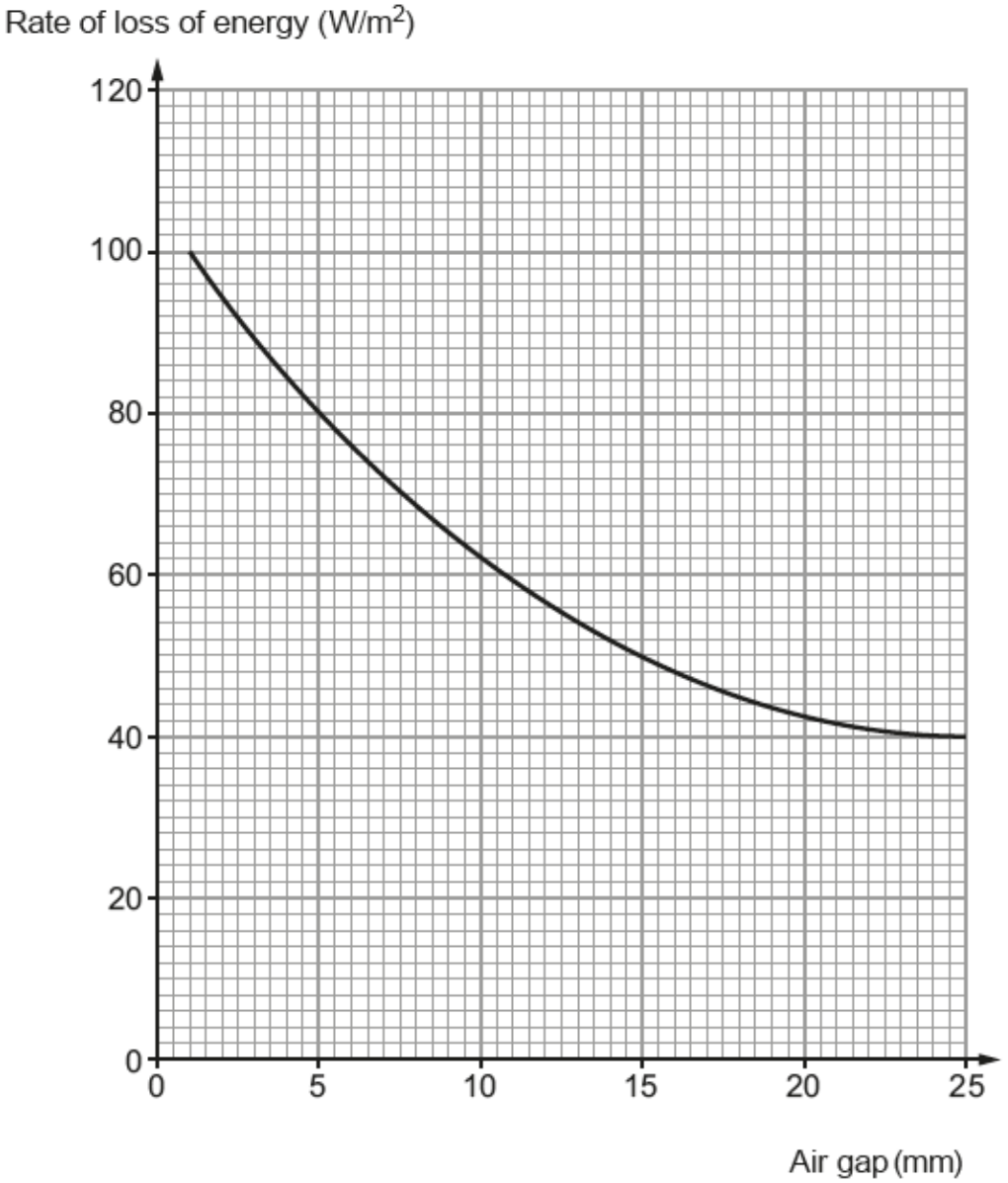


The cost of each type of insulation is shown in the table below.

Type	**Cost (£)**
Loft	250
Double-glazing	4000
Cavity wall insulation	1200

The graph on the next page shows the results of an investigation into how heat loss from a double glazed window is affected by the width of the gap between the two panes of glass.

The investigation used a window of area 1 m^2 and kept a temperature difference of 20°C between the inside and the outside.



(a) Compare the cost effectiveness of loft insulation, double-glazing and cavity wall insulation to determine which is the most effective. [4]

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(b) Refer to the information about double-glazing and the graph to answer the following questions.

(i) I Describe how the rate of loss of energy is related to the size of the air gap. [1]

……..

II Give **one** reason why makers of double-glazing are unlikely to use an air gap larger than 20 mm. [1]

……..……..

(ii) A house has a window area of 24 m^2. The air gap used in the windows is 15 mm. There is a 20 °C temperature difference between the inside and outside of the house.

Calculate the rate of loss of energy through the windows of the house. [2]

rate of loss of energy = ……W

(c) A heating system uses 2000 W of electrical power to keep a house at constant temperature. Calculate the cost of using the heating for 24 h. Include the unit in your answer. [4]

One unit of electricity costs 14p.

Use the equations:

units used = power (kW) x time (h)

total cost = cost of one unit x units used

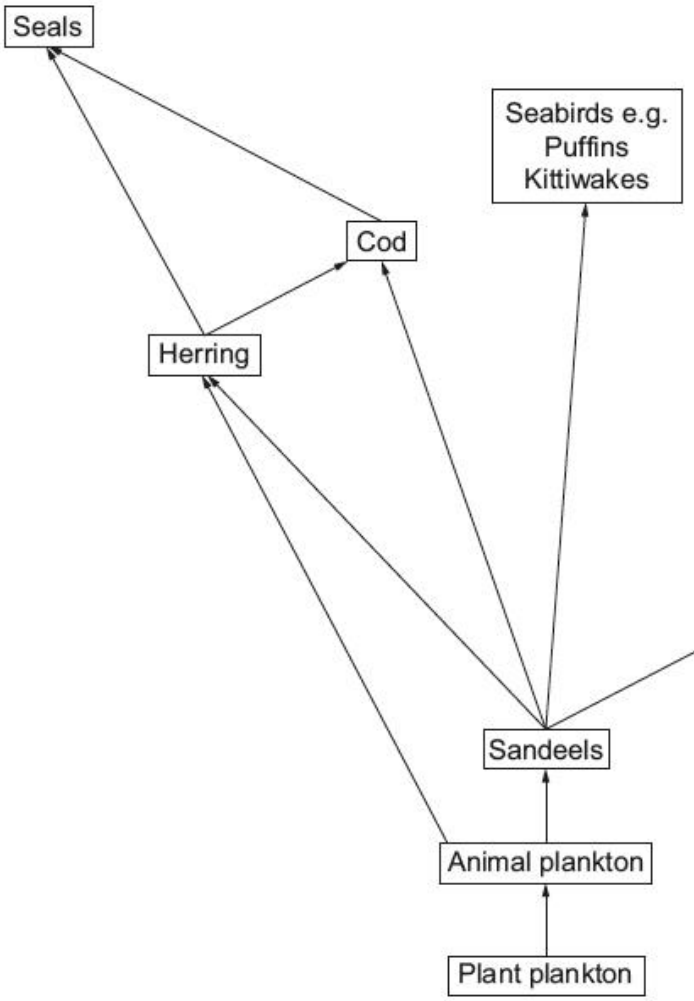
cost = ……

2. Many of the UK's 4 million seabirds of the North Sea are at risk because there are not enough sandeels for them to feed on.

Key facts about the North Sea

- herring stocks are increasing after years of decline.
- many of the puffins and kittiwakes are feeding their young on thin, starving sandeels.
- there are many trawlers in the North Sea fishing for sandeels. Sandeels are turned into fishmeal which is used to feed livestock and farmed salmon.
- sea surface temperatures have risen by 2 ºC in the last 25 years. This is causing a decrease in the quantity of plant plankton available.

The diagram below shows a small part of the North Sea food web.



Puffin with catch of sandeels
© Mark Medcalf/Shutterstock

Danish trawler catching sandeels
© Nikolojs Lunskijs/Shutterstock

(a) (i) Read the statements below. Place a tick (✓) next to each statement that is correct for this North Sea food web. [3]

Animal plankton are the producers ☐

Herring are primary consumers ☐

Cod are carnivores ☐

Sandeels are herbivores ☐

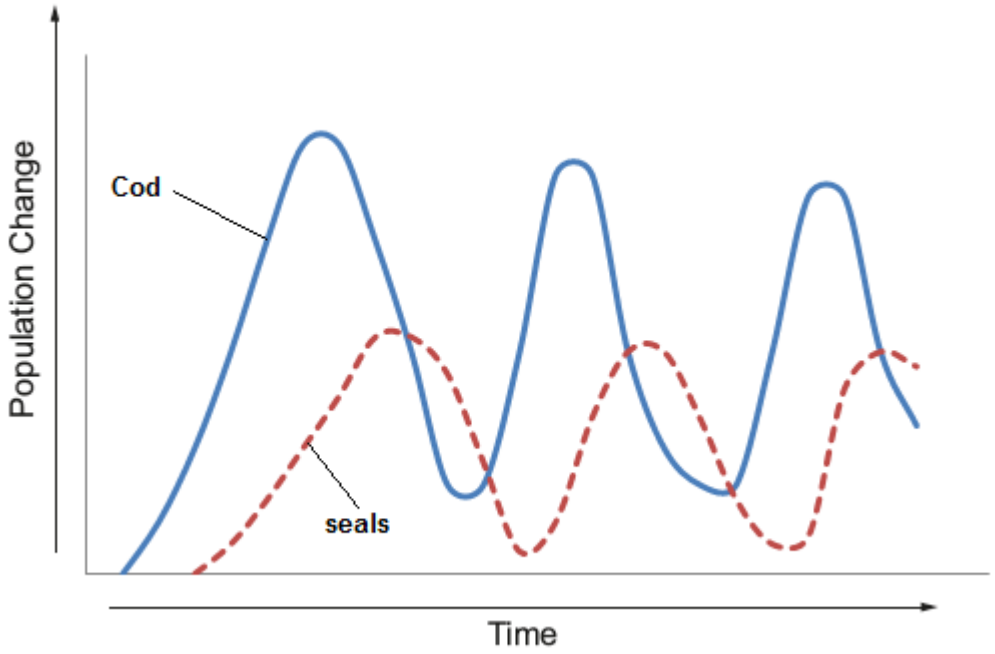
Seals have no predators ☐

Cod are tertiary consumers ☐

(ii) Construct and label a pyramid of numbers for the food chain below. [3]

plant plankton → animal plankton → herring → cod → seals

(iii) The population of cod and seals changes according to a typical predator prey relationship as shown in the graph.



Explain why the population change of seals lags behind that of the cod. [3]

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……

(b) Using the information in the food web and the key facts explain why the North Sea puffin and kittiwake populations are being affected. [6 QER]

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15

3. The tables below show tests that can be carried out by a technician.

Tests for negative ions

Negative ion	Symbol	Solutions added	Results
carbonate	CO_3^{2-}	dilute hydrochloric acid	carbon dioxide gas given off
chloride	Cl^-	dilute nitric acid then silver nitrate	white precipitate
iodide	I^-	dilute nitric acid then silver nitrate	yellow precipitate
nitrate	NO_3^-	iron(II) sulfate then concentrated sulfuric acid	brown ring forms
sulfate	SO_4^{2-}	barium chloride	white precipitate

Test for positive ions

Positive ion	Symbol	Flame test colour
barium	Ba^{2+}	yellow-green
calcium	Ca^{2+}	brick red
copper	Cu^{2+}	green
lead	Pb^{2+}	blue
lithium	Li^+	red
potassium	K^+	lilac
sodium	Na^+	yellow
ammonium	NH_4^+	no colour

The table below shows the tests carried out by the technician on four compounds, **A, B, C** and **D**, and the results of those tests.

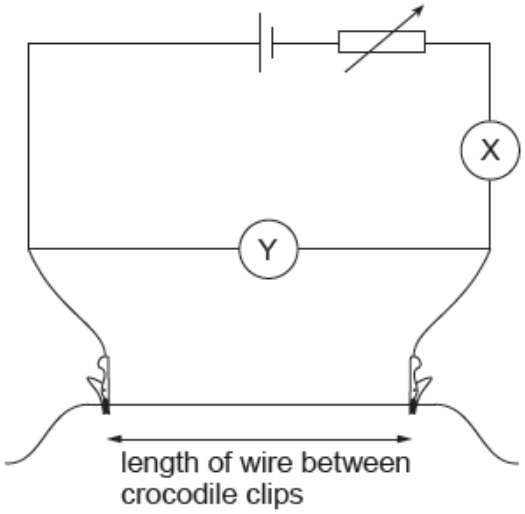
Compound	Test used to identify the positive ion		Test used to identify the negative ion	
	Test using the solid form of compound	**Result**	**Test using a solution of compound**	**Result**
A	Flame test	Lilac coloured flame	Add dilute nitric acid followed by silver nitrate solution	Yellow precipitate
B	Flame test	Red coloured flame	Add dilute hydrochloric acid Bubble gas given off into limewater	Fizzing occurs Gas given off turns limewater milky
C	Add sodium hydroxide solution and warm mixture. Test gas given off with damp litmus paper	Pungent smelling gas given off which turns damp red litmus paper blue	Add barium chloride solution	white precipitate
D	Flame test	Yellow coloured flame	Add dilute nitric acid followed by silver nitrate solution	white precipitate

Use the information to complete the table below [8]

Compound	Name of compound	Chemical formula
A	……	……
B	……	……
C	ammonium ……..	……
D	……	……

8

4. The circuit shown is used to investigate how the current changes for different lengths of a wire. Each wire has the same thickness and is made from the same material.



The results from the experiment are displayed.

Length of wire (cm)	Voltage (V)	Current (A)
10	1.80	0.90
20	1.80	0.45
30	1.80	0.30
50	1.80	0.18
60	1.80	0.15
75	1.80	0.12

(i) The student carrying out the experiment cannot say if these results are repeatable. Explain what she should do to enable her to judge the repeatability of her data. [2]

……

……

……

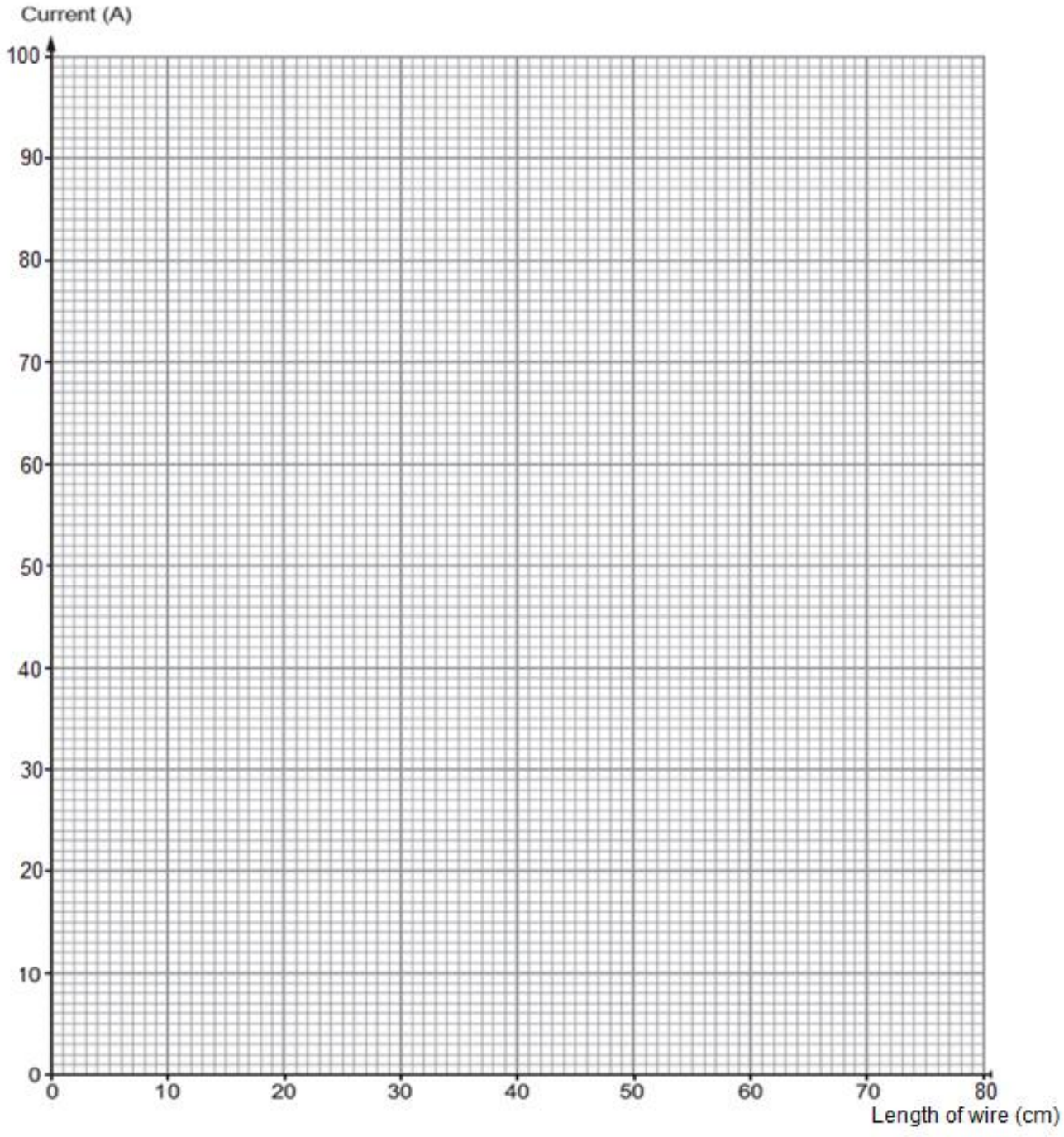
(ii) The student correctly suggests that the resistance of the wire is directly proportional to its length. Explain how the results in the table agree with this statement. [3]

……

……

……

(iii) Plot the data on the grid below and draw a suitable line. [3]



(iv) Describe the relationship between the length of the wire and the current. [2]

……

……

……

(v) The wire used in the experiment had been labelled by the science technician as 0.2 Ω/cm. Explain if the results for a 45 cm length of wire agree with the information on the label. s[4]

You should use your graph and the equation V = IR to answer this question.

……

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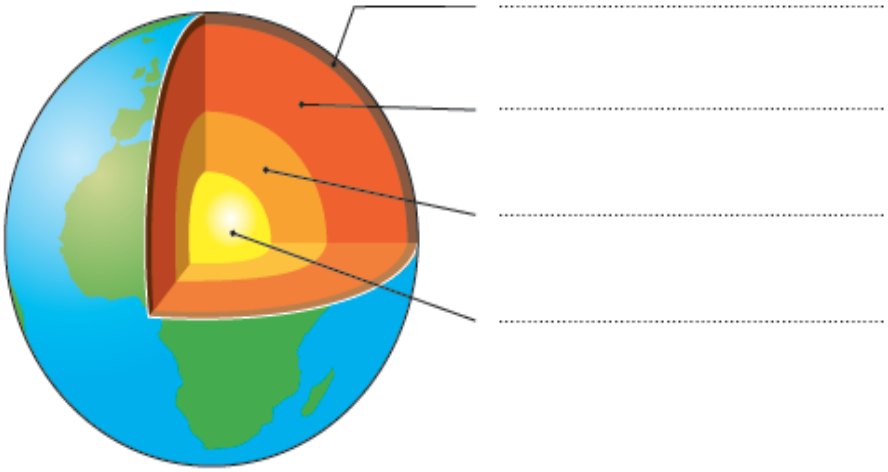
14

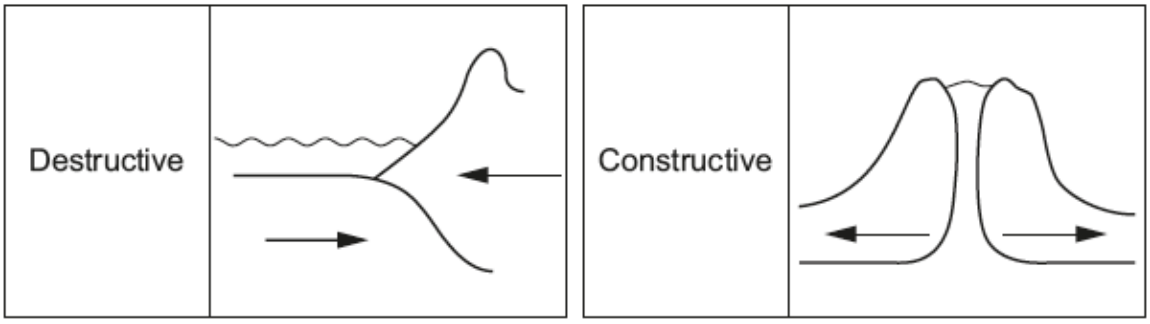
5. The diagram below shows the structure of the Earth.

(a) Label the four parts shown. [4]



(b) The point where two or more tectonic plates meet is known as a plate boundary.

There are four main types of plate boundary. These are conservative, destructive, constructive and collision boundaries. Two of these are shown in the diagrams below.



Describe the formation of new rock at each boundary.

(i) Destructive [3]

……

……

……

(ii) Constructive [2]

……

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……

9

6. The table below shows the volume of soap solution required by different samples of water to form a permanent lather. In each case 25 cm^3 of the water samples were used and the soap solution was added 1 cm^3 at a time.

	Volume of soap solution added (cm^3)				
Sample	**Test 1**	**Test 2**	**Test 3**	**Test 4**	**Mean**
distilled water	2	2	2	2	2
A	8	8	9	7	8
B	11	18	12	13	
C	15	14	14	13	14
A after boiling	8	7	9	8	8
B after boiling	6	5	6	7	6
C after boiling	2	2	2	2	2

(a) (i) Two pupils, Gareth and Helen, calculated the mean value for sample **B**. Gareth calculated a value of 13.5 and Helen calculated a value of 12.

Explain why the mean calculated by Helen is the better value to use. [3]

……

……

……

……

(ii) State which of water samples **A**, **B** or **C** is the least hard. [1]

water sample ……

(b) State the cause of hardness in water and distinguish between temporary and permanent hardness. [3]

……

……

……

(c) Describe the problems caused by hard water on household water systems. [2]

……

……

……

9

7. The wavelength of the infra-red (I-R) radiation from the Sun ranges from 2×10^{-7} to 4×10^{-6} m. I-R radiation travels through space at a speed of 3×10^{8} m/s.

(a) Calculate the highest frequency of I-R radiation that arrives at Earth, using the equation: [4]

wave speed = frequency x wavelength

frequency = …… Hz

(b) (i) I-R radiation is one part of the electromagnetic (em) spectrum.

Complete the first column only to show the missing regions of the em spectrum in order of decreasing frequency. [2]

Region of em spectrum	**Typical wavelength (m)**
visible light	……
I-R	4×10^{-6}
……	……
……	……

Highest frequency

Lowest frequency

(ii) Typical wavelengths (in meters) for each region of the em spectrum are listed below in a random order.

4×10^{-2}	5×10^{-7}	1.5

Use these values to complete the wavelength column in the table. [2]

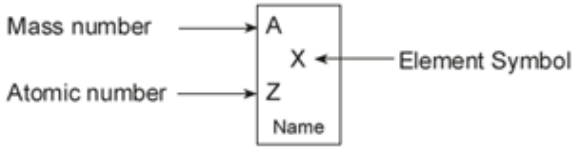
8

END OF PAPER

PERIODIC TABLE OF ELEMENTS

1	2											3	4	5	6	7	0
											$^{1}_{1}$H Hydrogen						$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulfur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key:



UNIT 1: (Single Award) SCIENCE IN THE MODERN WORLD
HIGHER TIER

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

Question				Marking details	Marks Available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
1	(a)			The loft saves 1200 J/s and double-glazing saves 800 J/s. Cavity wall insulation saves 1 000 J/s (2) All three correct (2), Two correct (1) Loft insulation is the cheapest to install (1) Therefore installing loft insulation saves most money and has the shortest payback time (1)			4	4		
	(b)	(i)		I The larger the air gap the lower the (rate of) energy loss (1) II (After 20mm), not much increase in saving (1)		1	1	2		
		(ii)		Reading from graph of 50 (W/m) (1) 50 x 24 = 1 200 W (1) (correct answer only - 1 200 W (2))		2		2	2	
	(c)			Convert 2 000 W to 2 kW (1) Units used = 2 x 24 = 48 (subs) (1) Cost = 48 (ecf) x 14 = 672 (subs) (1) Either 672 p OR £6.72 (1)	2	1 1		4	4	
				Question 1 total	**2**	**5**	**5**	**12**	**6**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Ticks in boxes 3, 5 and 6 (3) If all boxes ticked (0) If 5 boxes then maximum of (1) If 4 boxes ticked then maximum of (2)	3			3		
		(ii)		Pyramid shape for top three layers (1) Narrow box at bottom (1) Correctly labeled.(1)		3		3		
		(iii)		If the population of cod increases, there will be more food so seal population will increase. (1) As the population of seals increases more food is needed so eventually the population of cod will decrease. (1) Less food for the seals so their population falls again (1)	3			3		
	(b)			**Indicative content:** Herring compete with birds for sandeels. Herring population is increasing so this leads to a reduction in the number of sandeels. In addition trawlers are catching large numbers of sandeels Rise in sea temp (global warming) is affecting plant plankton distribution or numbers. Therefore sandeels do not have enough food / animal plankton. All these factors are diminishing the sandeel population so there is not enough food for birds. As a result their numbers will decline. **5 – 6 marks** Detailed description of effects on prey and predators linked with consequential effects on the birds. *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3 – 4 marks** Detailed description of some effects on direct prey and predator relationships and the consequence on the birds. *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.*		3	3	6		

				1 – 2 marks A basic description of some effects is given. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure*. *The candidate used limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** *No attempt made or no response worthy of credit*						
				Question 2 total	**6**	**6**	**3**	**15**	**0**	**0**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>3</td><td></td><td></td><td></td><td>(1) for each correct point
Correct answers shown in bold.

<table><tr><th>Compound sample</th><th>Name of compound</th><th>Chemical formula</th></tr><tr><td>A</td><td>potassium iodide</td><td>KI</td></tr><tr><td>B</td><td>lithium carbonate</td><td>Li_2CO_3</td></tr><tr><td>C</td><td>ammonium sulfate</td><td>$(NH_4)_2SO_4$</td></tr><tr><td>D</td><td>sodium chloride</td><td>NaCl</td></tr></table></td><td></td><td>8</td><td></td><td>8</td><td></td><td>8</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 3 total</td><td>0</td><td>8</td><td>0</td><td>8</td><td>0</td><td>8</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4		(i)		Repeat the experiment / gather more data (1) and if the current values or results are close to the first set of readings (the results are repeatable) (1)	2			2		2
		(ii)		As the length doubles the current is halved (1) V is constant (1) so the resistance doubles (1) **Alternative solution:** For a length of e.g. 10 cm, R = 2 Ω(1) and for a length of e.g. 30 cm, R = 6 Ω _(1) therefore tripling l, triples R (1)			3	3	3	
		(iii)		Points plotted within ± 1 small square division (2-all correct, 1 five correct) Curved line of best fit ± 1 one small square division of each point within the range 20 - 75 cm (1)		3		3	3	3
		(iv)		inversely (1) proportional (1) **Note the following responses:** As the length increases current decreases (1) If length doubles, current is halved (2) Decreases at a decreasing rate (1)		2		2		
		(v)		0.2 A identified from the graph (1) will be dependent on their graph line $R = \frac{V}{I} = \frac{1.8}{0.2} = 9\ \Omega$ (1) ecf on 0.2A (1) So $\frac{9}{45}$ = 0.2 Ω/cm (1) ecf on 9 Ω (1) Yes or No must be consistent with their answer (1) **Alternative solution:** $V = 0.2$(1) x 0.2 = 0.04 V cm^{-1} (1) 0.04 x 45 cm = 1.8 V (1) So correct V (1) **Alternative solution:** *R* = 0.2 (1) x 45 = 9 Ω(1) $I = \frac{V}{R} = \frac{1.8}{9} = 0.2\ A$ (1) So correct value for I (1)			4	4	3	
				Question 4 total	**2**	**5**	**7**	**14**	**9**	**5**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			1 mark for each correct label: crust mantle outer molten core inner solid/iron core	4			4		
	(b)	(i)		The denser plate is driven down (1) Which melts to form magma (1) Then cools forming igneous rock (1)	3			3		
		(ii)		Magma rises to fill the gap formed as plates move apart (1) Cooling to form igneous rock (1)	2			2		
				Question 5 total	**9**	**0**	**0**	**9**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
6	(a)	(i)		Gareth took a mean of all four values (54 ÷ 4 = 13.5) (1) Helen took a mean of three values, with indication which three were selected (1) Helen's value is better as she used repeatable values only / discarded the value that appears to be anomalous (1)		3		3		3
		(ii)		**A**		1		1		
	(b)			Cause: the presence of calcium and magnesium ions in water(1) in permanent hardness some ions removed by boiling but some remain (1) in temporary hardness ions are removed by boiling (1)	3			3		
	(c)			Lime scale blocks pipes (1) Damages boilers (1)	2			2		
				Question 6 total	**5**	**4**	**0**	**9**	**0**	**3**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td></td><td>Use of 2 x 10^{-7} m (1)
Substitution (1)
Manipulation 3 x 10^{8}/2 x 10^{-7} (1)
Answer = 1.5 x 10^{15} Hz (1)
An answer of 7.5 x 10^{13} earns 3 marks</td><td>2</td><td>2</td><td></td><td>4</td><td>4</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>microwaves (1)
radio waves (1)</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td><table><tr><th>Region of em spectrum</th><th>Typical Wavelength (m)</th></tr><tr><td></td><td>5 x 10^{-7}</td></tr><tr><td></td><td></td></tr><tr><td></td><td>4 x 10^{-2}</td></tr><tr><td></td><td>1.5</td></tr></table>All correct – 2 marks
1 or 2 correct – 1 mark</td><td>2</td><td></td><td></td><td>2</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 7 total</td><td>6</td><td>2</td><td>0</td><td>8</td><td>6</td><td>0</td></tr>
</table>

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	2	5	5	12	6	0
2	6	6	3	15	0	0
3	0	8	0	8	0	8
4	2	5	7	14	9	5
5	9	0	0	9	0	0
6	5	4	0	9	0	3
7	6	2	0	8	6	0
TOTAL	30	30	15	75	21	16

Candidate Name	Centre Number					Candidate Number				
						0				

GCSE

APPLIED SCIENCE (Single Award)

UNIT 2: (Single Award) SCIENCE TO SUPPORT OUR LIFESTYLES
FOUNDATION TIER

SAMPLE ASSESSMENT PAPER

(1 hour 30 minutes)

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**16**	
3.	**9**	
4.	**4**	
5.	**10**	
6.	**10**	
7.	**14**	
8.	**8**	
Total	**75**	

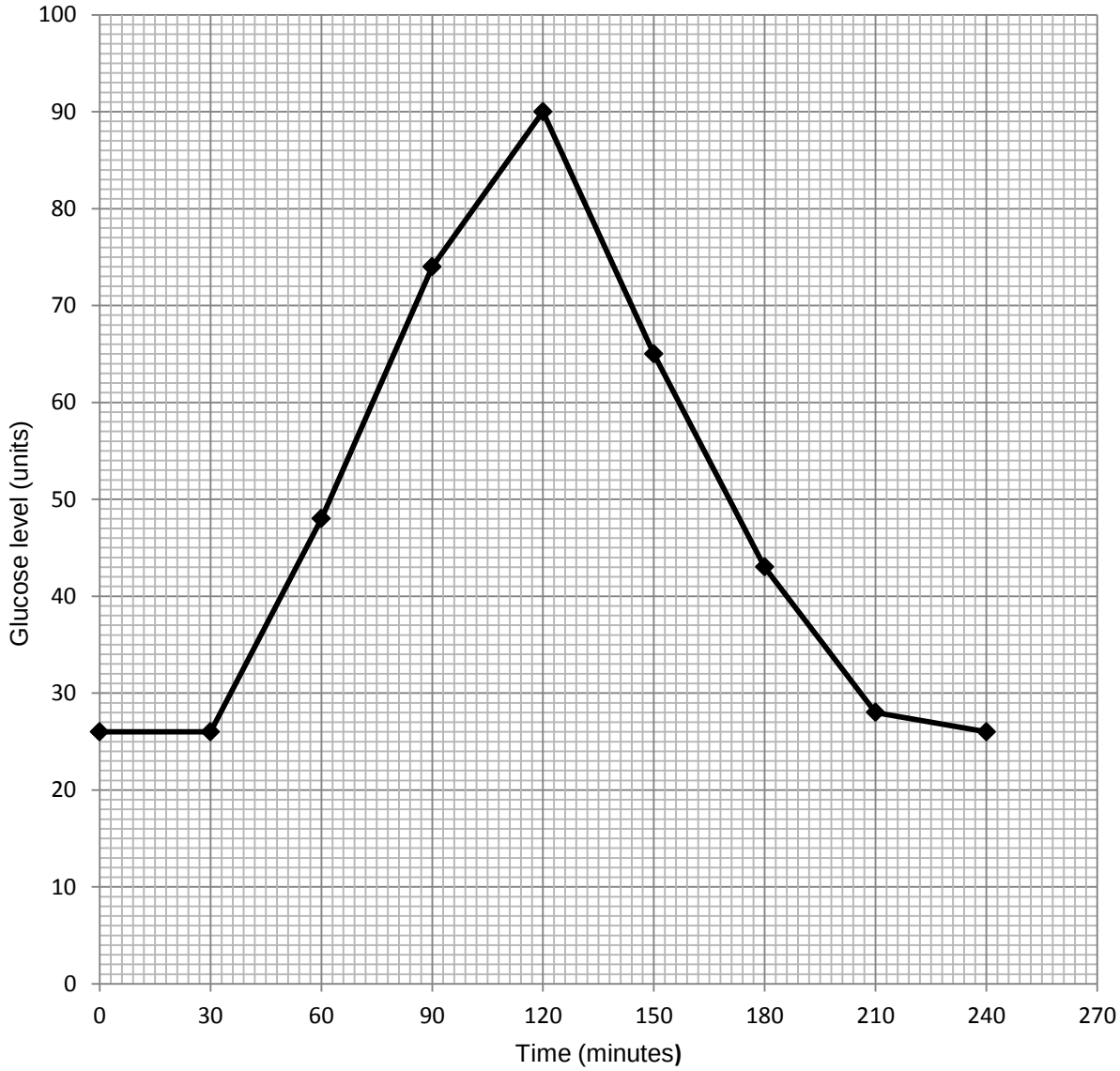
ADDITIONAL MATERIALS
In addition to this paper you will require a calculator.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES
The number of marks is given in brackets at the end of each question or part-question.
Question 7(c) is a quality of extended response (QER) question where your writing skills will be assessed.

Answer **all** *questions*

1. The level of glucose in a person's blood was measured every 30 minutes for three and a half hours. During this time the person was given a drink containing glucose.



(a) (i) At what time did the person take the glucose drink? [1]

……

(ii) At what time did the glucose level return to normal? [1]

……

(b) (i) The level of glucose in the blood is controlled by a hormone. Name the hormone. [1]

……

(ii) Some people have a medical condition where they do not produce enough of this hormone. Name the condition. [1]

……

4

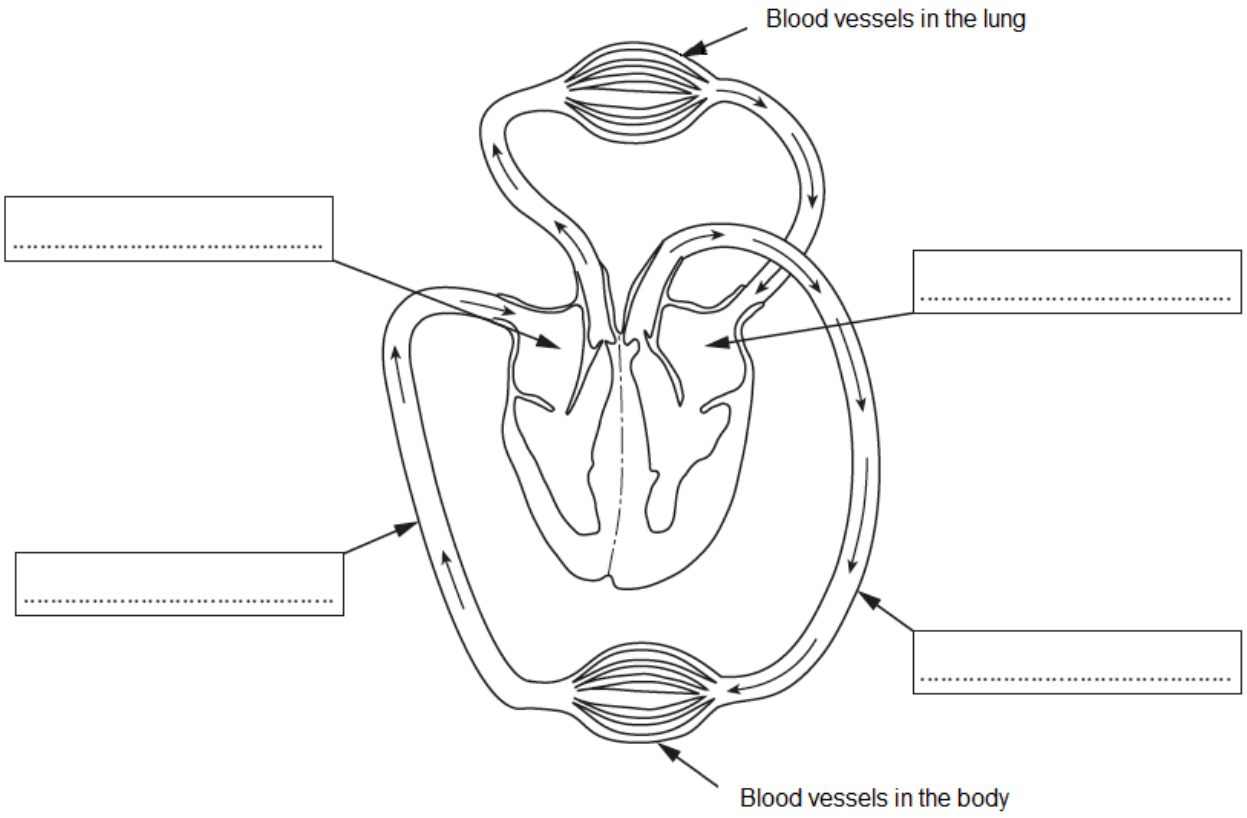
2. Jack is an amateur cyclist who is going to take part in the Wales Velothon.

He intends to improve his performance and investigates the effect of training on his heart and muscles.

The diagram below represents Jack's heart and circulatory system.

(a) (i) Add the following labels to the diagram. [3]

vein	artery	ventricle	atrium



(ii) State from which part of the system blood receives oxygen. [1]

……

(iii) State the role of an artery. [1]

……

(b) Jack measures his pulse rate.

(i) He counts 22 pulse beats in 15 seconds when at rest.

Calculate his pulse rate. [1]

pulse rate = …….. beats/minute

(ii) State what would happen to Jack's resting pulse rate after a month of training. [1]

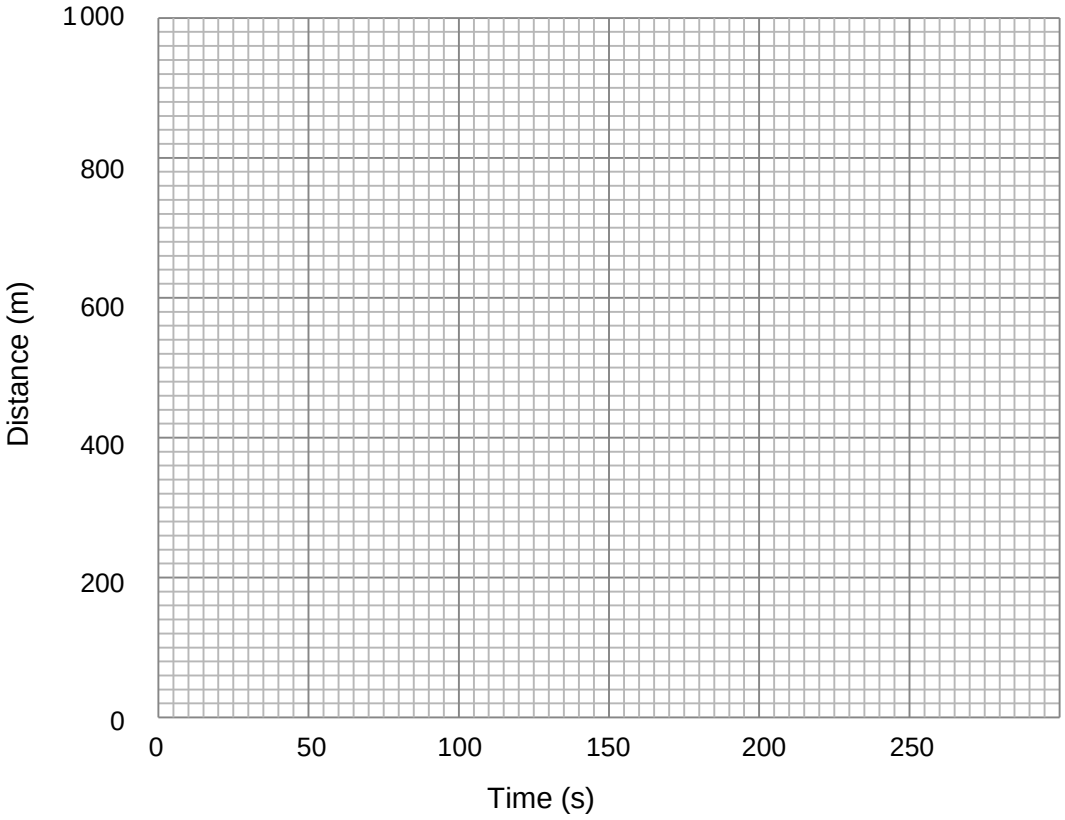
…….

…….

(c) Jack recorded the following data from his first 1000 m training session.

Time (seconds)	Distance (m)
0	0
50	300
100	600
150	820
200	950
250	1000

(i) Use the data to plot a graph on the grid below. [3]



(ii) Describe how Jack's motion changes over the 1000 m. [2]

……

……

(iii) Calculate Jack's mean speed over 1000 m using the equation below. [2]

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

mean speed = ……

(iv) On the grid, draw a line to show the motion you would expect after a month of training. [2]

16

3. Ryan has been suffering from health problems. His doctor sent him for an X-ray and a MRI scan.

(a) Underline the correct words to complete the following sentences. [2]

(i) X-ray machines use (*magnetic fields / electromagnetic waves /sound waves*) to produce an image.

(ii) MRI scanners use (*magnetic fields / electromagnetic waves /sound waves*) to produce an image.

(b) State a use for: [2]

(i) X-ray images;

……

(ii) MRI scans.

……

(c) The results from the scans show that Ryan has a cancerous lump. His doctor is going to use targeted internal radiotherapy that involves injecting the tumour with the radioactive isotope, iridium-192 which emits β particles.

(i) Circle the correct answer below. [1]

β particles are:

A fast moving protons

B fast moving electrons

C fast moving neutrons

D fast moving nuclei

(ii) The half life of iridium-192 is 11 days. Calculate how long it will take for the activity of iridium to fall to $^{1}/_{8}$ (one eighth) of its original level. Show your workings. [2]

……. days

(iii) Explain why Ryan's visitors are asked not to sit near him for the first few days after treatment. [2]

……

……

……

……

9

4. Thalassemia occurs when red blood cells are unable to synthesise haemoglobin. This often leads to anaemia.

Thalassemia is caused by a single faulty recessive allele, **t**.

Tony and Trudi are planning to start a family.

(i) Trudi and Tony are both carriers of the allele. State their genotype. [1]

……..

(ii) Complete the Punnett square below to show the possible genotypes of their children.

[2]

	…….	…….
……	……..	…….
……	…….	…….

(iii) Use the Punnett square to calculate the percentage chance of one of their children being born with this blood disorder.

[1]

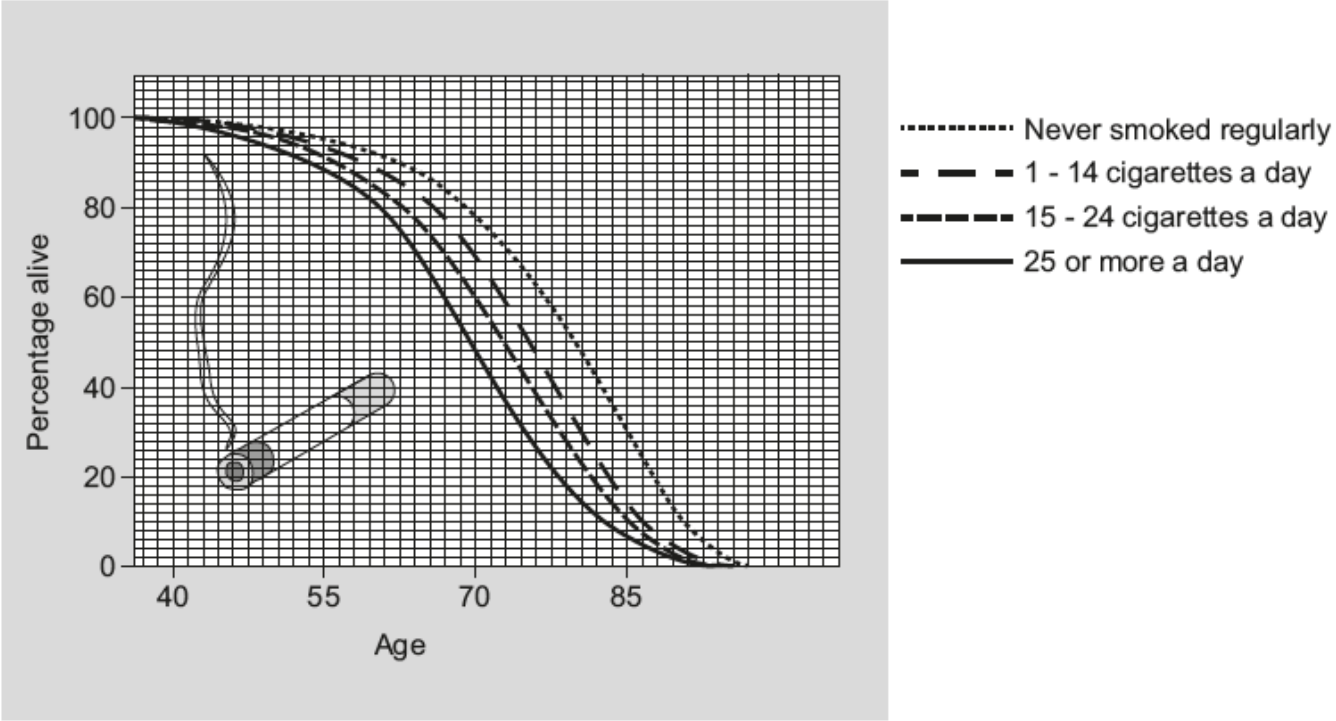
chance = …….. %

4

5. Rachel is trying to improve her general health by changing her diet and lifestyle.

Rachel smokes 20 cigarettes per day, drinks three bottles of wine a week and is forty years of age.

(a) The information in the graph shows the effect of smoking on lifespan.



(i) State what percentage of people who smoke 30 cigarettes per day are expected to live until 70 years of age. [1]

……

(ii) Explain what will happen to Rachel's life expectancy if she stops smoking now. Give **one** reason for your answer. [2]

……

……

……

……

(b) (i) Suggest **one** other action that Rachel should take to improve her long term health. [1]

……

(ii) What long term health problem may Rachel face if she does not take the action you suggest? [1]

……

(c) Rachel is 1.6 m tall and has a mass of 72 kg.

(i) Calculate her BMI. [2]

$$\text{BMI} = \frac{\text{mass}}{\text{height}^2}$$

BMI= ……..……

(ii) Use the chart below to classify Rachel's weight. [1]

BMI	Classification
Less than 18	underweight
19-24	normal
25-29	slightly obese
Greater than 30	obese

classification:…….……...

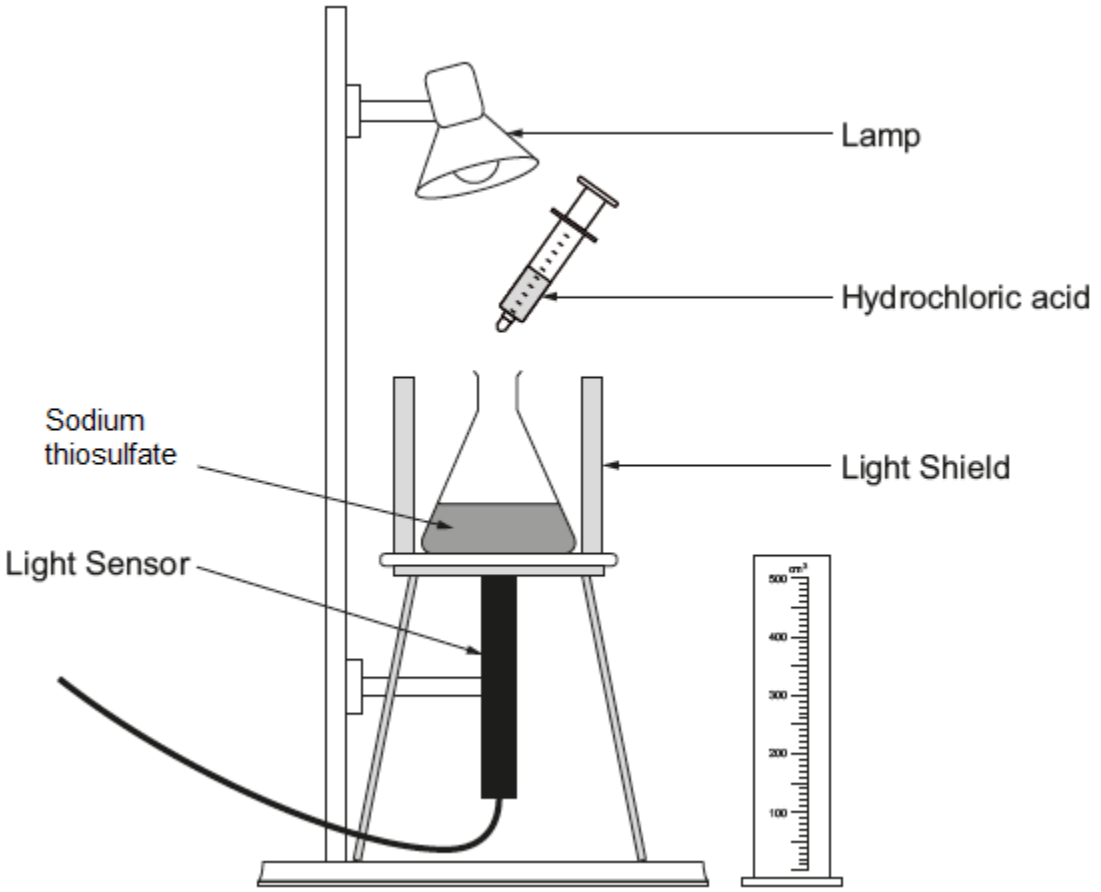
(iii) Rachel has a friend who is obese. State **two** possible health risks that Rachel's friend might face in the future. [2]

1 ……..…….

2 ……

10

6. Hydrochloric acid and sodium thiosulfate are both clear solutions. When they are mixed they become cloudy. The apparatus below can be used to determine the rate of sulfur formation during the reaction.



1. Measure out 50 cm^3 of sodium thiosulfate solution and 10 cm^3 of dilute hydrochloric acid.
2. Mix them together in the flask.
3. Observe the output from the light sensor.
4. Record the end point of the reaction with a stopwatch.
5. Repeat steps 1 to 4, increasing the volume of hydrochloric acid by 5 cm^3 each time.

The following results were obtained:

Volume of HCl added (cm^3)	**Time to react (s)**			
	Test 1	**Test 2**	**Test 3**	**Mean**
10	118	122	120	120
15	81	85	83	83
20	40	62	60	…….
25	26	41	43	42
30	20	28	28	28
35	20	25	25	25
40	20	25	25	25

(a) Explain how the student would determine the time taken to reach the endpoint. [2]

……..

……..

(b) Complete the table. [2]

(c) (i) A student accidentally shook test 1. Explain how the results show this. [1]

……

(ii) State how the results would change if the temperature was increased. [1]

……....

……

(iii) Explain in terms of particles why the results would change in this way. [2]

……

……

……

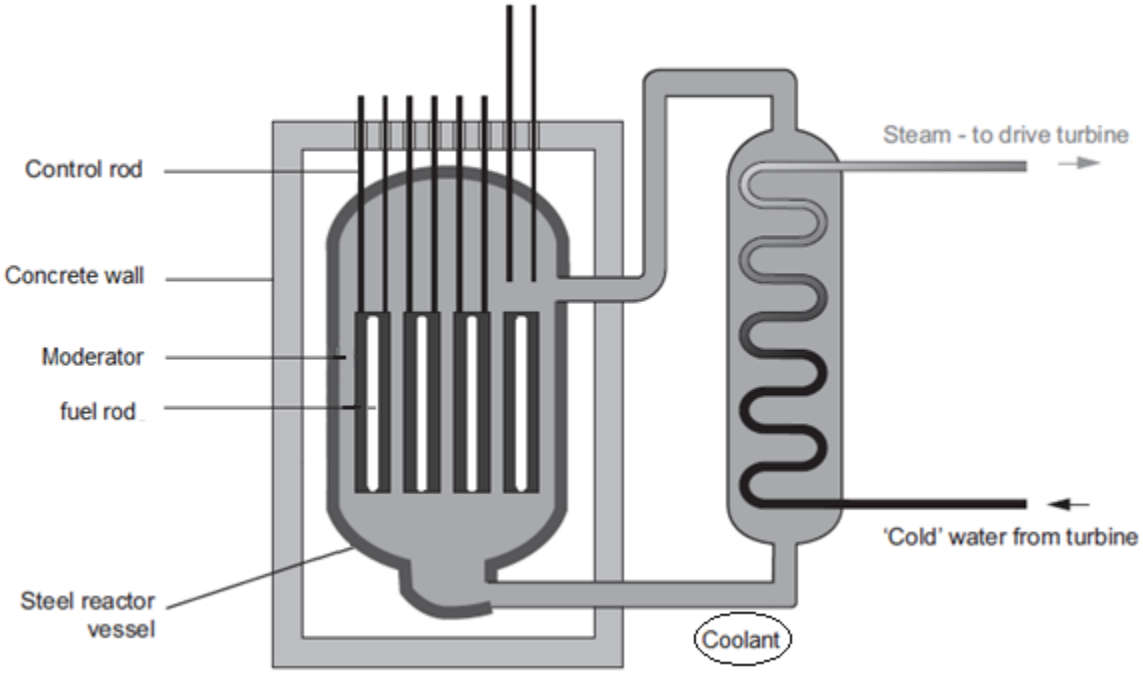
(d) Chemical reactions can be classified as being endothermic or exothermic. Tick the statements that are true. [2]

Thermal energy is released to the surroundings during an exothermic process.	☐
The substance gets colder in both endothermic and exothermic reactions.	☐
Exothermic reactions have led to thermal runaway disasters.	☐
Exothermic reactions always give out light energy.	☐
An endothermic reaction caused the Chernobyl accident.	☐

10

7. The UK Government has committed to cut the use of fossil fuels. One way to achieve this is to increase the use of nuclear power. The Hinkley Point C nuclear reactor is being built in Somerset. It is the UK's first new nuclear plant in more than 20 years. Power generated will be enough to meet the needs of nearly six million homes.

There are two other reactors already on the site. Hinckley Point C is different as it is a pressurized water reactor.



(a) All nuclear reactors have the same components.

(i) Name the fuel used in Hinkley C. [1]

……

(ii) Draw **one** line from each component to its purpose. [4]

Component	**Application**
fuel rod	removes excess neutrons
moderator	contains the material needed for fission
control rod	holds the reactor together
concrete wall	acts as a radiation shield
	slows down fast moving neutrons

(b) A coolant needs to be pumped around the reactor.

(i) Describe what may happen to a nuclear reactor if the pumps fail. [2]

……

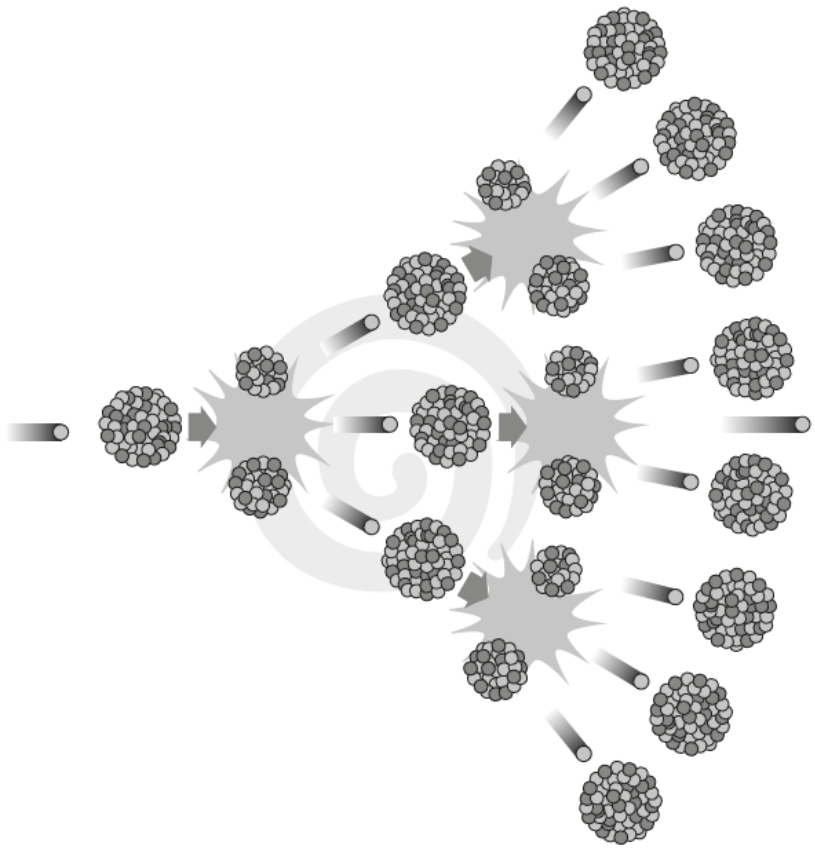
……

(ii) What action would immediately be taken to make the reactor safe? [1]

……

……

(c) All nuclear power stations use a controlled chain reaction in the fuel rods. The diagram below shows an uncontrolled chain reaction.



Compare the controlled chain reaction in Hinkley C with the uncontrolled chain reaction shown on the previous page. Describe how a controlled chain reaction is achieved. [QER 6]

……..

……..

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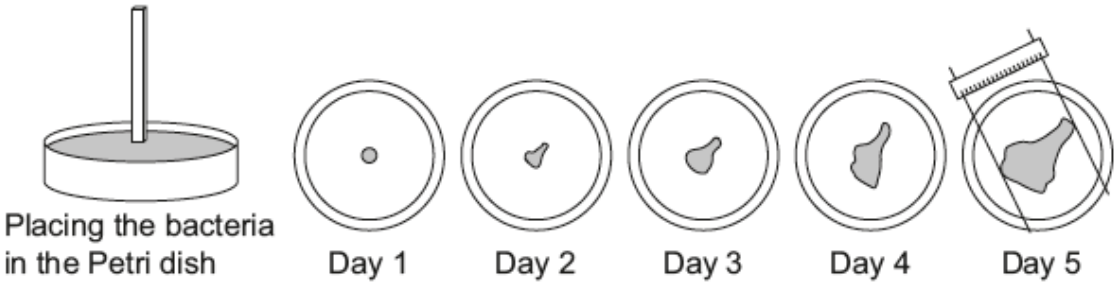
……..

8. Sue thinks that washing her hands in antibacterial hand wash kills more bacteria than traditional soap. Bev disagrees because she thinks that traditional soap is just as good.

They carry out the following experiment:

1. Place some saliva into a beaker.
2. Dip three short, cylindrical pieces of wood into the saliva.
3. Wash one in traditional soap, wash one in antibacterial handwash and leave the other as a control.
4. Dab each piece of wood onto the agar of separate petri dishes as shown in the diagram below.
5. Cover and leave for five days.
6. Measure the maximum diameter of bacterial growth each day.



(a) The results of their experiment are shown below.

Sample	Maximum diameter (mm)				
	day 1	**day 2**	**day 3**	**day 4**	**day 5**
control	10	13	18	29	34
handwash	10	10	14	19	21
soap	10	10	15	17	22

(i) Explain if there is enough evidence to say that Sue is correct. [2]

……

……

……

(ii) Explain why, from day 2 onwards, the maximum diameter is greatest in the control. [2]

……

……

……

(b) State **two** variables that should be controlled. [2]

……..

……..

……..

……..

(c) In order to reach a better conclusion they carry out the experiment again, this time they measure the **mean** diameter at the end of each day.

Describe how Sue and Bev should measure the mean diameter in the new experiment. [2]

……..

……..

……..

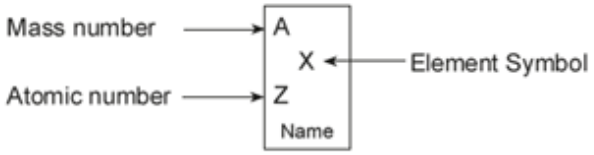
8

END OF PAPER

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}H$ Hydrogen									$^{4}_{2}He$ Helium
$^{7}_{3}Li$ Lithium	$^{9}_{4}Be$ Beryllium											$^{11}_{5}B$ Boron	$^{12}_{6}C$ Carbon	$^{14}_{7}N$ Nitrogen	$^{16}_{8}O$ Oxygen	$^{19}_{9}F$ Fluorine	$^{20}_{10}Ne$ Neon
$^{23}_{11}Na$ Sodium	$^{24}_{12}Mg$ Magnesium											$^{27}_{13}Al$ Aluminium	$^{28}_{14}Si$ Silicon	$^{31}_{15}P$ Phosphorus	$^{32}_{16}S$ Sulfur	$^{35}_{17}Cl$ Chlorine	$^{40}_{18}Ar$ Argon
$^{39}_{19}K$ Potassium	$^{40}_{20}Ca$ Calcium	$^{45}_{21}Sc$ Scandium	$^{48}_{22}Ti$ Titanium	$^{51}_{23}V$ Vanadium	$^{52}_{24}Cr$ Chromium	$^{55}_{25}Mn$ Manganese	$^{56}_{26}Fe$ Iron	$^{59}_{27}Co$ Cobalt	$^{59}_{28}Ni$ Nickel	$^{64}_{29}Cu$ Copper	$^{65}_{30}Zn$ Zinc	$^{70}_{31}Ga$ Gallium	$^{73}_{32}Ge$ Germanium	$^{75}_{33}As$ Arsenic	$^{79}_{34}Se$ Selenium	$^{80}_{35}Br$ Bromine	$^{84}_{36}Kr$ Krypton
$^{86}_{37}Rb$ Rubidium	$^{88}_{38}Sr$ Strontium	$^{89}_{39}Y$ Yttrium	$^{91}_{40}Zr$ Zirconium	$^{93}_{41}Nb$ Niobium	$^{96}_{42}Mo$ Molybdenum	$^{99}_{43}Tc$ Technetium	$^{101}_{44}Ru$ Ruthenium	$^{103}_{45}Rh$ Rhodium	$^{106}_{46}Pd$ Palladium	$^{108}_{47}Ag$ Silver	$^{112}_{48}Cd$ Cadmium	$^{115}_{49}In$ Indium	$^{119}_{50}Sn$ Tin	$^{122}_{51}Sb$ Antimony	$^{128}_{52}Te$ Tellurium	$^{127}_{53}I$ Iodine	$^{131}_{54}Xe$ Xenon
$^{133}_{55}Cs$ Caesium	$^{137}_{56}Ba$ Barium	$^{139}_{57}La$ Lanthanum	$^{179}_{72}Hf$ Hafnium	$^{181}_{73}Ta$ Tantalum	$^{184}_{74}W$ Tungsten	$^{186}_{75}Re$ Rhenium	$^{190}_{76}Os$ Osmium	$^{192}_{77}Ir$ Iridium	$^{195}_{78}Pt$ Platinum	$^{197}_{79}Au$ Gold	$^{201}_{80}Hg$ Mercury	$^{204}_{81}Tl$ Thallium	$^{207}_{82}Pb$ Lead	$^{209}_{83}Bi$ Bismuth	$^{210}_{84}Po$ Polonium	$^{210}_{85}At$ Astatine	$^{222}_{86}Rn$ Radon
$^{223}_{87}Fr$ Francium	$^{226}_{88}Ra$ Radium	$^{227}_{89}Ac$ Actinium															

Key:



UNIT 2: (Single Award) SCIENCE TO SUPPORT OUR LIFESTYLES
FOUNDATION TIER

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

Question				Marking details	Marks available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
1	(a)	(i)		30 min (unit must be given for the mark)		1		1	1	
		(ii)		240 minutes (unit must be given for the mark)		1		1	1	
	(b)	(i)		Insulin	1			1		
		(ii)		Diabetes	1			1		
				Question 1 total	**2**	**2**	**0**	**4**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		All correct (3) 2/3 correct (2) 1 correct (1)	3			3		
		(ii)		Lungs	1			1		
		(iii)		carries blood away from the heart / carries high pressure blood	1			1		
	(b)	(i)		88		1		1	1	
		(ii)		Decrease		1		1		
	(c)	(i)		All points correctly plotted (2) 5 correctly plotted (1) Appropriate curve drawn (1)		3		3	3	
		(ii)		runs at a steady speed for first 100s (1) then slows down (1)			2	2	2	
		(iii)		1000/250 (1) 4 m/s (1)	1	 1		2	2	
		(iv)		Line above original line (straighter and steeper)(1) Plateau at 1000m (1)		2		2	2	
				Question 2 total	**6**	**8**	**2**	**16**	**10**	**0**

Question				Marking details	Marks available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
3	(a)	(i)		electromagnetic waves	1			1		
		(ii)		magnetic fields	1			1		
	(b)	(i)		imaging bones	1			1		
		(ii)		imaging soft tissue	1			1		
	(c)	(i)		**B**	1			1		
		(ii)		calculation of 3 half lives (1) 33 days (1)		2		2	2	
		(iii)		β particles can damage DNA/ cells so need to prevent exposure (1) they do not travel far in air so don't affect those that do not sit near him (1)			2	2		
				Question 3 total	**5**	**2**	**2**	**9**	**2**	**0**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>4</td><td></td><td>(i)</td><td></td><td>Tt</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td><table><tr><td></td><td>T</td><td>t</td></tr><tr><td>T</td><td>TT</td><td>Tt</td></tr><tr><td>t</td><td>Tt</td><td>tt</td></tr></table>correct alleles (1)
correct cross (1)</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>25% (allow ECF)</td><td></td><td></td><td>1</td><td>1</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 4 total</td><td>0</td><td>3</td><td>1</td><td>4</td><td>1</td><td>0</td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		48%		1		1	1	
		(ii)		Life expectancy will increase/return to non-smoker level (1) Toxins/ carcinogens no longer entering/damaging body (1)			2	2		
	(b)	(i)		Reduce alcohol intake/ drink less wine		1		1		
		(ii)		liver damage	1			1		
	(c)	(i)		$72/1.6^2$ (1) 28.1 (1) Correct answer gets both marks Allow 28	1	1		2	2	
		(ii)		Slightly obese		1		1		
		(iii)		**Any two x (1) from:** • heart disease • stroke • diabetes • arthritis	2			2		
				Question 5 total	**4**	**4**	**2**	**10**	**3**	**0**

Question				Marking details	Marks available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
6	(a)	(i)		record time when light decreases / add HCl (1) until light becomes constant (1)		2		2		2
	(b)			ignore anomalous result (1) mean = 61 (1) inclusion of anomaly and calculation of 58 (1)		2		2	2	2
	(c)	(i)		reaches endpoint quicker / reaction speeds up		1		1		1
		(ii)		Reaction speeds up/ reach plateau at lower concentration	1			1		1
		(iii)		Particles move faster (1) More successful collisions per unit of time (1)	2			2		
	(d)			ticks in boxes 1 and 3	2			2		
				Question 6 total	**5**	**5**	**0**	**10**	**2**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		Uranium-235	1			1		
		(ii)		Fuel rods – contain the material needed for fission (1) Moderator – slows down fast neutrons (1) Control rods- absorb excess neutrons (1) Concrete walls – act as a radiation shield (1)	4			4		
	(b)	(i)		Heat can no longer escape from reactor (1) May cause melt down/ explosion/ containment failure (1)			2	2		
		(ii)		Drop the control rods		1		1		
	(c)			**Indicative content** In a controlled chain reaction a slow moving neutron is absorbed by a uranium nucleus. The nucleus splits into two lighter nuclei, releasing thermal energy, and 2/3 more neutrons. Some of these neutrons are absorbed using boron control rods so that only one neutron goes on from that reaction to split another nucleus keeping the reaction at a constant rate. A moderator is used to slow down the neutrons so that they can be absorbed. In an uncontrolled chain reaction 2/3 neutrons are released splitting the first atom causing other nuclei to split. Even more neutrons are released that causes an uncontrolled reaction.	3	3		6		

Question				Marking details	Marks available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
				5 - 6 marks Detailed description of both controlled and uncontrolled chain reactions, with correct use of moderator and control rods. *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3 - 4 marks** Descriptions of both controlled and uncontrolled chain reactions *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1 - 2 marks** A basic description of a nuclear chain reaction is given *There is a basic line of reasoning, which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate used limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 Marks** *No attempt made or no response worthy of credit*						
				Question 7 total	**8**	**4**	**2**	**14**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		No clear pattern/ evidence is not clear (1) since there is not much difference in numbers/ similar (1)			2	2		2
		(ii)		no antibacterial agent (1) so there are more bacteria present (1)		2		2		2
	(b)			**Any 2 x (1) from:** • Keep time of wood in saliva constant • Keep volume of saliva on wood the same/Put wood into the saliva the same depth • Wash for same time/same way • Same contact with the agar.			2	2		2
	(c)			find the diameter through centre (1) In several directions (1) Allow: many directions (1)			2	2		2
				Question 8 total	**0**	**2**	**6**	**8**	**0**	**8**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	2	2	0	4	2	0
2	6	8	2	16	10	0
3	5	2	2	9	2	0
4	0	3	1	4	1	0
5	4	4	2	10	3	0
6	5	5	0	10	2	6
7	8	4	2	14	0	0
8	0	2	6	8	0	8
Total	30	30	15	75	20	14

Candidate Name	Centre Number					Candidate Number				
						0				

GCSE

APPLIED SCIENCE (Single Award)

UNIT 2: (Single Award) SCIENCE TO SUPPORT OUR LIFESTYLES HIGHER TIER

SAMPLE ASSESSMENT MATERIALS

(1 hour 30 minutes)

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**12**	
3.	**15**	
4.	**12**	
5.	**17**	
6.	**11**	
Total	**75**	

ADDITIONAL MATERIALS
In addition to this paper you will require a calculator.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES
The number of marks is given in brackets at the end of each question or part-question.
Question 3(a) is a quality of extended response (QER) question where your writing skills will be assessed.

Answer **all** *questions*

1. Thalassemia refers to a collection of genetic blood disorders. It occurs when haemoglobin can't be correctly synthesised. Thalassemia often leads to anaemia. Thalassemia is caused by a single faulty recessive allele, t.

(a) Before Tony and Trudi start a family, they have a genetic screening test. Give **one** reason why. [1]

……..

……..

(b) Having undergone the test, the results show that Tony does not have the recessive allele, and Trudi is a carrier of the disease.

(i) Complete the Punnett square to find the possible genotypes of their children. [2]

	……	……
……	……	……
……	……	……

(ii) State the percentage chance of a child being born with thalassemia. [1]

chance = …….. %

(c) Counsellors often give advice about genetic screening during pregnancy. During a genetic screen a pregnant woman discovers that her unborn child has a high chance of suffering from a life-changing condition.

Discuss the ethical and moral considerations that should be taken into account before the pregnancy is allowed to continue. [4]

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8

2. Diabetics are at risk of a condition called hypoglycemia which is characterised by abnormally low levels of blood glucose.

Hypoglycemia is not a disease itself but an indicator of a health problem. Diabetics refer to a period of hypoglycemia as suffering a 'hypo'.

The table shows the blood glucose levels of two 55 year old men over a period of 12 hours.

Time	**Blood glucose (arbitrary units)**	
	Tom	**Jerry**
4:00	8	5
6:00	6	5
8:00	18	6
10:00	8	5
12:00	2	6
14:00	22	6
16:00	18	5

(a) (i) Explain how the data shows that Tom is a diabetic. [1]

……

……

(ii) Explain why Tom's blood glucose level increased by a large amount at 8:00 and 14:00. [2]

……

……

(iii) At what time did Tom suffer a "hypo"? [1]

……

(iv) State what could have caused his blood glucose level to drop so low that a "hypo" occurred. [1]

……

(v) State what Tom should do to recover quickly from his "hypo". [1]

……

(b) Describe the difference between the two types of diabetes. [2]

……..

……..

……..

(c) Jerry is 180 cm tall and has a mass of 150 kg.

His BMI can be calculated using the following equation:

$$\text{BMI} = \frac{\text{mass}}{\text{height}^2}$$

His body type can be classified using the table below:

BMI	**Classification**
Less than 18	underweight
19-24	normal
25-29	slightly obese
Greater than 30	obese

Explain why the Government concerned about the number of people in the country who are like Jerry. [4]

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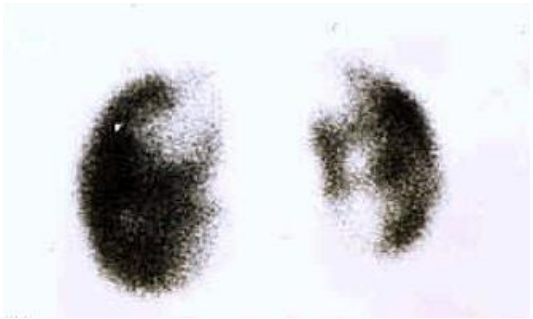
3. A Gamma camera can be used to carry out a kidney scan.

A renal scan is an examination done to study the function and blood flow through the kidneys. The test will check how well the kidneys are working by watching the kidneys fill and empty urine into the bladder. The diagram below shows the result of such a scan.



(a) Describe how a renal scan image is produced using a gamma camera. [6 QER]

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(b) The patient has been diagnosed with cancer of the kidneys and will be treated using chemotherapy and targeted external radiotherapy.

(i) Explain how chemotherapy is used to treat cancer. [2]

……

……

(ii) Explain why X-rays are used in external radiotherapy. [2]

……

……

(c) The table below shows information about some radioisotopes.

Radioisotope	**Half-life**	**Method of decay**
Tellurium-133	12 minutes	beta
Astatine-211	7.2 hours	alpha
Cobalt-60	5 years	beta and gamma
Caesium-137	30 years	beta
Americium-241	432 years	alpha

(i) Using the information in the table, select the most suitable radioisotope to treat cancer of the kidney by injecting the radioisotope directly into the tumour. [3]

Name of radioisotope:…….

Reasons:…….....

……

……

……

(ii) Cobalt-60 is used to sterilise packaged surgical instruments. Its initial activity is 240 units. Calculate its activity after 25 years. [2]

……...…….units

4. Sue thinks that washing her hands in antibacterial handwash kills more bacteria than traditional soap. Bev disagrees because she thinks that traditional soap is just as good.
They carry out the following experiment:

1. Place some saliva into a beaker.
2. Three short, cylindrical pieces of wood into the saliva.
3. Wash one in traditional soap, wash one in antibacterial handwash and leave the other as a control.
4. Dab each piece of wood onto the agar of separate petri dishes as shown in the diagram below.
5. Cover and leave for five days.
6. Measure the maximum diameter of bacterial growth each day.

(a) The results of their experiment are shown below.

Sample	**Maximum diameter (mm)**				
	day 1	**day 2**	**day 3**	**day 4**	**day 5**
control	10	13	18	29	34
handwash	10	10	14	19	21
soap	10	10	15	17	22

(i) Explain if there is enough evidence to say that Sue is correct. [2]

……

……

……

(ii) Explain why, from day 2 onwards, the maximum diameter is greatest in the control. [2]

……

……

……

(b) State **two** variables that should be controlled. [2]

……..

……..

……..

……..

(c) In order to reach a better conclusion they carry out the experiment again, this time measuring the **mean** diameter at the end of each day.

Describe how Sue and Bev should measure the mean diameter in the new experiment. [2]

……..

……..

……..

(d) Human saliva can contain many pathogens. When a pathogen enters the body, antibodies are produced by the immune system.

(i) Explain how antibodies are produced by the immune system. [2]

……

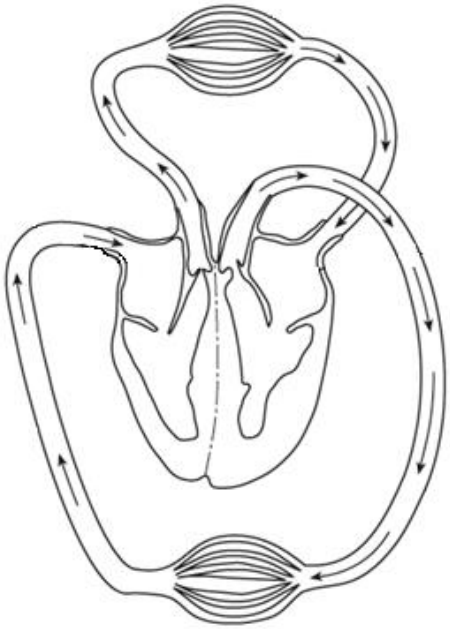
……

(ii) Explain how a vaccine helps the immune system protect an individual from pathogens. [2]

……

……

5. (a) Jack is an amateur cyclist who is going to take part in the Wales Velothon. He intends to improve his performance and investigates the effect of training on his heart and muscles.
The diagram below represents Jack's heart and circulatory system.



(i) State from which part of the system blood receives oxygen. [1]

……

(ii) Explain how the amount of oxygen getting to the cells increases during exercise. [2]

……

……

(b) Jack measures his pulse rate.

(i) He counts 22 pulse beats in 15 seconds when at rest.
Calculate his pulse rate. [1]

pulse rate = …….. beats/minute

(ii) State what would happen to Jack's resting pulse rate after a month of training. [1]

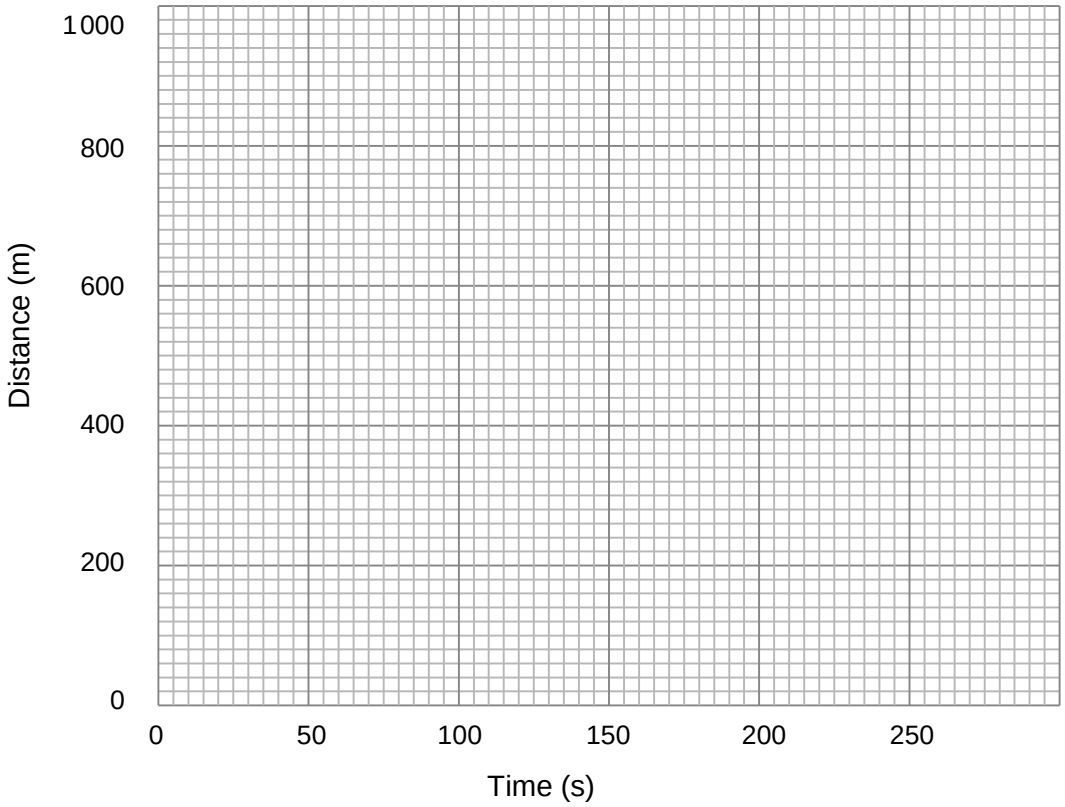
……

……

(c) Jack recorded the following data from his first 1000 m training session.

Time (seconds)	Distance (m)
0	0
50	300
100	600
150	820
200	950
250	1000

(i) Use the data to plot a graph on the grid below. [3]



(ii) Describe how Jack's motion changes over the 1000 m. [2]

……..…

……

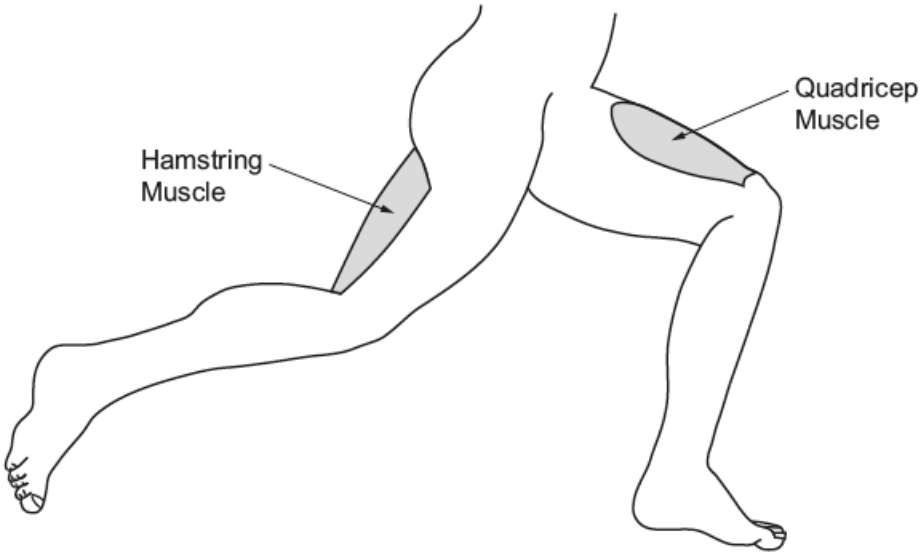
(iii) Calculate Jack's mean speed over 1000 m using the equation below. [2]

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

mean speed = ……

(iv) On the grid, draw a line to show the motion you would expect after a month of training. [2]

(d) The picture shows the muscular structure of Jack's Leg. The muscles work as an antagonistic pair.



Explain how the muscles enable Jack to cycle [3]

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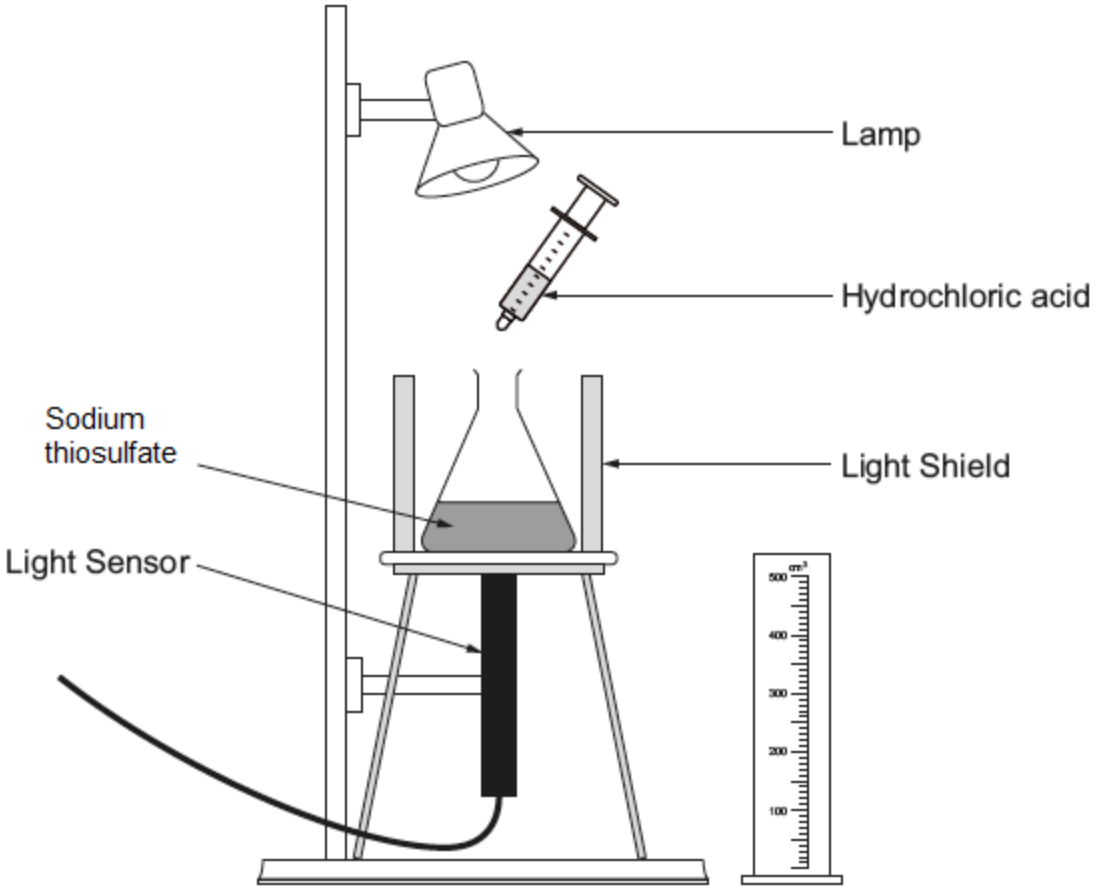
17

6. Ibrahim runs a large chemical plant that produces dye for the clothing industry.

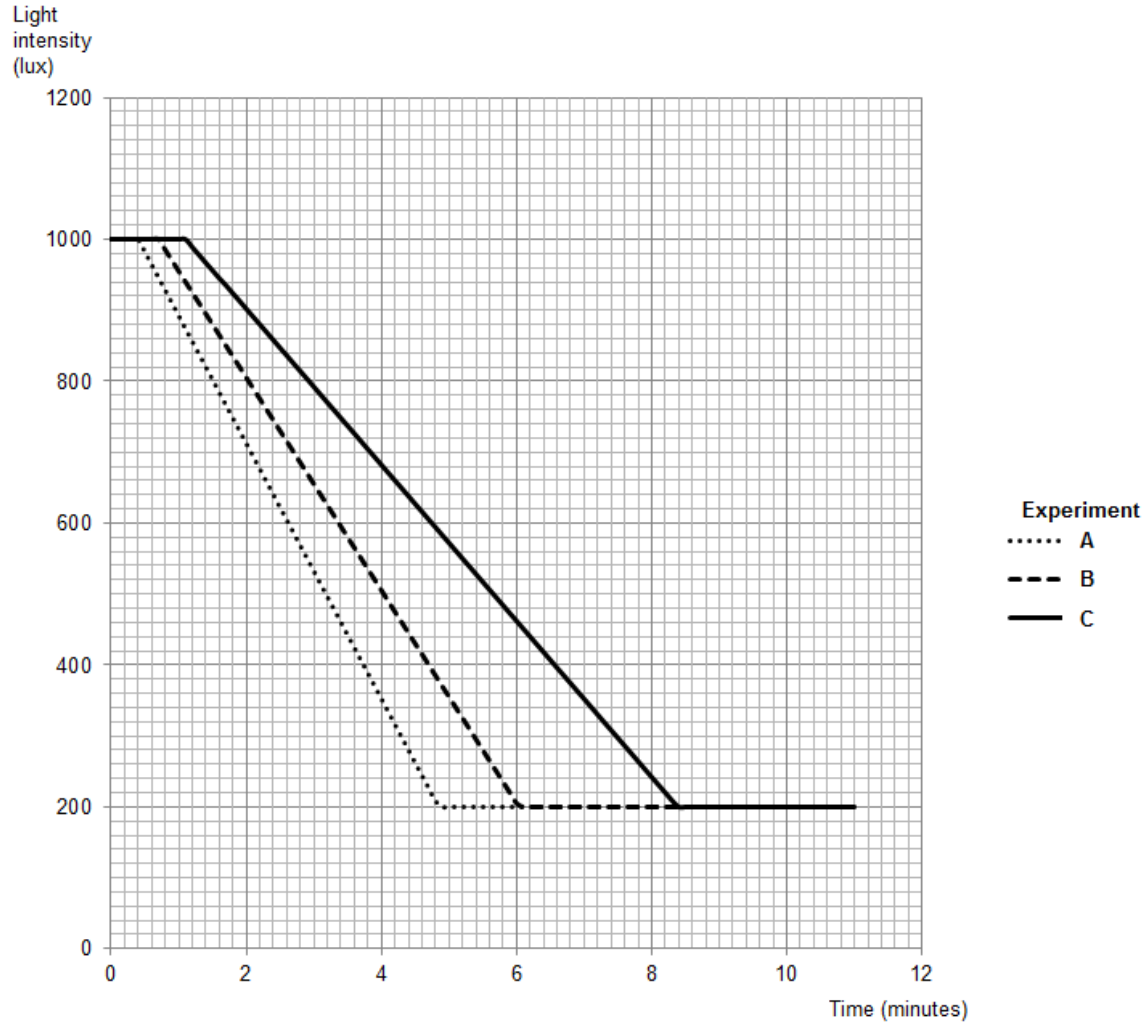
Sodium thiosulfate is a waste product of this process. When sodium thiosulfate is reacted with hydrochloric acid sulfur is released. Ibrahim wants to find out if he can increase the rate of reaction sufficiently for it to be cost effective to re-cycle this sulfur.

One of his scientists carries out the following experiment to determine the rate of sulfur formation at various temperatures:



1. Measure out 50 cm^3 of sodium thiosulfate solution and 10 cm^3 of dilute hydrochloric acid.
2. Place them in a water bath until they reach the required temperature.
3. Mix the chemicals together when they have both reached the required temperature.
4. Repeat steps 1-3 for different temperatures.
5. The output from the light sensor is observed and recorded on a data logger.

The following results were obtained from the data logger for three experiments, **A**, **B** and **C** at different temperatures:



(a) (i) Calculate the slope of the results for experiment **A** between 1.4 and 4.4 minutes. [3]

Slope = ……..units/min

(ii) Explain how you know that the results for experiment A were done at the highest temperature. [2]

……

……

(iii) Explain how increasing the temperature changes the rate of the reaction. [2]

……

……

……

(b) Apart from temperature name **one** other factor that Ibrahim can change to reduce the time taken for the reaction. [1]

……..

(c) One of reactions in the manufacture of dye is an *exothermic* reaction. If this is not controlled it can lead to a thermal runaway reaction.

State what is meant by an exothermic reaction and explain how this can lead to a 'thermal runaway'. [3]

……

……

……

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……

11

END OF PAPER

UNIT 2: (Single Award) SCIENCE TO SUPPORT OUR LIFESTYLES
HIGHER TIER

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td></td><td>To be aware of any possibility that her child would have the disease</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td><table><tr><td></td><td>T</td><td>T</td></tr><tr><td>T</td><td>TT</td><td>TT</td></tr><tr><td>t</td><td>Tt</td><td>Tt</td></tr></table>
(1) for alleles correct
(1) for correct cross (allow ECF)</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>0% (allow) ECF)</td><td></td><td></td><td>1</td><td>1</td><td>1</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>Termination: any 2 x (1) from:
• Prevents disease passing to future generations,
• Will save you money/time in future treatment regimes
• Child won’t suffer pain/discomfort
• Parents won’t suffer the stress/Heartache of your child suffering

Continuation: any 2 x (1) from:
• Religious beliefs against termination
• Belief that child has a right to life/is already alive in womb
• Statistical chance of there being nothing wrong with child.
• Emotional regret/stress/guilt felt by mother on termination</td><td>4</td><td></td><td></td><td>4</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 1 total</td><td>5</td><td>2</td><td>1</td><td>8</td><td>1</td><td>0</td></tr>
</table>

Question				Marking details	Marks available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
2	(a)	(i)		Large changes in blood glucose level (which is characteristic of diabetes)		1		1		
		(ii)		Meal times (1) no/less insulin released (1)		2		2		
		(iii)		12:00		1		1		
		(iv)		Too much exercise / too much insulin		1		1		
		(v)		Eat sugary food Allow examples	1			1		
	(b)			Type 1 – failure to produce insulin Type 2- Resistance to insulin (1)	2			2		
	(c)			$150/1.8^2$ (1) 46.3 (1) Jerry is obese (1) This leads to increased demands/costs on Health service (1)	1		3	4	2	
				Question 2 total	**4**	**5**	**3**	**12**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			**Indicative content** The patient is injected with a radioactive tracer. The tracer consist of a chemical that travels to the kidneys and a radioisotope. The tracer is absorbed by the parts of the kidney that are functioning. The radioisotope gives out gamma rays, that can pass out of the body. These are detected by a gamma camera, which converts the gamma rays into electrical signals. A computer turns these signals into a image which is displayed showing the function of the kidney. **5 – 6 marks** Detailed description of how a renal scan is produced using a gamma camera *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3 – 4 marks** Detailed description of some aspects how a renal scan is produced using a gamma camera *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1-2 marks** A basic description of some aspects how a renal scan is produced using a gamma camera. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with*	4	2		6		

				very little structure. The candidate uses limited *appropriate scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** *No attempt made or no response worthy of credit.*						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(b)	(i)		Chemical is injected/taken into body (1) poisons cancer cells(1)	2			2		
		(ii)		X rays easily produced/targeted (1) ionising so they kill cancer cells (1)	2			2		
	(c)	(i)		Astatine (1) Alpha particles are easily absorbed (by cancer cells) and would not penetrate beyond the tumour (to affect healthy cells) (1) It decays (to a safe level) quickly or equivalent (1) **Alternative solution:** Tellurium (1) Beta penetrates all of the tumour (1) It decays (to a safe level) quickly or equivalent (1)			3	3		
		(ii)		5 half lives (1) 7.5 units (1)		2		2	2	
				Question 3 total	**8**	**4**	**3**	**15**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		No clear pattern/ evidence is not clear (1) since there is not much difference in numbers/ similar (1)			2	2		2
		(ii)		no antibacterial agent (1) so there are more bacteria present (1)		2		2		2
	(b)			**Any 2 x (1) from:** • Keep time of wood in saliva constant • Keep volume of saliva on wood the same/Put wood into the saliva the same depth • Wash for same time/same way • Same contact with the agar.			2	2		2
	(c)			find the diameter through centre (1) In several directions (1) Allow: many directions (1)			2	2		2
	(d)	(i)		Pathogens contain antigens that are foreign to the body (1) white blood cells (lymphocytes) produce specific antibodies (that can attach to antigen) (1)	2			2		
		(ii)		Vaccination involves putting a small amount of an inactive form of a pathogen into the body (1) Body then produces antibodies which are then available to attack active pathogen (1)	2			2		
				Question 4 total	**4**	**2**	**6**	**12**	**0**	**8**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		Lung	1			1		
		(ii)		Heart beats faster/increases blood flow (1) So more oxygen gets to (muscle) cells (1)	1	1		2		
	(b)	(i)		88		1		1	1	
		(ii)		Decrease		1		1		
	(c)	(i)		All points correctly plotted (2) 5 correctly plotted (1) Appropriate curve drawn (1)		3		3	3	
		(ii)		runs at a steady speed for first 100s (1) then slows down (1)			2	2	2	
		(iii)		1000/250 (1) 4m/s (1)	1	1		2	2	
		(iv)		Line above original line (straighter and steeper)(1) Plateau at 1000m (1)		2		2	2	
	(d)			One muscle relaxes/lengthens when other contracts/shorten (to control movement of limb)(1) Quadriceps contract (and hamstring relaxes) to move leg forward (1) Hamstrings contract to move leg back (1)		3		3		
				Question 5 total	**3**	**12**	**2**	**17**	**10**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		Reading correctly from graph / correct triangle drawn on graph 820 (+/- 10) 280 (+/-10) (1) Working out gradient correctly $(\frac{960-240}{3})$ (1) 180 (range 188-172)		3		3	3	3
		(ii)		Experiment A steepest slope/gradient (1) Higher temp faster reaction (1)		2		2		1
		(iii)		Particles move faster (1) More successful collisions per unit of time (1)	2			2		
	(b)			Stir / increase concentration of HCl	1			1		1
	(c)			Exothermic reaction - Gives out heat/energy (1) This energy speeds up the reaction (1) Which in turn creates more heat(1)	3			3		
				Question 6 total	**6**	**5**	**0**	**11**	**3**	**5**

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	2	1	8	1	0
2	4	5	3	12	2	0
3	8	4	3	15	2	0
4	4	2	6	12	0	8
5	3	12	2	17	10	0
6	6	5	0	11	3	5
Total	30	30	15	75	18	13

GCSE

APPLIED SCIENCE (Single Award)

UNIT 3: (Single Award) TASK BASED ASSESSMENT

INSRUCTIONS TO TEACHERS/EXAMS OFFICERS

Confidential

To be opened on receipt for immediate use by

TEACHERS / EXAMS OFFICERS

This document should be stored securely by the exams officer when not in use by the teacher. Its contents should not be divulged except to those concerned with the preparation of the assessment.

A. General Instructions

1. Candidates are required to submit one complete pack which will contain two activities

The tasks will need to be completed in the second half of the autumn term (i.e. November-December). The unit will be completed in four sessions each of 60 minutes duration.

Activity 1 will be completed in sessions 1-3 and will involve the obtaining of results. This should be securely stored by the teacher between sessions. Activity 2 will be completed in session 4 and will involve the analysis and evaluation of given data. This should be collected in at the end of session 4.

2. A foundation tier paper is also available. Use of this paper will limit candidates to grades C-G.

3. The task should be supervised at all times by a member of staff responsible for teaching GCSE Science. Centres may use additional laboratories, provided that a subject teacher is available to supervise all candidates at all times.

4. The question papers for all activities will be made available to the examinations officer in each centre at the start of November. Teachers may open the **"List of apparatus required"** document at the start of September. **This is for the purpose of ensuring that centres have the required apparatus.**

5. **Activity 1**: Candidates should work individually to produce their plan. It is permissible for candidates to work in small groups to perform the practical procedure (no more than three candidates) **provided their plans are sufficiently similar**. Teachers should ensure that each group has adequate working space and that the groups are set a reasonable distance apart. Each candidate requires uninterrupted access to the allocated apparatus. This is carried out under a limited level of control, i.e. learners may work with others to obtain results but they must provide their own responses to the questions set. Teacher assistance should not normally be required, but may be given if equipment failure occurs. Candidates should complete the analysis and evaluation sections of activity 1 individually under a high level of control, i.e.learners must work individually. This section is to be completed with no teacher feedback or assistance allowed and under formal supervision.

6. When activity 1 is completed, it should be securely stored by the teacher and passed to the Examination Officer when both activities are complete. **Candidates should not** have access to activity 1 after they have started activity 2.

7. **Activity 2**: This is carried out under a high level of control, i.e. candidates work individually, set a suitable distance apart and under supervision. When activity 2 is complete, it should be securely stored by the teacher and passed to the examination officer when both activities are complete.

8. Candidates should write their answers in the spaces provided on the question paper. Should there be a need for additional space then a standard extension/answer booklet should be provided.

9. If candidates fail to obtain results for activity 1, it is acceptable for them to be given unformatted teacher results.

10. As soon as all assessments have taken place, the completed activities for each candidate should be attached to each other and then securely stored by the exams officer before they are sent to the examiner by …… at the latest. Teachers should not be given access to the completed examination papers after the actual assessments have taken place.

11. The papers will be externally marked by a WJEC examiner. The name and address of the examiner will be issued to centres by the end of April.

12. Monitoring visits will take place on a random sample of centres to ensure the task based assessment is being administered correctly.

GCSE

APPLIED SCIENCE (Single Award)

UNIT 3: (Single Award) TASK BASED ASSESSMENT

Information for teachers and technicians

Details of the apparatus and materials required for the assessment follow.

If any difficulty is experienced in providing the apparatus, WJEC should be informed as soon as possible.

Contacts:

Subject Officer: Llinos Wood **029 2026 5384** llinos.wood@wjec.co.uk

Support Officer: Sarah Price **029 2026 5103** sarah.price@wjec.co.uk

ACTIVITY 1

Apparatus Required

The following apparatus is required for each candidate or group of candidates (each group should consist of no more than three candidates)

- Boiling tube
- Clamp stand, boss and clamp
- Bunsen burner
- Mounted needle or tongs
- forceps
- Measuring cylinder, 50 cm^3
- pipettes
- 5 types of snack foods
- Thermometer
- water
- pencil
- ruler

Please note that candidates will not be required to use all the apparatus.
When choosing snack foods, centres should be aware of candidates with nut allergies.

CLEAPSS student safety sheets should be available for candidates to do their risk assessment.

ACTIVITY 2

No specific equipment is required for this activity, however candidates should have access to a calculator.

Candidate Name	Centre Number					Candidate Number				
						0				

GCSE

APPLIED SCIENCE (Single Award)

UNIT 3: (Single Award) TASK BASED ASSESSMENT

ACTIVITY 1

FOUNDATION TIER

SAMPLE ASSESSMENT PAPER

(3 hours)

For Examiner's use only		
Skill Area	**Maximum Mark**	**Mark Awarded**
Planning	**17**	
Collecting and Recording	**13**	
Analysis	**10**	
Evaluation	**5**	
Total	**45**	

ADDITIONAL MATERIALS
In addition to this paper you will require a calculator and CLEAPSS Student Safety sheets.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

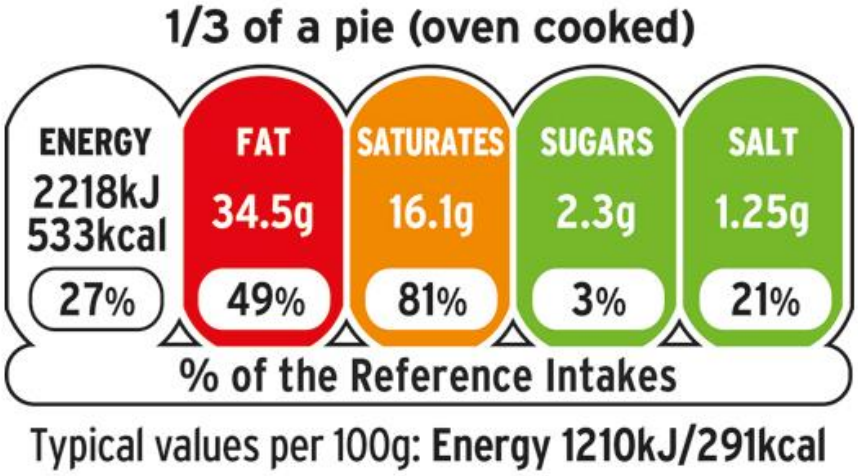
INFORMATION FOR CANDIDATES
Assessment will take into account the quality of your writing.

Background

As a society, we are increasingly aware of the food that we consume and the amount of energy that we take in compared to the amount of energy that we use.

Food packaging now has nutritional information that tells us how much energy is contained in the food that we eat.

Releasing the energy by burning gives an insight into the total energy available in a sample of foodstuff.



Assessment summary

You will need to:

1. Plan (task A)

Plan a suitable procedure(s) that will allow you to find out the energy content of **5** different snack foods.

Include a risk assessment for the main hazards in your procedure.

2. Collect and record data (task B)

Use your procedure to **collect and record** data to find out the energy content of **5** different snack foods.

3. Analyse the data and draw conclusions (task C)

Analyse your data to find out the energy content of **5** different snack foods.

You may find the following equation useful:

$$\text{Energy released from food per gram (J)} = \frac{\text{mass of water (g)} \times \text{temperature rise (°C)} \times 4.2}{\text{mass of food sample (g)}}$$

4. Evaluate the data and procedure (task D)

Evaluate (comment on) the **quality** of your data and the **method** you used. Consider the **changes** you could make to the procedure to improve your investigation.

Task A Planning

Plan suitable procedure(s) that will allow you to find out the energy content of **5** different snack foods.

Include a risk assessment for the main hazards in your procedure.

What equipment/materials will be available to you?

- Boiling tube
- Clamp stand, boss and clamp
- Bunsen burner
- Mounted needle or tongs
- forceps
- Measuring cylinder, 50 cm^3
- pipettes
- snack foods
- Thermometer
- water
- pencil
- ruler

Points to note:

- Do not feel that you have to use all the equipment above when you plan your investigation.
- Do not feel that you are restricted to the equipment above – you may wish to use other equipment if it is available.

What variable will you change in your experiment?

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What variable(s) do you need to you keep the same in your experiment?

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What will you measure in your experiment?

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What equipment will you use?

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How will you carry out your experiment?

In the space below write a step-by step plan. You should start each step on a new line and call them step 1, step 2 and so on.

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Carry out a risk assessment for the main hazards in your procedure by filling in the table below.

Material/activity	**Hazard**	**Risk** What might go wrong?	**Control Measures** What precaution should I take?

Material/activity	**Hazard**	**Risk** What might go wrong?	**Control Measures** What precaution should I take?

Task B Carry out your method to collect data

Use your procedure to **collect and record** data that will allow you to find out the energy content of **5** different snack foods.

You may find the following equation useful:

$$\text{Energy released from food per gram (J)} = \frac{\text{mass of water (g) x temperature rise (ºC) x 4.2}}{\text{mass of food sample (g)}}$$

*This page is for recording your results when you do the experiment. It **must either be** all be your **own** work or if you work in a group your data must be easily identifiable.*

Your teacher can also give you a different sheet with gaps for you to fill in your results if you are not sure of the best way of recording your results.

Data collection (continued)

Task C Analyse your data and make conclusions.

You must now **present** and **analyse** the data that you have gained from your experiment.

Your teacher may also give you some extra experimental results.
Graph paper is provided.

Which food contains the most energy?

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How do you know this?

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Put the food in order of energy content (the highest first).

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What advice would you give consumers who wanted to reduce their body mass?

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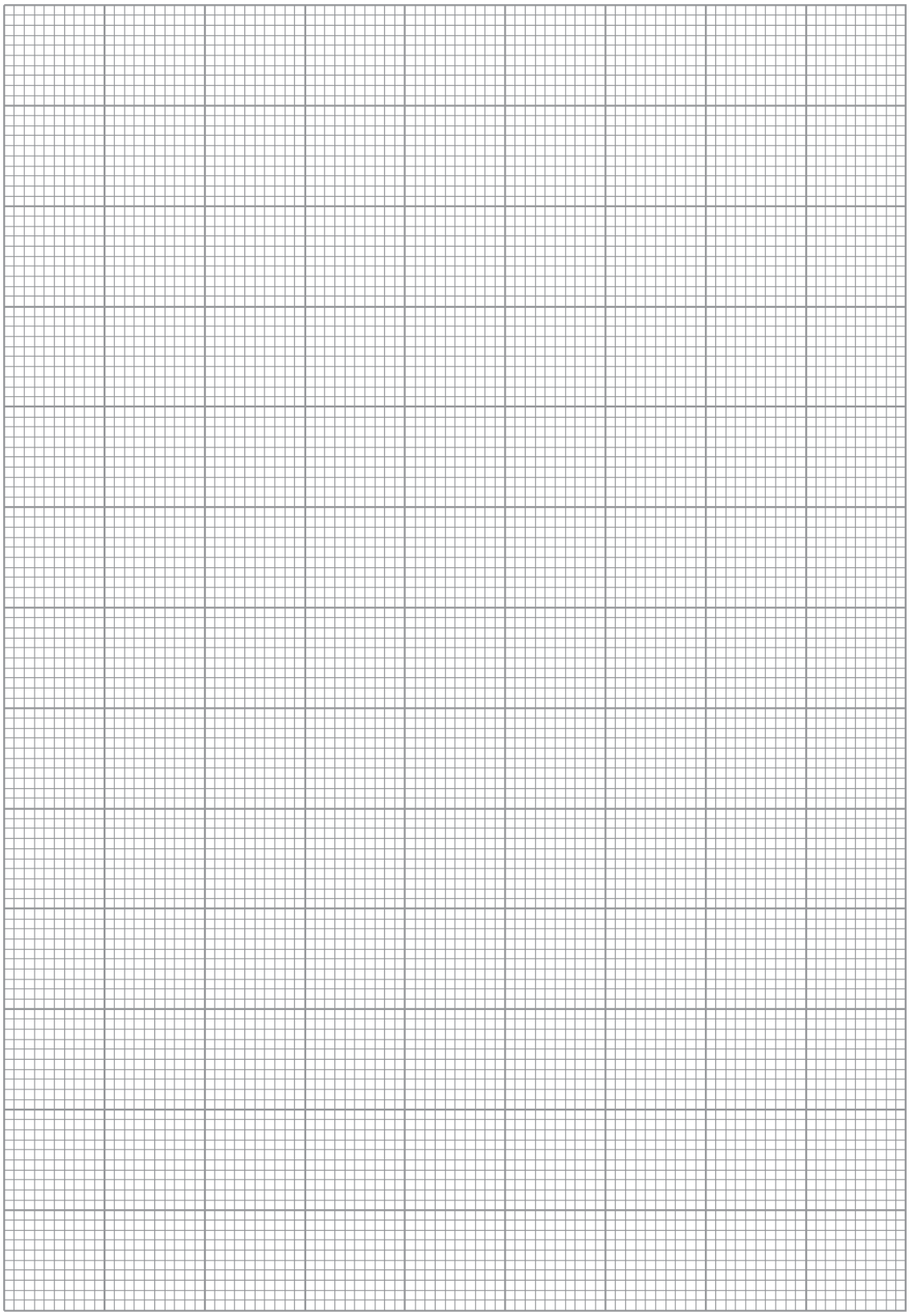

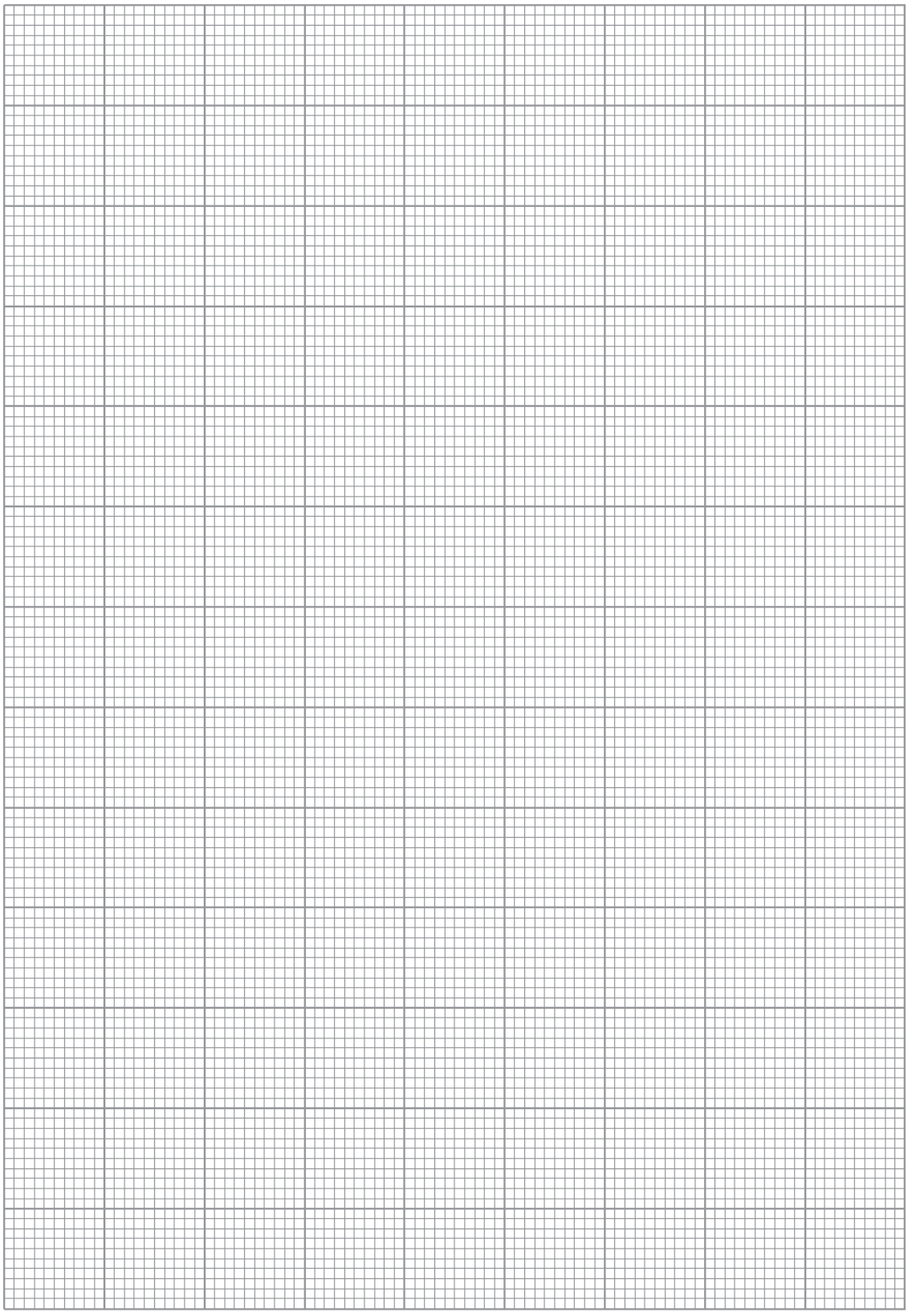

Task D Evaluate

Evaluate the **method** that have been used:

➢ how suitable was your method?

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➢ were there any causes of inaccuracy in your method?

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➢ were there any ways to improve your method?

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Evaluate the **quality** of your data/evidence:

➢ were your results repeatable?

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➢ were there any anomalies or uncertainties in your data?

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➢ were you fully convinced about your conclusions?

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GCSE

APPLIED SCIENCE (Single Award)

UNIT 3: (Single Award) TASK BASED ASSESSMENT

FOUNDATION TIER

RESOURCE FOLDER FOR USE WITH ACTIVITY 2

Energy in Food

Background

Food scientists at 'We just eat and Co.' have produced a new type of crisp in four different flavours. They wanted to find out the energy content of their new crisps.

In this assessment you need to analyse the energy content of different flavours of crisp and find out what flavour is most suitable for somebody following a 'low energy diet'.

What do you need to do?

You are provided with data from two experiments. You will be required to analyse the data and come to a conclusion.

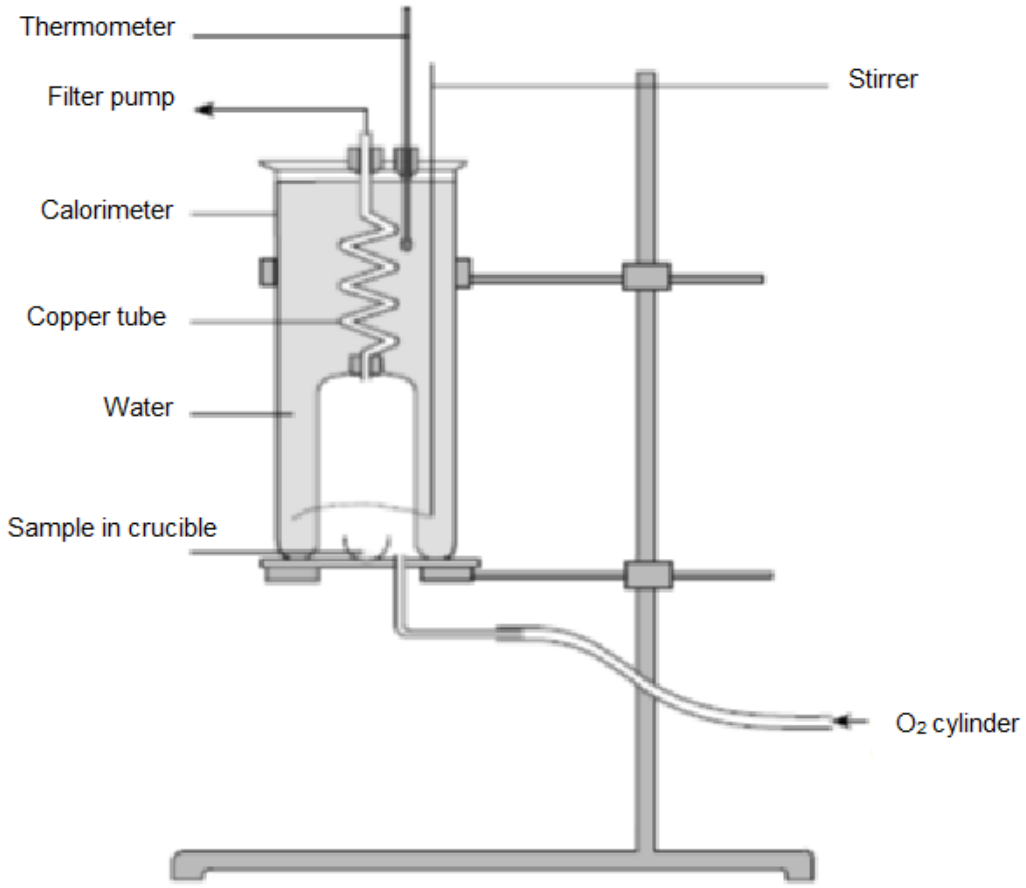
Food scientists have measured the energy content of food by two methods. You will analyse the data given and find out what flavour is most suitable for somebody following a 'low energy diet'.

Method 1: Calorimetry

Food scientists can use a purpose built device called a food calorimeter to measure the amount of energy in food.

The energy value of a food can be found by burning it in the calorimeter and measuring the energy that is given out as heat.

The calorimeter contains a known mass of water, a stirrer and a thermometer. The food to be burned is placed in a nickel crucible and put in an oxygen rich atmosphere. The food is set alight and the rise in temperature of the water is measured when the food burns



Food scientists at 'We just eat and Co.' obtained the following data:

Flavour of crisp	Mass of crisp (g)	Energy released (kJ)
Spikey chilly	2	49.6
Spikey chilly	12	235
Spikey chilly	4	85.2
Sausage and beans	1	22.1
Sausage and beans	3	68.4
Sausage and beans	5	111.3
Cheesy pizza	8	188.9
Cheesy pizza	1	25.5
Cheesy pizza	6	146.4
Chicken tikka	3	78.2
Chicken tikka	1	24.0
Chicken tikka	2	49.7

Method 2: Estimation by energy density

Food scientists can use the list of recipe components and data for energy densities to estimate a product's energy content. This means that they only consider the 'digestible' components of food in their calculations.

'We just eat and Co.' obtained the following data for their new flavors of crisp:

Flavour of crisp	Energy content in 100 g of crisp (kJ)
Spikey chilly	2215
Sausage and beans	2100
Cheesy pizza	2224
Chicken tikka	2213

Candidate Name	Centre Number					Candidate Number				
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GCSE

APPLIED SCIENCE (Single Award)

UNIT 3: (Single Award) TASK BASED ASSESSMENT

ACTIVITY 2

FOUNDATION TIER

SAMPLE ASSESSMENT PAPER

(1 hour)

For Examiner's use only		
Skill Area	**Maximum Mark**	**Mark Awarded**
Analysis	**10**	
Evaluation	**5**	
Total	**15**	

ADDITIONAL MATERIALS
In addition to this paper you will require a calculator.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES
Assessment will take into account the quality of your writing.

Task A: Analysis

Analyse the data given for the calorimetry experiment **(method 1):**

- Calculate the energy released **per gram** for each flavour crisp. Enter your values into the table below (some have been calculated for you).

- Calculate the **mean** energy released per gram for each flavour of crisp. Enter your values into the table below (some have been calculated for you).

  The first two flavours have been done for you.

Flavour of crisp	Mass of crisp (g)	Energy released (kJ)	Energy released (kJ/g)	Mean energy released (kJ/g)
Spikey chilly	2	49.6	24.8	21.9
Spikey chilly	12	235	19.6	
Spikey chilly	4	85.2	21.3	
Sausage and beans	1	22.1	22.1	22.3
Sausage and beans	3	68.4	22.8	
Sausage and beans	5	111.3	22.7	
Cheesy pizza	8	188.9	……..	……..
Cheesy pizza	1	25.5	……..	
Cheesy pizza	6	146.4	……..	
Chicken tikka	3	78.2	……..	……..
Chicken tikka	1	24.0	……..	
Chicken tikka	2	49.7	……..	

Space for working

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State what flavour of crisp would be the best for somebody on a 'low energy diet'?

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Explain why you came to this conclusion.

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The space below is for any other points you wish to make about the results of method 1.

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Analyse the data given for the energy density experiment **(method 2):**

Calculate the energy content **per gram** for each flavour crisp. Enter your value into the table below.

Flavour of crisp	**Energy content in 100 g of crisp (kJ)**	**Energy content (kJ/g)**
Spikey chilly	2215	.....
Sausage and beans	2100	.....
Cheesy pizza	2224	.....
Chicken tikka	2213	.....

Space for working

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State what flavour of crisp would be the best for somebody on a 'low energy diet'?

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Explain why you came to this conclusion.

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The space below is for any other points you wish to make about the results of method 2.

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Task B: Evaluation

Evaluate **method 1** (calorimetry):

➢ how suitable was the method?

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➢ were there any causes of inaccuracy?

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➢ ware there any ways to improve the method?

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Evaluate the **quality** of the data for **method 1**:

➢ were the results repeatable?

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➢ were there any anomalies or uncertainties in the data

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➢ were you fully convinced about your conclusions?

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Extra Space

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Evaluate **method 2** (energy density):

➢ how suitable was the method?

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➢ were there any causes of inaccuracy?

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➢ ware there any ways to improve the method?

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Evaluate the **quality** of the data for **method 2**:

➢ were the results repeatable?

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➢ were there any anomalies or uncertainties in the data

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➢ were you fully convinced about your conclusions?

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➢ did both methods give the same result? Explain your answer.

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END OF PAPER

Candidate Name	Centre Number					Candidate Number				
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GCSE

APPLIED SCIENCE (Single Award)

UNIT 3: (Single Award) TASK BASED ASSESSMENT

ACTIVITY 1

HIGHER TIER

SAMPLE ASSESSMENT PAPER

(3 hours)

For Examiner's use only		
Skill Area	**Maximum Mark**	**Mark Awarded**
Planning	**17**	
Collecting and Recording	**13**	
Analysis	**10**	
Evaluation	**5**	
Total	**45**	

ADDITIONAL MATERIALS
In addition to this paper you will require a calculator and CLEAPSS Student Safety sheets.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

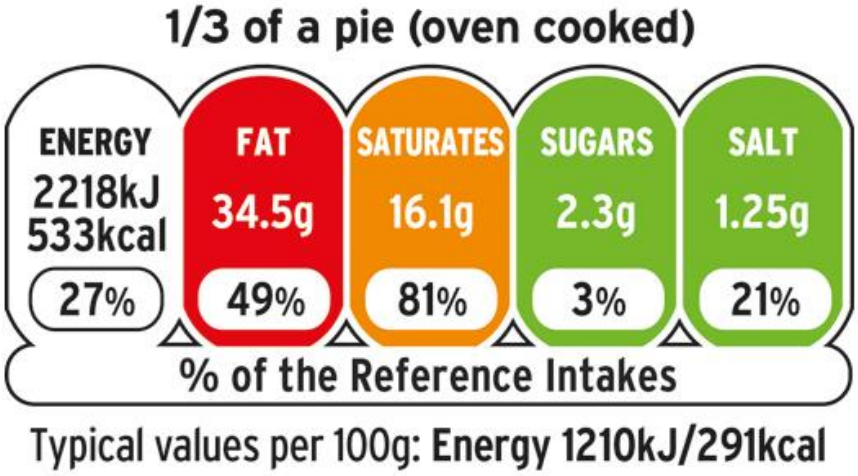
INFORMATION FOR CANDIDATES
Assessment will take into account the quality of your writing.

Background

As a society, we are increasingly aware of the food that we consume and the amount of energy that we take in compared to the amount of energy that we use.

Food packaging now has nutritional information that tells us how much energy is contained in the food that we eat.

Releasing the energy by burning gives an insight into the total energy available in a sample of foodstuff.



Assessment summary

You will need to:

1. Plan (task A)

Plan a suitable procedure(s) that will allow you to find out the energy content of **5** different snack foods.

Include a risk assessment for the main hazards in your procedure.

2. Collect and record data (task B)

Use your procedure to **collect and record** data to find out the energy content of **5** different snack foods.

3. Analyse the data and draw conclusions (task C)

Analyse your data to find out the energy content of **5** different snack foods.

You may find the following equation useful:

$$\text{Energy released from food per gram (J)} = \frac{\text{mass of water (g) x temperature rise (ºC) x 4.2}}{\text{mass of food sample (g)}}$$

4. Evaluate the data and procedure (task D)

Evaluate (comment on) the **quality** of your data and the **method** you used. Consider the **changes** you could make to the procedure to improve your investigation.

Task A Planning

Plan suitable procedure(s) that will allow you to find out the energy content of **5** different snack foods.

Include a risk assessment for the main hazards in your procedure.

What equipment/materials will be available to you?

- Boiling tube
- Clamp stand, boss and clamp
- Bunsen burner
- Mounted needle or tongs
- forceps
- Measuring cylinder, 50 cm^3
- pipettes
- snack foods
- Thermometer
- water
- pencil
- ruler

Points to note:

- Do not feel that you have to use all the equipment above when you plan your investigation.
- Do not feel that you are restricted to the equipment above – you may wish to use other equipment if it is available.

Plan suitable procedure(s) that will allow you to find out the energy content of **five** different snack foods.

Include a risk assessment for the main hazards in your procedure.

Include a list of equipment you need with your method.

Planning (continued)

Carry out a risk assessment for the main hazards in your procedure by filling in the table below

Material/activity	Hazard	Risk	Control Measures

Material/activity	Hazard	Risk	Control Measures

Task B Carry out your method to collect data

Use your procedure to **collect and record** data that will allow you to find out the energy content of **5** different snack foods.

You may find the following equation useful:

$$\text{Energy released from food per gram (J)} = \frac{\text{mass of water (g) x temperature rise (ºC) x 4.2}}{\text{mass of food sample (g)}}$$

*This page is for recording your results when you do the experiment. It **must either be** all be your **own** work or if you work in a group your data must be easily identifiable.*

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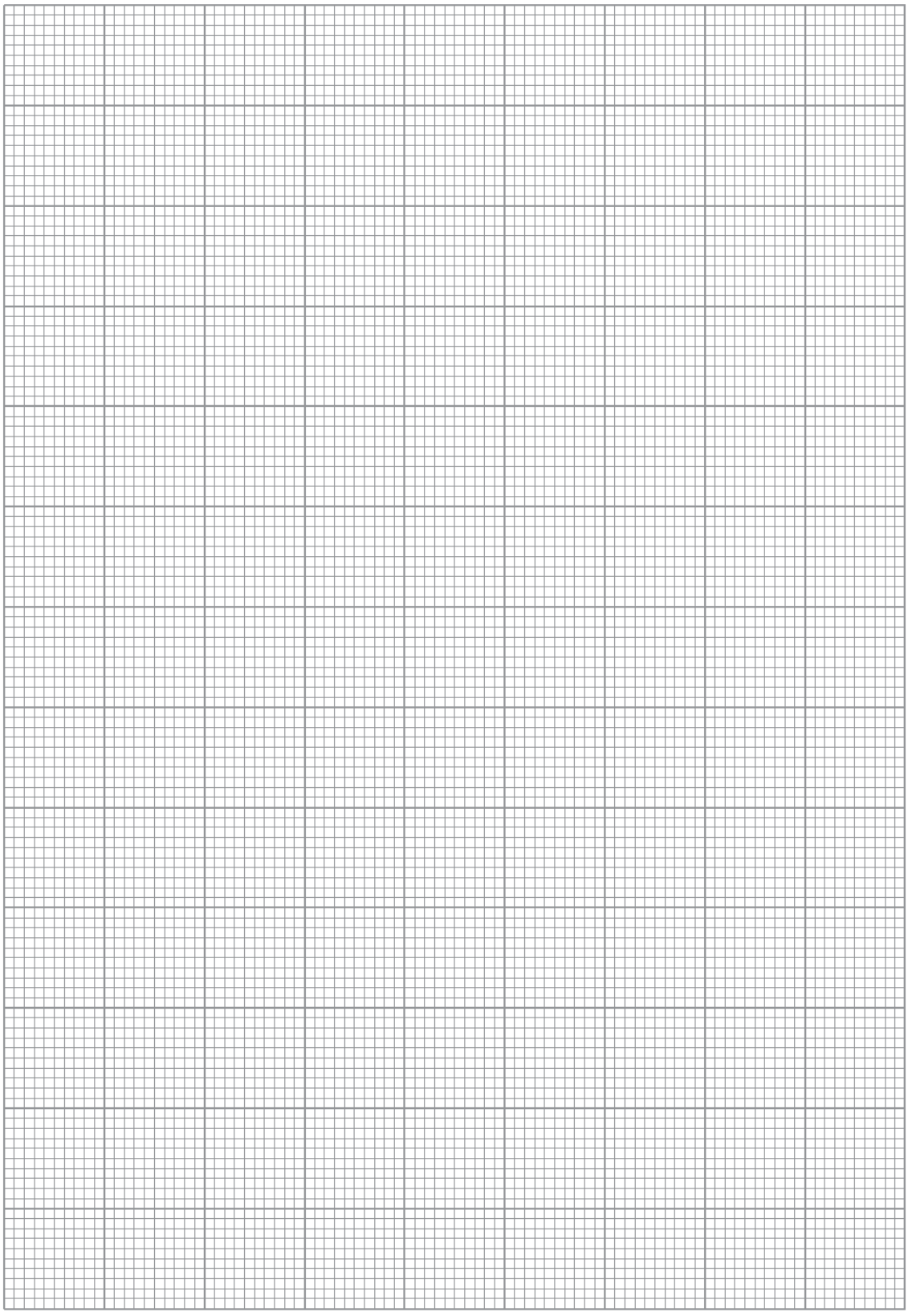
Data collection (continued)

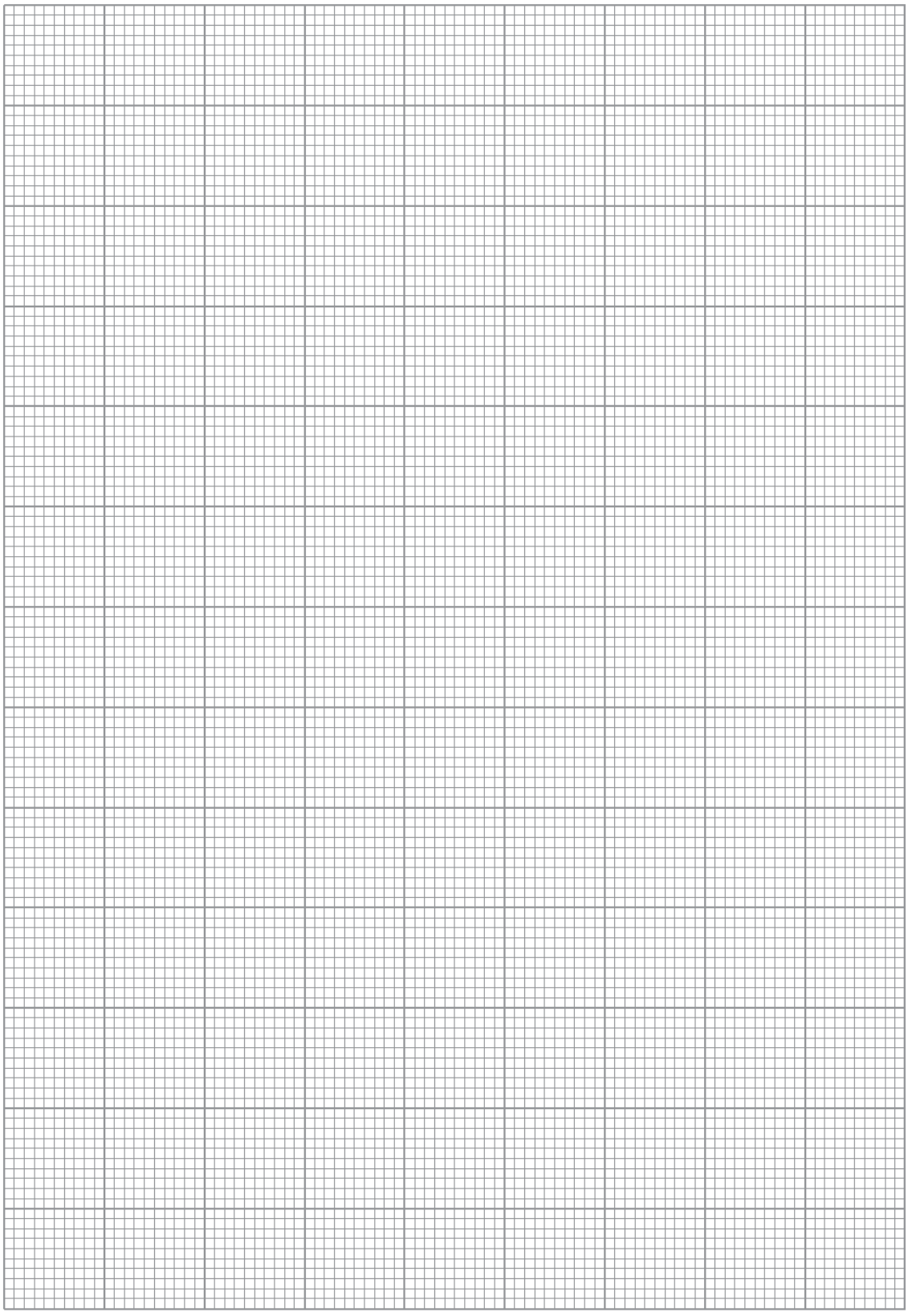
Task C Analyse your data and make conclusions.

You must now **present** and **analyse** the data that you have gained from your experiment.

Graph paper is included

Analysis (continued)





Task D Evaluate

Evaluate your procedure and the quality of data collected.

Evaluate (continued)

GCSE

APPLIED SCIENCE (Single Award)

UNIT 3: (Single Award) TASK BASED ASSESSMENT

HIGHER TIER

RESOURCE FOLDER FOR USE WITH ACTIVITY 2

Energy in Food

Background

Food scientists at 'We just eat and Co.' have produced a new type of crisp in four different flavours. They wanted to find out the energy content of their new crisps.

In this assessment you need to analyse the energy content of different flavours of crisp and find out what flavour is most suitable for somebody following a 'low energy diet'.

What do you need to do?

You are provided with data from two experiments. You will be required to analyse the data and come to a conclusion.

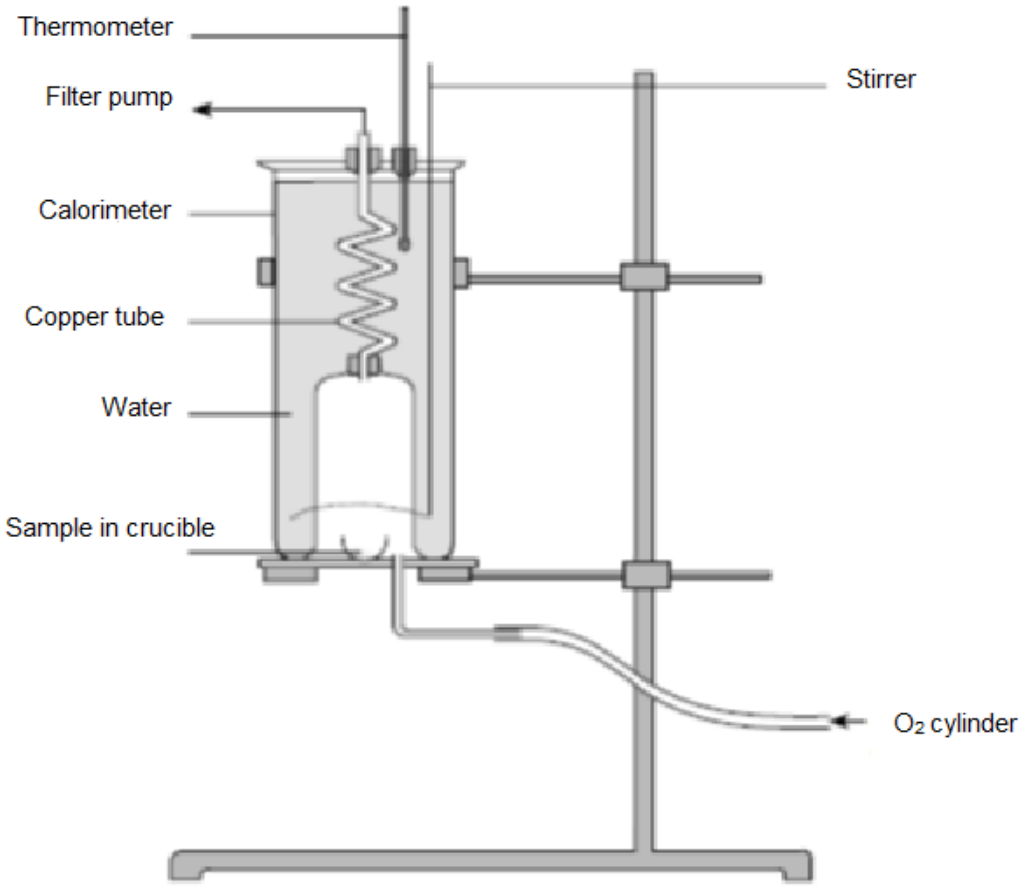
Food scientists have measured the energy content of food by two methods. You will analyse the data given and find out what flavour is most suitable for somebody following a 'low energy diet'.

Method 1: Calorimetry

Food scientists can use a purpose built device called a food calorimeter to measure the amount of energy in food.

The energy value of a food can be found by burning it in the calorimeter and measuring the energy that is liberated as heat.

The calorimeter contains a known mass of water, a stirrer and a thermometer. The food to be burned is placed in a nickel crucible and put in an oxygen rich atmosphere. The food is ignited, by an electrical device, and the rise in temperature of the water during combustion is measured.



Food scientists at 'We just eat and Co.' obtained the following data:

Flavour of crisp	Mass of crisp (g)	Energy released (kJ)
Spikey chilly	2	49.6
Spikey chilly	12	235
Spikey chilly	4	85.2
Sausage and beans	1	22.1
Sausage and beans	3	68.4
Sausage and beans	5	111.3
Cheesy pizza	8	188.9
Cheesy pizza	1	25.5
Cheesy pizza	6	146.4
Chicken tikka	3	78.2
Chicken tikka	1	24.0
Chicken tikka	2	49.7

Method 2: Estimation by energy density

Food scientists can use the list of recipe components and data for energy densities to estimate a product's energy content. This means that they only consider the 'digestible' components of food in their calculations.

'We just eat and Co.' obtained the following data for their new flavors of crisp:

Flavour of crisp	Energy content in 100 g of crisp (kJ)
Spikey chilly	2215
Sausage and beans	2100
Cheesy pizza	2224
Chicken tikka	2213

Candidate Name	Centre Number					Candidate Number				
						0				

GCSE

APPLIED SCIENCE (Single Award)

UNIT 3: (Single Award) TASK BASED ASSESSMENT

ACTIVITY 2

HIGHER TIER

SAMPLE ASSESSMENT PAPER

(1 hour)

For Examiner's use only		
Skill Area	**Maximum Mark**	**Mark Awarded**
Analysis	**10**	
Evaluation	**5**	
Total	**15**	

ADDITIONAL MATERIALS

In addition to this paper you will require a calculator.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES
Assessment will take into account the quality of your writing.

Task A: Analysis

Analyse the data given for the two experiments.

Summarise the findings of these experiments.

You should recommend which flavour is the best for somebody trying to reduce their energy intake.

You should also suggest what additional information is needed in order that consumers can make an informed choice about what crisps to eat.

Analysis (continued)

Task B: Evaluation

Evaluate the procedures given and data obtained.

You may wish to consider the following:

- How repeatable is the data?
- What are the drawbacks of these experiments?
- How would you improve these experiments to show which flavour contains the least energy?

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Evaluation (continued)

UNIT 1: (Single Award) TASK BASED ASSESSMENT

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Crossed out responses not replaced should be marked.

A banded mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with all the content statements and the communication statements.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

Generic Mark Scheme for Activity 1

	Level 1	Level 2	Level 3
Planning	The candidate outlines a brief method to solve a practical problem. The candidate makes a plan to collect some relevant data without necessarily controlling variables. There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. Some equipment is identified for the task. Guidance may be required. 1-4	The candidate devises a method to solve a practical problem which, with some changes or elaboration, could be followed by another person. Most variables are controlled. There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. The candidate identifies the equipment needed for the task. 5-8	The candidate devises a method to solve a practical problem, which would enable the investigation to be carried out successfully by another person. All variables are controlled. There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. The candidate identifies the equipment needed for the task, without the inclusion of unnecessary apparatus. 9-11
	The candidate identifies some hazards and risks associated with the activity. Not all significant hazards or risks are identified. 1-2	The candidate identifies the most of the significant hazards and risks associated with the activity. They identify some suitable control measures. 3-4	The candidate accurately describes the significant hazards and risks associated with the activity. Where necessary, they identify suitable and sensible control measures for the hazards/risks listed. 5-6
			Total Available Marks: 17

Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.

Generic Mark Scheme for Activity 1

	Level 1	Level 2	Level 3
Collecting and Recording Data	The candidate uses procedures to collect data of low quality or of limited value or relevance. The quantity of data may be limited 1-2	The candidate uses procedures to collect mainly appropriate data of reasonable quality. The quantity of data is adequate for purposes of investigation. 3-4	The candidate uses procedures to collect data of high quality. The data is suitable and relevant to their investigation. The candidate collects a wide range of data for the investigation. 5-6
	The candidate partially records data or observations into a given template. 1-2	The candidate independently devises methods to record data. Their records of data are clear and largely error free. 3-5	The candidate independently devises their own format for recording results and accurately records data or observations to an appropriate degree of precision. Their data is recorded to a high standard and is easy to follow. All units correctly recorded. 6-7
			Total Available Marks: 13

Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.

Generic Mark Scheme for Activity 1+ 2

	Level 1	Level 2	Level 3
Analysis of Data	The candidate carries out very simple and limited processing of data. The candidate makes a very limited attempt to analyse and interpret data. The candidate gives a simple statement of findings. The candidate demonstrates a limited ability to structure the work in an appropriate way. 1-3	The candidate carries out mainly suitable and appropriate processing of data. The candidate makes an appropriate interpretation of the data using mainly appropriate methods of analysis. The candidate gives detailed conclusions largely consistent with the evidence. The work is well structured and logically argued with relatively minor errors. 4-7	The candidate carries out suitable and appropriate processing of data, transforming data into useful information. The candidate makes a detailed interpretation of data using suitable methods of data analysis. All their work can be easily followed. The candidate makes detailed conclusions consistent with the evidence. They identify and explain all the patterns within the data. The work is logically argued and is well structured. 8-10
			Total Available Marks: 10

Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.

Generic Mark Scheme for Activity 1 and 2

	Level 1	Level 2	Level 3
Evaluating	The candidate gives a simple evaluation of the data or procedure. 1	The candidate gives a clear evaluation of their investigation/ procedure. The candidate makes an assessment of the validity **and** quality of evidence. 2-3	The candidate gives a detailed evaluation of their investigation/procedure. They suggest suitable/relevant improvements to their method. The candidate makes a detailed assessment of the validity and quality of data. 4-5
			Total Available Marks: 5

Zero marks to be awarded where there is insufficient evidence to achieve a mark at level 1.

Skill Area	AO1	AO2	AO3	Maths	Prac
Activity 1: Planning	11	6			17
Activity 1: Collecting and recording data	13			2	13
Activity 1: Analysis		9	1	4	10
Activity 1: Evaluation			5		5
Activity 2: Analysis		9	1	4	10
Activity 2: Evaluation			5		5
Total	**24**	**24**	**12**	**10**	**60**

GCSE

APPLIED SCIENCE (Single Award)

UNIT 4: (Single Award) PRACTICAL ASSESSMENT

SAMPLE ASSESSMENT MATERIALS

INSTRUCTIONS TO TEACHERS / EXAMS OFFICERS

Confidential

To be opened on receipt for immediate use by

TEACHERS / EXAMS OFFICERS

This document should be stored securely by the exams officer when not in use by the teacher. Its contents should not be divulged except to those concerned with the preparation of the assessment.

A. General Instructions

1. Each candidate will have to submit the number of tasks indicated in the table below.

Qualification	Number of tasks to be submitted
Biology	1
Chemistry	1
Physics	1
Science (Double Award)	2
Applied Science (Double Award)	2
Applied Science (Single Award)	1

The assessment will need to be completed in the first half of the spring term (i.e. January-February). Each task will be completed in two sessions each of 60 minutes duration.

Each task will have a section A and a section B. Section A and section B will be two separate question papers.

Section A will be completed in session 1 and will involve obtaining results. This will be collected from the candidates at the end of session 1. Section B will be completed in session 2 and will involve the analysis and evaluation of the results. Candidates should be given access to their section A question paper in session 2. **Section B should not be given to candidates until the second session. Both sections should be collected in at the end of session 2.**

2. The assessment should be supervised at all times by a member of staff responsible for teaching GCSE Science. Centres may use additional laboratories, provided that a subject teacher is available to supervise all groups at all times.

3. Teachers may open the **"Setting up Instructions"** document at the start of January. **This is for the purpose of ensuring that the apparatus functions well enough for the candidates to complete the task fully. Teachers are encouraged to try out the task, whilst preserving the confidentiality of the assessment.**

4. The question papers for all tasks will be made available to the examinations officer in each centre at the start of January.

5. **Section A**: It is permissible for candidates to work in small groups, of no more than three candidates. Teachers should ensure that each group has adequate working space and that the groups are set a reasonable distance apart. Each group requires uninterrupted access to the allocated apparatus – one set of apparatus per group. This is carried out under a limited level of control, i.e. learners may work with others to obtain results but they must provide their own responses to the questions set. Teacher assistance should not normally be required, but may be given if equipment failure occurs.

6. Once section A is completed, the question paper should be securely stored by the teacher until the section B assessment takes place.

7. **Section B**: This is carried out under a high level of control, i.e. learners must work individually. This section is to be completed with no teacher feedback or assistance allowed and under formal supervision. Candidates should have access to their section A question paper, as they need the results obtained in the first session to answer the questions in section B.

8. Candidates should write their answers in the spaces provided on the question paper. Should there be a need for additional space then a standard extension/answer booklet should be provided.

9. If candidates fail to obtain results for section A, it is acceptable for them to be given unformatted teacher results.

10. As soon as both section A and section B have taken place, question papers for each candidate should be attached to each other and then securely stored by the exams officer before they are sent to the examiner by …… at the latest. Teachers should not be given access to the completed question papers after the actual assessments have taken place.

11. The assessment will be externally marked by a WJEC examiner. The name and address of the examiner will be issued to centres by the end of April.

12. Monitoring visits will take place on a random sample of centres to ensure the practical assessment is being administered correctly.

B. Specific Instructions

Details of the apparatus and materials required for the tasks follow.

If any difficulty is experienced in providing the apparatus, WJEC should be informed as soon as possible.

Contacts:

Subject Officer Llinos Wood	**029 2026 5384**	**llinos.wood@wjec.co.uk**
Support Officer Sarah Price	**029 2026 5103**	**sarah.price@wjec.co.uk**

INVESTIGATING THE RATE OF COOLING OF AN INSULATED CONICAL FLASK

Apparatus Required

The following apparatus is required for each group:
(each group should consist of no more than three candidates)

- $1 \times 250\,cm^3$ conical flask
- $1 \times$ thermometer ($-10\,°C$ to $110\,°C$ and resolution $\pm 1\,°C$)
- A **single** layer of bubble wrap to insulate the flask. The bubble wrap can be attached with sellotape or a rubber band
- $1 \times$ stopwatch (resolution $\pm$ 0.01 second)

The following is required for each class:

- Access to recently boiled water (kettle)

GCSE

APPLIED SCIENCE (Single Award)

UNIT 4: (Single Award) PRACTICAL ASSESSMENT

SAMPLE ASSESSMENT MATERIALS

INVESTIGATING THE RATE OF COOLING OF AN INSULATED CONICAL FLASK

SETTING UP INSTRUCTIONS

Confidential

To be opened on …… (date) by TEACHERS

This document should be stored securely by the exams officer when not in use by the teacher. Its contents should not be divulged except to those concerned with the preparation of the assessment.

SECTION A

Introduction

Your task is to investigate the rate of cooling for an insulated flask.

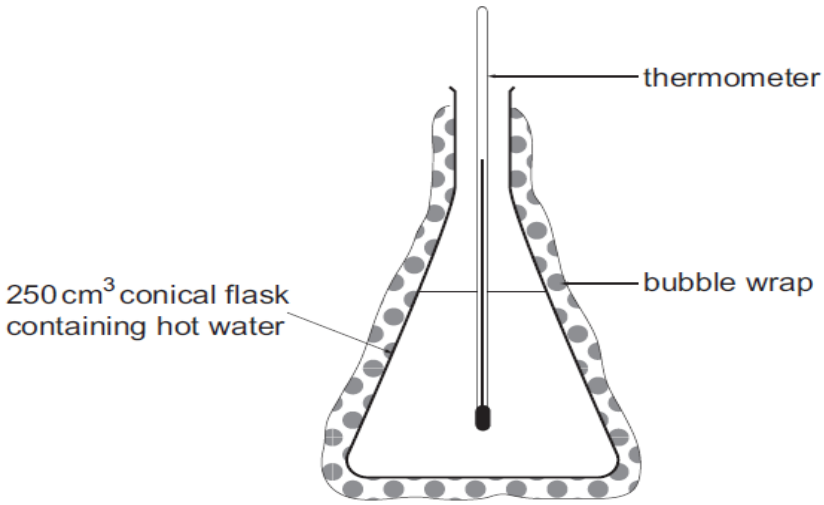
Apparatus

The following apparatus is required for each group:
(each group should consist of no more than three candidates)

- 1 × 250 cm^3 conical flask
- 1 × thermometer (-10 °C to 110 °C and resolution ± 1 °C)
- A **single** layer of bubble wrap to insulate the flask. The bubble wrap can be attached with sellotape or a rubber band
- 1 × stopwatch (resolution ± 0.01 second)

The following is required for each class:

- Access to recently boiled water (kettle)



Method

1. Fill a conical flask to three quarters full with water from a recently boiled kettle.

2. Measure the initial temperature of the water and start the stopwatch immediately.

3. Measure the temperature every minute for 15 minutes.

The remainder of the examination paper is not required for the purpose of checking the setting up of the task.

In order that the work of each candidate may be correctly assessed, information is required about the materials used in the task. Please ensure that the "**Information required from centres**" sheet on page … is completed and given to the exams officer to be sent to the examiner with the completed examination papers.

GCSE

APPLIED SCIENCE (Single Award)

UNIT 4: (Single Award) PRACTICAL ASSESSMENT

SAMPLE ASSESSMENT MATERIALS

INVESTIGATING THE RATE OF COOLING OF AN INSULATED CONICAL FLASK

INFORMATION REQUIRED FROM CENTRES

Centre Number .....

(Please detach and send with the completed examination papers to the **examiner.**)

SPECIFIC DATA REQUIRED:

NONE

Candidate Name	Centre Number					Candidate Number				
						0				

GCSE

APPLIED SCIENCE (Single Award)

UNIT 4: (Single Award) PRACTICAL ASSESSMENT

SAMPLE ASSESSMENT MATERIALS

INVESTIGATING THE RATE OF COOLING OF AN INSULATED CONICAL FLASK

SECTION A

(1 hour)

For Examiner's use only		
	Maximum Mark	**Mark Awarded**
Section A	**6**	

ADDITIONAL MATERIALS
In addition to this paper you will require a calculator.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES
The total number of marks available for this section of the task is 6.
The number of marks is given in brackets at the end of each question or part question.
This task is in 2 sections, **A** and **B**. You will complete section **A** in one session and section **B** in the next session.

SECTION A

Introduction

Your task is to investigate the rate of cooling for an insulated flask.

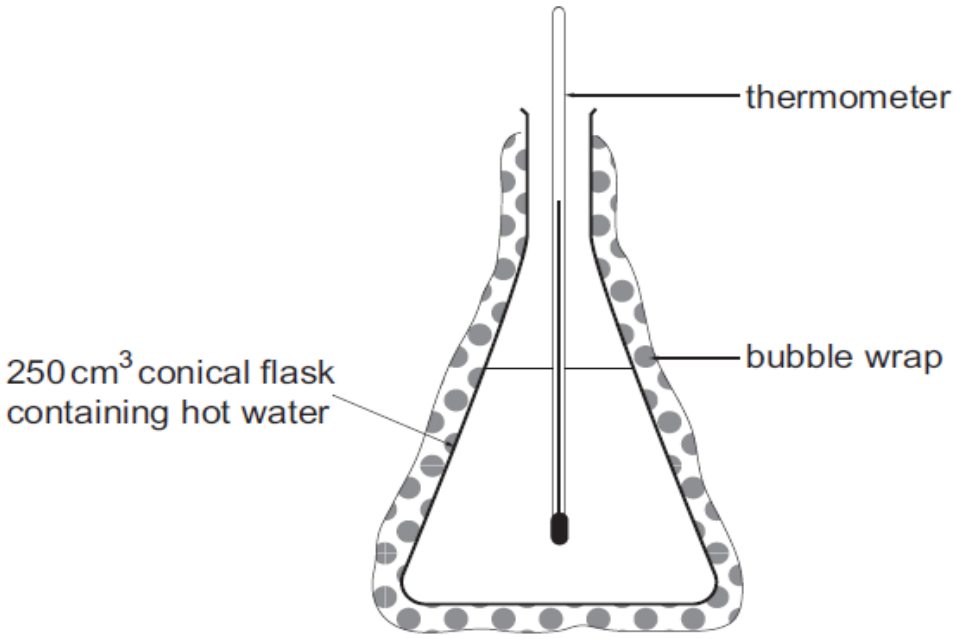
Apparatus

The following apparatus is required for each group:
(each group should consist of no more than three candidates)

- 1 × 250 cm^3 conical flask
- 1 × thermometer (-10 °C to 110 °C and resolution ± 1 °C)
- A **single** layer of bubble wrap to insulate the flask. The bubble wrap can be attached with sellotape or a rubber band
- 1 × stopwatch (resolution ± 0.01 second)

The following is required for each class:

- Access to recently boiled water (kettle)



Read the method and answer questions 1(a) and (b) before carrying out the experiment and recording your results.

Method

1. Fill a conical flask to three quarters full with water from a recently boiled kettle.

2. Measure the initial temperature of the water and start the stopwatch immediately.

3. Measure the temperature every minute for 15 minutes.

Answer **all** *questions*

1. (a) Identify the main hazard and risk associated with this experiment and describe an appropriate control measure. [2]

HAZARD	RISK	CONTROL MEASURE

(b) Make a hypothesis for this experiment. [1]

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You may record raw results in the space below.

(c) Present all your results in a table. [3]

Candidate Name	Centre Number					Candidate Number				
						0				

GCSE

APPLIED SCIENCE (Single Award)

UNIT 4: (Single Award) PRACTICAL ASSESSMENT

SAMPLE ASSESSMENT MATERIALS

INVESTIGATING THE RATE OF COOLING OF AN INSULATED CONICAL FLASK

SECTION B

(1 hour)

For Examiner's use only		
	Maximum Mark	**Mark Awarded**
Section B	**24**	

ADDITIONAL MATERIALS
In addition to this paper you will require a calculator and your section **A** exam paper.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES
The total number of marks available for this section of the task is 24.
The number of marks is given in brackets at the end of each question or part question.
This task is in 2 sections, **A** and **B**. You will have completed section **A** in a previous session.

SECTION B

Answer **all** *questions*

2. (a) (i) Identify the independent and dependent variables in this experiment. [2]

independent variable; ……

dependent variable: ……

(ii) Identify **two** variables (other than starting temperature) that you controlled in order to compare your results with other groups [2]

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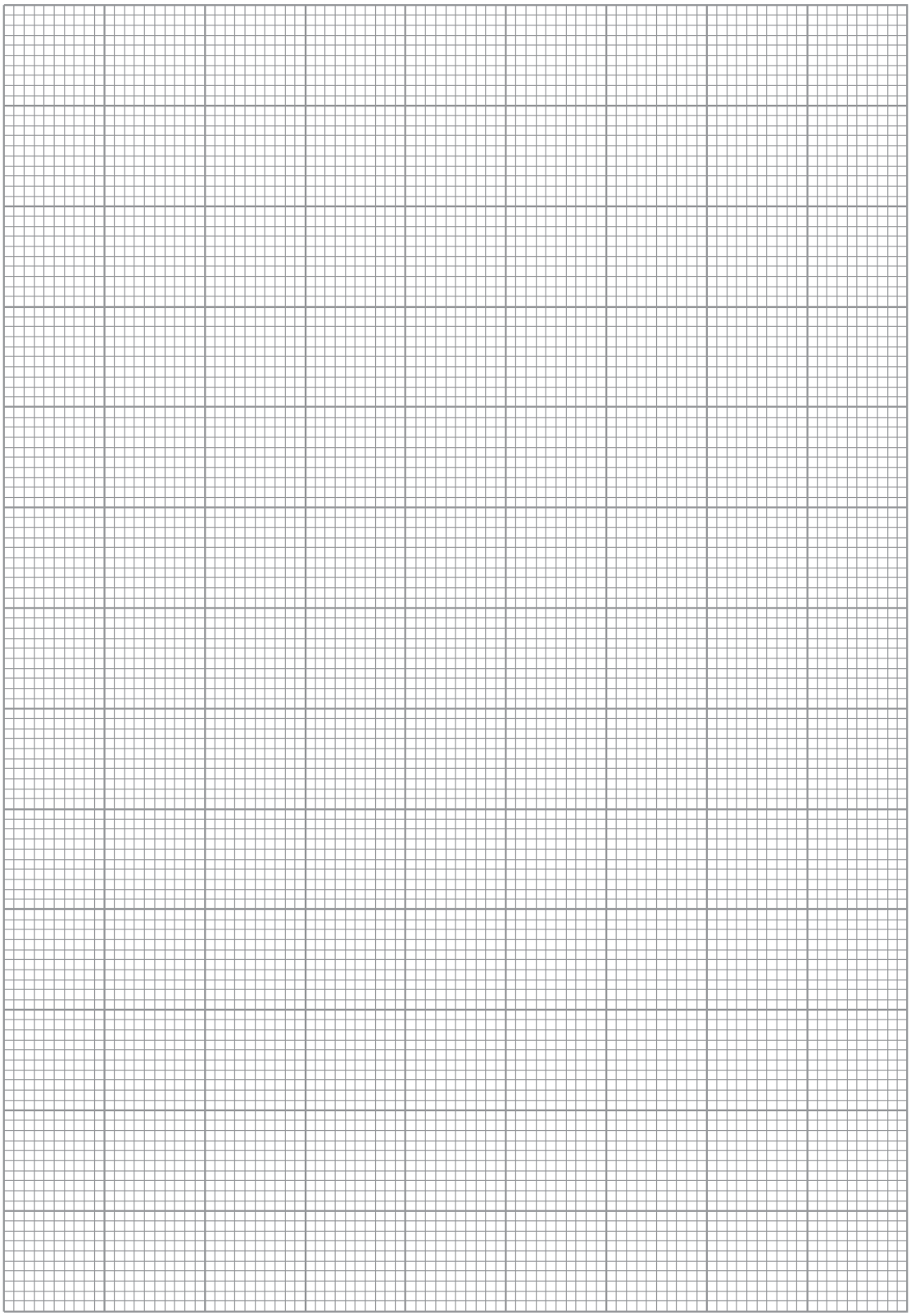
(b) Use your results from section A to draw a graph on the grid below. [5]



(c) Was your prediction in section A correct? Give a reason for your answer. [1]

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(d) Calculate the mean drop in temperature per minute. [2]

mean drop in temperature per minute = …….. °C

(e) (i) **Add a line to the graph** to show the how you would expect uninsulated flask to cool, label the line 'Uninsulated Flask'. [1]

(ii) Explain the difference between the two lines. [2]

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(f) For every 1 °C drop in temperature of 1 000 cm^3 of water 4.2 **kJ** of energy is transferred to the surroundings. Calculate the amount of energy transferred in **Joules** when 250 cm^3 water cools by 10 °C. [3]

Energy transferred = …….. J

(g) State **two** changes that would reduce the heat loss from the flask. [2]

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(h) Write a plan describing how you would carry out an experiment to compare two different insulating materials to discover which one was the more effective at preventing heat loss. You will not be expected to carry out this experiment. [4]

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END OF PAPER

APPLIED SCIENCE (Single Award) UNIT 4: PRACTICAL ASSESSMENT

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

SECTION A

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td></td><td>
<table>
<tr><th>HAZARD</th><th>RISK</th><th>CONTROL MEASURE</th></tr>
<tr><td>Scalding by hot water</td><td>Hot water spilling from flask</td><td>Place the flask on a flat clear surface / take care not to tip the flask when taking thermometer readings</td></tr>
</table>
</td><td>2</td><td></td><td></td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>The temperature of the <u>water</u> in the flask will decrease with time</td><td></td><td>1</td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>All data recorded and logically organised (1)
Headings - time/ temperature(1)
Units – minutes/ °C (1)</td><td>3</td><td></td><td></td><td>3</td><td></td><td>3</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Section A total</td><td>5</td><td>1</td><td>0</td><td>6</td><td>0</td><td>6</td></tr>
</table>

SECTION B

Marking details				Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)	Independent variable - time (1) Dependent variable - temperature (1)	2			2		2
		(ii)	**Any 2 x (1) from:** • Volume of water • thickness of bubble wrap • type of bubble wrap • material of flask	2			2		2
	(b)		Axes labelled correctly with units (1) Scales & use of at least ½ of graph paper (1) All plots correctly plotted with ± ½ small square tolerance (2) 1 error (1) >1 error (0) Smooth curve of best fit within ± ½ small square division of all points (1) Don't accept thick, double, wispy lines	1 1 1	2		5	5	5
	(c)		Suitable comment <u>related to graph</u> (1)	1			1		1
	(d)		Substitution: $\frac{\text{Total temperature drop}}{\text{Total time}}$ (1) Answer = (1)		2		2	2	2
	(e)	(i)	Line / curve drawn below the graph of the experiment		1		1		1
		(ii)	Gradient of uninsulated flask is greater (1) Because heat is lost quicker (1)		2		2		2
	(f)		4.2×10 (1) $42 \times 1\,000$ (1) $\frac{42\,000}{4} = 10\,500$(1)		3		3	3	3
	(g)		Insulate the opening of the flask (1) Cover the flask with silver foil/ another layer of bubble wrap (1)			2	2		2

	(h)		Logical sequence planned (1) Two control variables stated (volume of water/ thickness of insulation/ starting temperature/ size of flask) (1) Clearly states temperature measured at set intervals (1) Clear statement as to how the results will be analysed to establish the most effective insulation – comparison of heat lost (1)			4	4		4
			Section B total	**7**	**11**	**6**	**24**	**10**	**24**