GCSE Science

Spring Hub meetings

Sample high demand questions

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The questions are taken from the first set of sample assessment materials for the separate sciences.

This resource is for use in the discussion about stretch and challenge.

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B2H	Grades 4–5	Grades 6–7	Grades 8–9	AO	Type
09.1		4		1	Knowledge in isolation.
09.2		2	2	1	
09.3		1	2	2	Maths.
09.4			1	3	
09.5			1	2	
09.6		2		3	Interpreting graphs.

0 9 Homeostasis controls the internal conditions of the body.

0 9 . 1 Explain how blood glucose levels are controlled in the body of someone who does **not** have diabetes.

[4 marks]

0 9 . 2 Compare how each type of diabetes is caused.

Suggest how each type of diabetes can be treated.

[4 marks]

0 9 . 3 Look at **Table 5**.

Table 5

Population of UK in 2015	6.5×10^7
Number of people diagnosed with diabetes	3.45×10^6
Estimated number of people with undiagnosed diabetes	5.49×10^5

Calculate the percentage (%) of the UK population estimated to have diabetes.

You should include both diagnosed and undiagnosed people in your calculation.

Give your answer to 2 significant figures.

[3 marks]

Estimated percentage of population with diabetes = ____________ %

0 9 . 4 A urine test can be used to check for the presence of glucose in the urine.

Diabetes can also be diagnosed with a blood test to measure the concentration of blood glucose.

Suggest why a blood test is more reliable than a urine test.

[1 mark]

0 9 . 5 A blood test called the glucose tolerance test checks how well the body processes glucose.

Concentrations of glucose in the blood are measured before and after drinking a glucose drink.

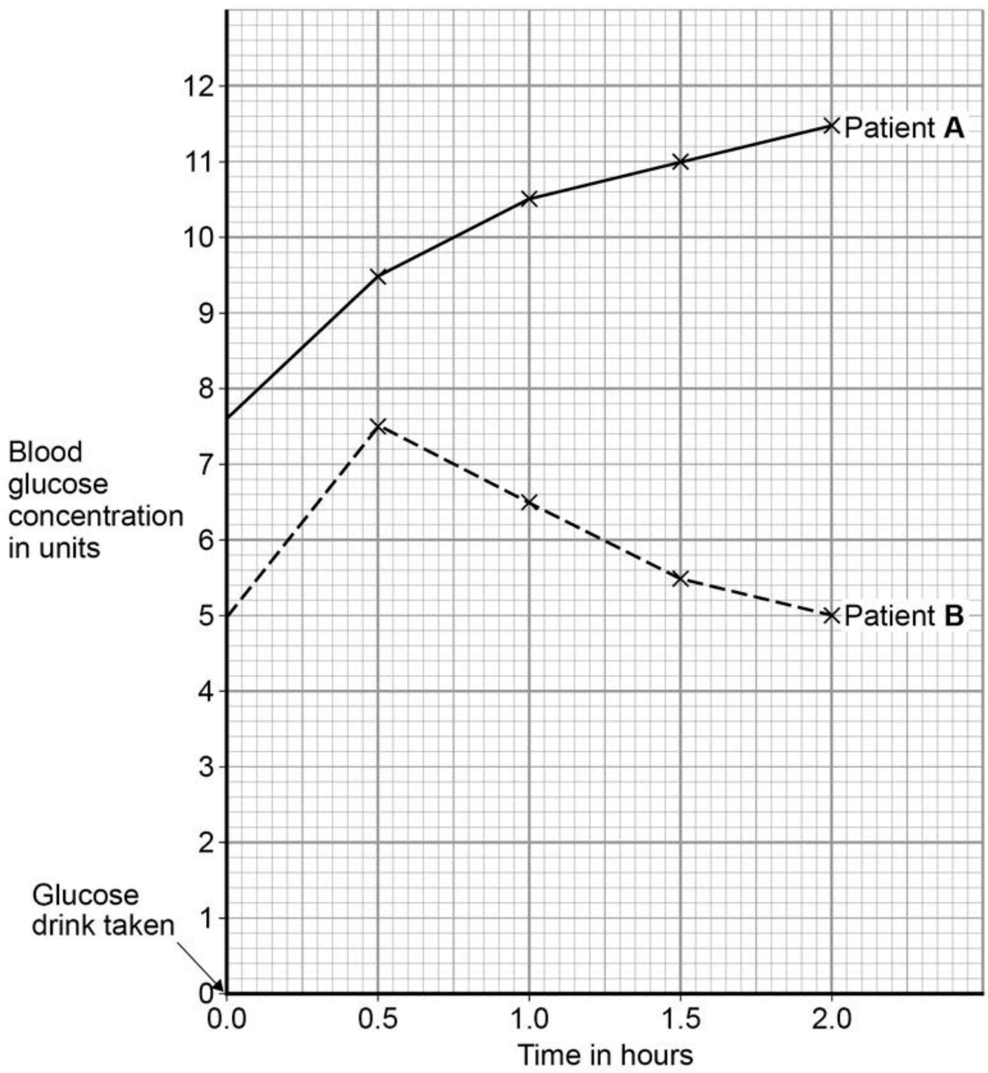
Patients are not allowed to eat food for 8 hours before the glucose tolerance test.

Suggest why patients are **not** allowed to eat for 8 hours before the test.

[1 mark]

0 9 . 6 **Figure 11** shows the results of a glucose tolerance test for two patients, **A** and **B**.

Figure 11



Which patient has diabetes?

Justify your answer.

[2 marks]

Patient ______________________

Justification ______________________

____

B2H	Grades 4–5	Grades 6–7	Grades 8–9	AO	Type
10.1			3	1	
10.2			2	1	
10.3			4	2 3	Applying knowledge to unfamiliar context.

10 Endocrine glands produce hormones.

10.1 Hyperthyroidism is caused by an overactive thyroid gland.

Suggest what would happen in the body of a person with hyperthyroidism.

[3 marks]

10.2 Describe the roles of FSH and LH in the menstrual cycle.

[2 marks]

10.3 The combined pill is a contraceptive that contains progesterone **and** oestrogen.

The 'mini-pill':

- is a contraceptive that **only contains** the progesterone hormone
- has to be taken at the same time each day to prevent pregnancy.

The success rate of the mini-pill in preventing pregnancy is lower than that of the combined pill.

Explain why missing a dose of the mini-pill would reduce the success rate of the mini-pill.

[4 marks]

C1H	Grades 4–5	Grades 6–7	Grades 8–9	AO	Type
8.1		2		1	Knowledge in isolation.
8.2		2		1	Knowledge in isolation.
8.3	2	2		1	Required practical.
8.4	2			2	Maths. Required practical.
8.5		2	2	2	Maths. Required practical.
8.6		2		2	Maths. Required practical.

0 8 Sodium hydroxide neutralises sulfuric acid.

The equation for the reaction is:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

0 8 . 1 Sulfuric acid is a strong acid.

What is meant by a strong acid?

2 marks]

0 8 . 2 Write the ionic equation for this neutralisation reaction. Include state symbols.

[2 marks]

0 8 . 3 A student used a pipette to add 25.0 cm^3 of sodium hydroxide of unknown concentration to a conical flask.

The student carried out a titration to find out the volume of 0.100 mol/dm^3 sulfuric acid needed to neutralise the sodium hydroxide.

Describe how the student would complete the titration.

You should name a suitable indicator and give the colour change that would be seen.

[4 marks]

The student carried out five titrations. Her results are shown in **Table 5**.

Table 5

	Titration 1	Titration 2	Titration 3	Titration 4	Titration 5
Volume of 0.100 mol/dm^3 sulfuric acid in cm^3	27.40	28.15	27.05	27.15	27.15

0 8 . 4 Concordant results are within 0.10 cm^3 of each other.

Use the student's concordant results to work out the mean volume of 0.100 mol/dm^3 sulfuric acid added.

[2 marks]

Mean volume = ____________________ cm^3

0 8 . 5 The equation for the reaction is:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

Calculate the concentration of the sodium hydroxide.

Give your answer to three significant figures.

[4 marks]

Concentration = ____________________ mol/dm^3

0 8 . 6 The student did another experiment using 20 cm^3 of sodium hydroxide solution with a concentration of 0.18 mol/dm^3.

Relative formula mass (M_r) of NaOH = 40

Calculate the mass of sodium hydroxide in 20 cm^3 of this solution.

[2 marks]

Mass = ____________________ g

C1H	**Grades 4–5**	**Grades 6–7**	**Grades 8–9**	**AO**	**Type**
9.1		3		1	Scientific ideas.
9.2		2		1	Scientific ideas.
9.3			3	2	Maths.
9.4		2	4	2 3	Extended response.

0 9 This question is about the reaction of ethene and bromine.

The equation for the reaction is:

$$C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$$

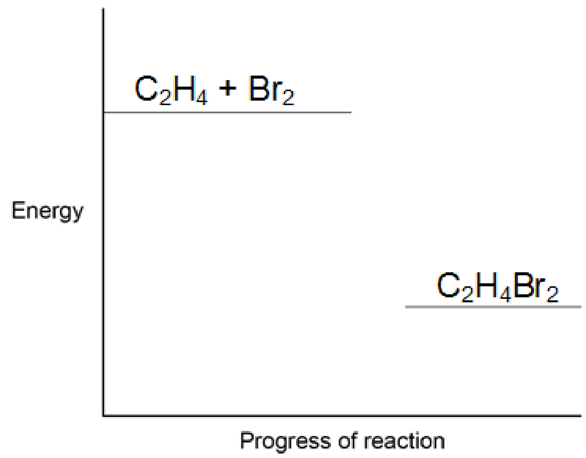
0 9 . 1 Complete the reaction profile in **Figure 6.**

Draw labelled arrows to show:

- The energy given out (ΔH)
- The activation energy.

[3 marks]

Figure 6



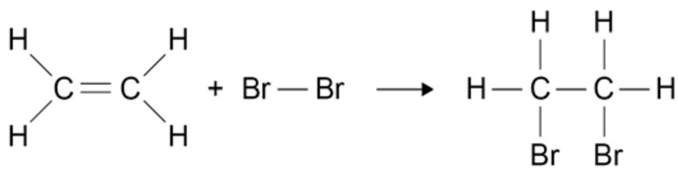
0 9 . 2 When ethene reacts with bromine, energy is required to break covalent bonds in the molecules.

Explain how a covalent bond holds two atoms together.

[2 marks]

Figure 7 shows the displayed formulae for the reaction of ethene with bromine.

Figure 7



The bond enthalpies and the overall energy change are shown in **Table 6**.

Table 6

	C=C	**C−H**	**C−C**	**C−Br**	**Overall energy change**
Energy in kJ/mole	612	412	348	276	-95

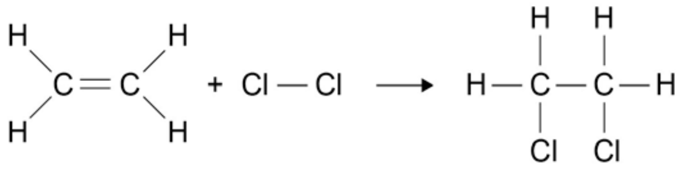
0 9 . 3 Use the information in **Table 6** and **Figure 7** to calculate the bond energy for the Br−Br bond.

[3 marks]

Bond energy ____________________ kJ/mole

0 9 . 4 **Figure 8** shows the reaction between ethene and chlorine and is similar to the reaction between ethene and bromine.

Figure 8



"The more energy levels (shells) of electrons an atom has, the weaker the covalent bonds that it forms."

Use the above statement to predict and explain how the overall energy change for the reaction of ethene with chlorine will differ from the overall energy change for the reaction of ethene with bromine.

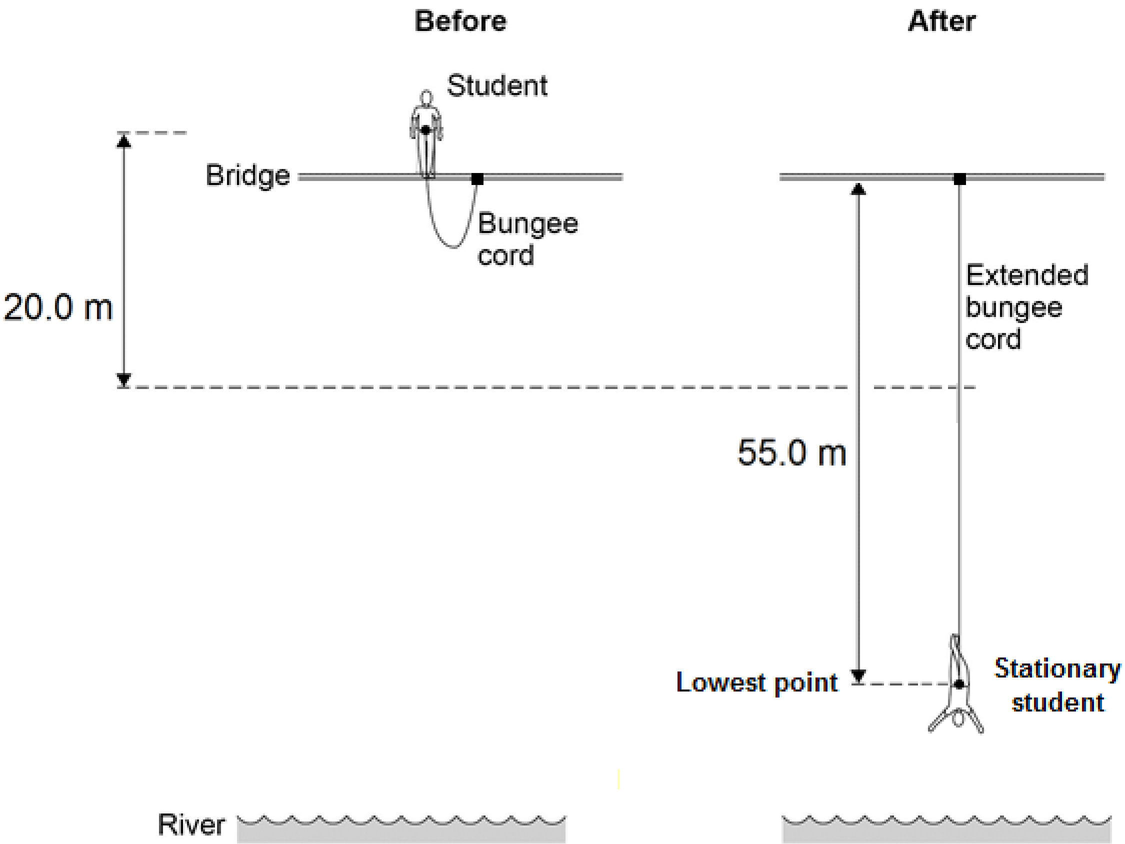
[6 marks]

P1H	Grades 4–5	Grades 6–7	Grades 8–9	AO	Type
11.1	1			1	Recall of equations.
11.2	2			2	Apply equation, show working.
11.3		1		2	Calculation.
11.4		1	3	2	Calculations. Rearranging with a square root.
11.5		3		2	Calculation.

1 1 **Figure 17** shows a student before and after a bungee jump.

The bungee cord has an unstretched length of 20.0 m.

Figure 17



The mass of the student is 50.0 kg.

The gravitational field strength is 9.8 N/kg.

11.1 Write down the equation which links gravitational field strength, gravitational potential energy, height and mass.

[1 mark]

11.2 Calculate the change in gravitational potential energy from the position where the student jumps to the point 20.0 m below.

[2 marks]

Change in gravitational potential energy = ____________________ J

11.3 80% of this change in gravitational potential energy has been transferred to the student's kinetic energy store.

How much has the student's kinetic energy store increased after falling 20.0 m?

[1 mark]

Kinetic energy gained = ____________________ J

11.4 Calculate the speed of the student after falling 20.0 m.

Give your answer to two significant figures.

[4 marks]

Speed = ____________________ m/s

11.5 At the lowest point in the jump, the energy stored by the stretched bungee cord is 24.5 kJ.

The bungee cord behaves like a spring.

Calculate the spring constant of the bungee cord.

Use the correct equation from the Physics Equation Sheet.

[3 marks]

Spring constant = ____________ N / m

P2H	Grades 4–5	Grades 6–7	Grades 8–9	AO	Type
11.1	2			1	
11.2		1		1	
11.3			6	1	Extended response. Linked.

11 Waves may be either longitudinal or transverse.

11.1 Describe the difference between a longitudinal and a transverse wave.

[2 marks]

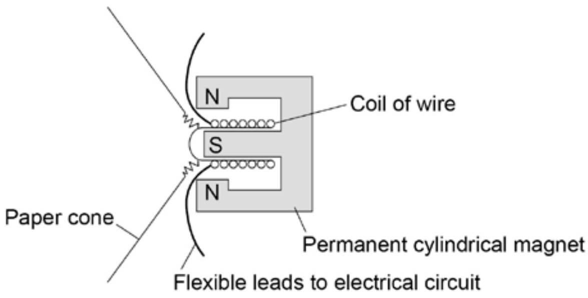
11.2 Describe **one** piece of evidence that shows when a sound wave travels through the air it is the wave and not the air itself that travels.

[1 mark]

1 1 . 3 **Figure 19** shows the parts of a moving-coil loudspeaker.

A coil of wire is positioned in the gap between the north and south poles of the cylindrical magnet.

Figure 19



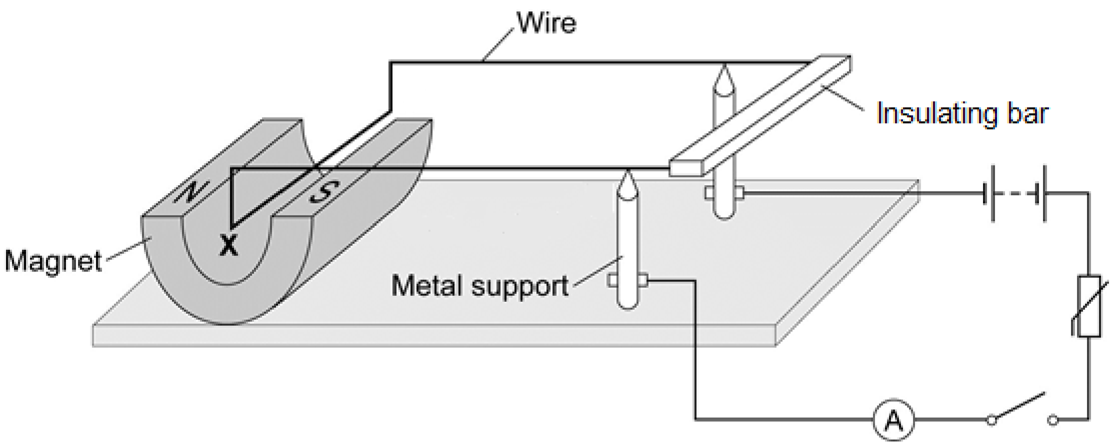
Explain how the loudspeaker converts current in an electrical circuit to a sound wave.

[6 marks]

P2H	Grades 4–5	Grades 6–7	Grades 8–9	AO	Type
12.1		1		1	
12.2		1		2	
12.3		1	5	1 2	Multi step calculation. Linked.

1 2 **Figure 20** shows a piece of apparatus called a current balance.

Figure 20



When the switch is closed, the part of the wire labelled **X** experiences a force and moves downwards.

1 2 . 1 What is the name of the effect that causes the wire **X** to move downwards?

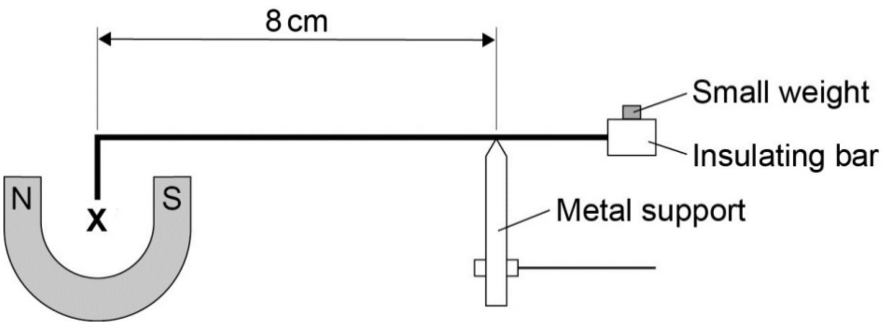
[1 mark]

1 2 . 2 Suggest one change you could make to the apparatus in **Figure 20** that would increase the size of the force that wire **X** experiences.

[1 mark]

Figure 21 shows how a small weight placed on the insulating bar makes the wire **X** go back and balance in its original position.

Figure 21



1 2 . 3 The wire **X** is 5 cm long and carries a current of 1.5 A.

The small weight causes a clockwise moment of 4.8×10^{-4} Nm.

Calculate the magnetic flux density where the wire **X** is positioned

Give the unit.

[1 mark]

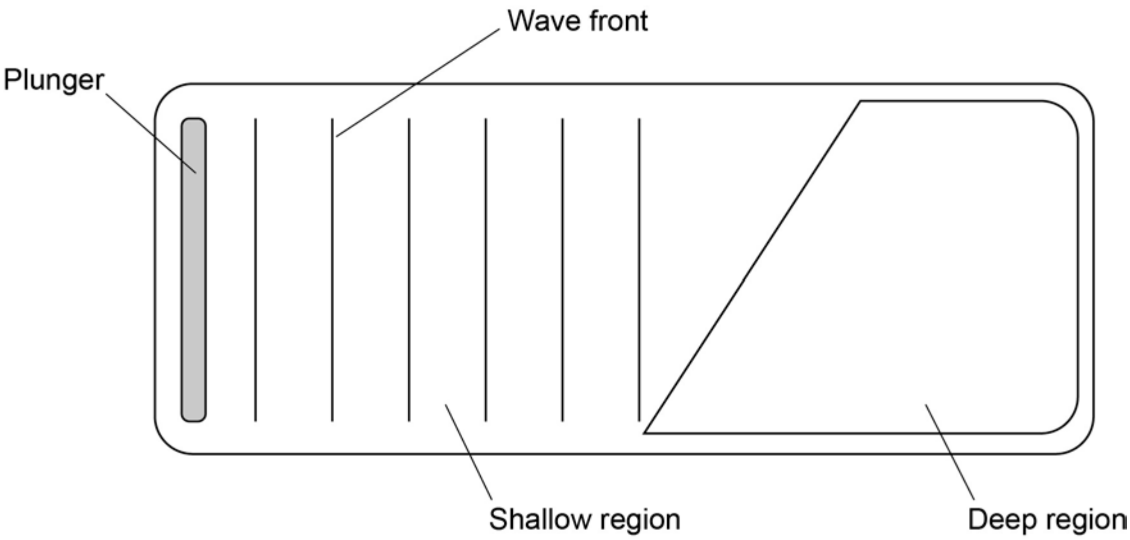
Magnetic flux density = ________________ Unit ________________

Synergy 1H	Grades 4–5	Grades 6–7	Grades 8–9	AO	Type
9.1			1		
9.2			2		
9.3		3			
9.4			2		
9.5		5			

0 9 Some students did an investigation to study the behaviour of waves.

Figure 9 shows a ripple tank that they used to model the behaviour of waves.

Figure 9



0 9 . 1 Complete the wave fronts on **Figure 9**.

Show how the wave is refracted as it passes from the shallow region into the deep region

[1 mark]

0 9 . 2 Explain what happens to the waves as they pass into the deep region.

[2 marks]

0 9 . 3 The waves generated on the surface of the water are transverse waves.

Describe the differences between longitudinal waves and transverse waves.

You may include labelled diagrams to help your answer.

[0 marks]

0 9 . 4 Some students investigate the properties of the waves generated in **Figure 9**.

Student **A** says ‘the waves move water from one end of the tank to the other’.

Student **B** says ‘that’s wrong. Only the waves move, not the water’.

Suggest what the students could do to decide which of them is correct.

[0 marks]

0 9 . 5 Another student uses a ripple tank where all the water is the same depth.

She measures the wavelength of each wave as 0.34 m.

The period of each wave is 0.42 s.

Calculate the speed of the wave.

Use the correct equation from the Physics Equation Sheet.

Give the unit.

Give your answer to three significant figures.

[5 marks]

Speed = ____________________

Unit = ____________________

Synergy 1H	**Grades 4–5**	**Grades 6–7**	**Grades 8–9**	**AO**	**Type**
8.1		2		1	
8.2		3		2	Required practical. Maths.
8.3		3		3	Required practical. Maths.
8.4			5	2	Required practical. Maths.

0 8 A student investigated the effect of light intensity on the rate of photosynthesis in pondweed.

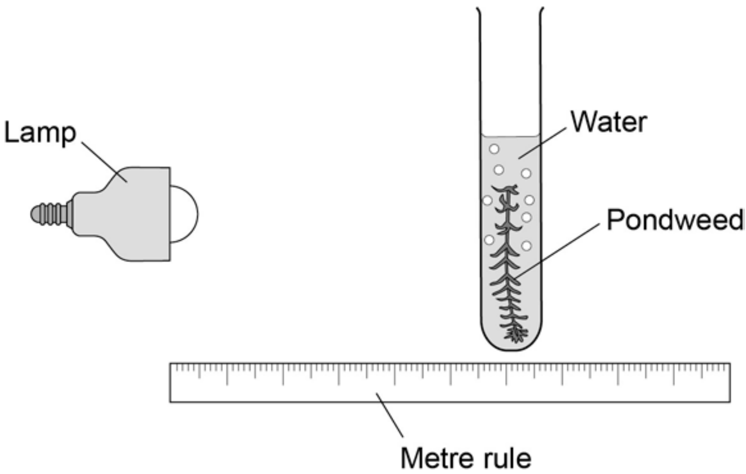
0 8 . 1 The formula for glucose is $C_6H_{12}O_6$

Use the formula for glucose to write the balanced symbol equation for photosynthesis.

[2 marks]

Figure 8 shows the apparatus the student used.

Figure 8



The student altered the distance of the lamp from the pondweed and counted the number of bubbles produced in 30 seconds for each distance.

Table 5 shows the student's results.

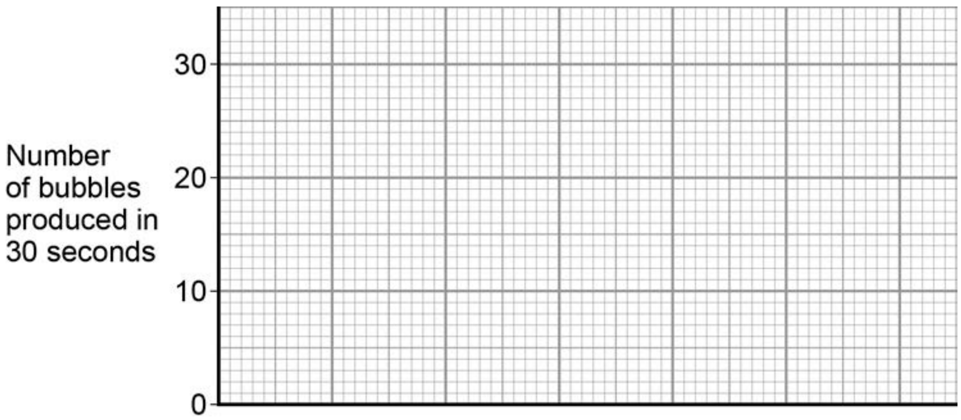
Table 5

Distance in cm	**Number of bubbles produced in 30 seconds**
10	27
20	23
30	16
40	7
50	2

0 8 . 2 Use the data in **Table 5** to complete the graph on **Figure 9**.

[3 marks]

Figure 9



0 8 . 3 The student concluded that the rate of photosynthesis is inversely proportional to the distance of the lamp from the pondweed.

Does the student's data support this conclusion?

Use data from **Figure 9** to justify your answer.

[3 marks]

0 8 . 4 The volume of one bubble can be calculated using the equation:

$$V = 4/3\ \pi\ r^3$$

The radius of one bubble is 0.1 cm.

The value for π is 3.14

Use data from **Table 5** and the information above to calculate the rate of gas production at a distance of 40 cm.

Give your answer in standard form to three significant figures.

[5 marks]

Rate of reaction = ______________________ cm^3 per minute

Synergy 2H	Grades 4–5	Grades 6–7	Grades 8–9	AO	Type
9		6		1	Linked ideas.

0 9 In the last 200 years the concentration of carbon dioxide in the Earth's atmosphere has risen.

Explain how a rise in carbon dioxide concentration in the atmosphere can decrease biodiversity.

[6 marks]

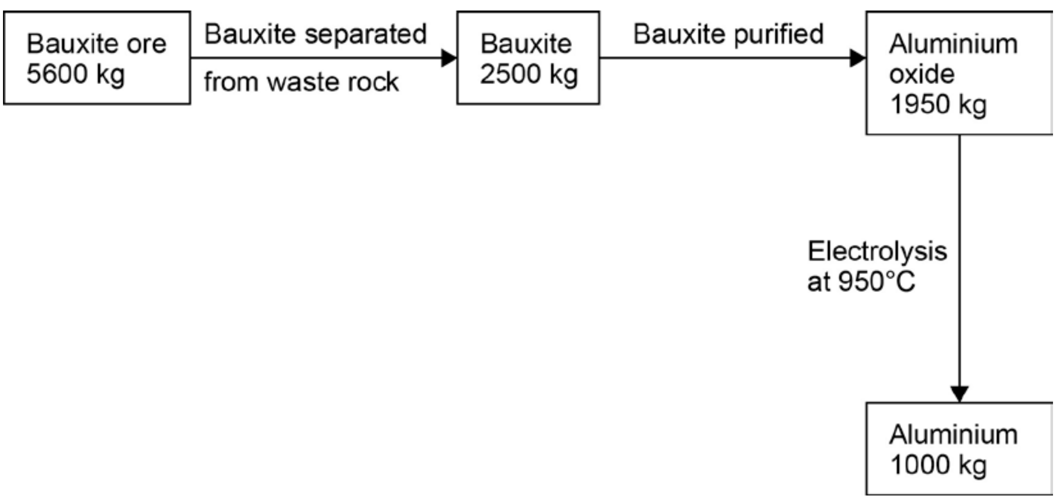
Synergy 3H	Grades 4–5	Grades 6–7	Grades 8–9	AO	Type
6.1	2			2	Maths.
6.2		3		2	Maths.
6.3		3		1	
6.4		5		2	Maths. Linked ideas.
6.5		3		2	Maths.

0 6 Aluminium is produced from an ore called bauxite.

Bauxite contains aluminium oxide.

Look at **Figure 7**.

Figure 7



0 6 . 1 Calculate the percentage of bauxite that is converted into aluminium oxide.

[2 marks]

Percentage = ____________

0 6 . 2 Show by calculation that the mass of aluminium produced is less than that expected from 1 950 kg aluminium oxide (Al_2O_3).

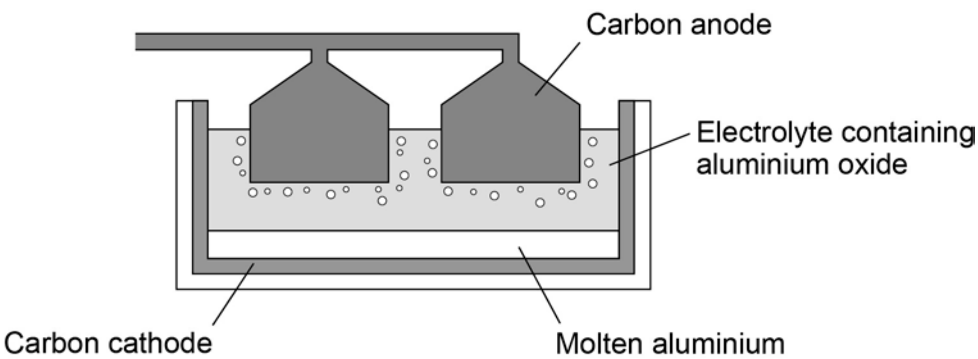
You should state the difference in the mass of aluminium expected and the mass of aluminium produced to three significant figures.

Relative atomic masses (A_r): O = 16; Al = 27

[3 marks]

Figure 8 shows an electrolysis cell used to extract aluminium.

Figure 8



0 6 . 3 Why does the carbon anode used in the electrolysis cell need to be continually replaced?

[3 marks]

0 6 . 4 In an electrolysis cell the current is 1.5×10^5 A, at a potential difference of 4V.

Calculate the energy transferred by the electrolysis cell in 24 hours.

[5 marks]

Energy transferred = ____________________ J

0 6 . 5 The half equation at the cathode is:

$Al^{3+} + 3\,e^{-} \longrightarrow Al$

Calculate the number of moles of electrons needed to produce 1 000 kg of aluminium.

Give your answer to three significant figures.

Relative atomic mass (A_r): Al = 27

[3 marks]

Answer = ____________________ moles

Synergy 4H	Grades 4–5	Grades 6–7	Grades 8–9	AO	Type
10		6		3	Extended response. Linked ideas.

1 0 Read the information about production of copper.

- World demand for copper in 2014 was about 22 million tonnes.
- World reserves of copper are about 700 million tonnes.
- Most of the copper today is obtained from copper ores. The ores are mined.
- Copper ore is heated in a furnace to produce copper sulfide. The furnace is heated by burning fossil fuels. Air is blown through the hot copper sulfide to produce copper and sulfur dioxide.
- Some copper is extracted from low-grade ores by phytomining. Phytomining uses plants to absorb copper compounds. The plants are burned and copper is extracted from the ashes.

A scientist stated:

'more copper should be extracted by phytomining.'

Use the information to justify the scientist's statement.

[6 marks]

Mark scheme

B2H Question 9

Question	Answers	Extra information	Mark	AO / Spec.
09.1	if too high insulin released from pancreas		1	AO1/1 4.5.3.2
	so glucose is moved into cells	allow glucose is stored	1	AO1/1 4.5.3.2
	if too low, glucagon is released (from pancreas)		1	AO1/1 4.5.3.2
	causes glycogen to be converted to glucose and released into the blood		1	AO1/1 4.5.3.2
09.2	type 1 not enough / no insulin produced		1	AO1/1 4.5.3.2
	whereas type 2 cells do not respond to insulin		1	AO1/1 4.5.3.2
	type 1 is treated with injections of insulin		1	AO1/1 4.5.3.2
	whereas type 2 is treated with diet and exercise **or** loss of weight **or** drugs		1	AO1/1 4.5.3.2

Question 9 continues on the next page

Question 9 continued

Question	Answers	Extra information	Mark	AO / Spec.
09.3	$(3.45 \times 10^6) + (5.49 \times 10^5) =$ 3.999×10^6 **or** 3 450 000 + 549 000 = 3 999 000	allow 3.999×10^6 **or** 3 999 000 with no working shown for **1** mark	1	AO2/2 4.5.3.2
	$\dfrac{3.999 \times 10^6}{6.5 \times 10^7} \times 100$ **or** $\dfrac{3\,999\,000}{65\,000\,000} \times 100$ = 6.15	allow 6.15 with no working shown for **2** marks allow for **1** mark for a calculation using either: $\dfrac{3.45 \times 10^6}{6.5 \times 10^7}$ **or** $\dfrac{3\,450\,000}{65\,000\,000}$ **or** $\dfrac{5.49 \times 10^5}{6.5 \times 10^7}$ **or** $\dfrac{549\,000}{65\,000\,000}$	1	AO2/2 4.5.3.2
	6.2	allow 6.2 with no working shown for **3** marks allow ecf from second step correctly rounded for **1** mark	1	AO2/2 4.5.3.2

Question 9 continues on the next page

Question 9 continued

Question	Answers	Extra information	Mark	AO / Spec.
09.4	could be other reasons for glucose in urine **or** blood test gives current / immediate result, urine levels might be several hours old **or** not always glucose in urine		1	AO3/1a 4.5.3.2
09.5	results not affected by glucose from food **or** 8 hours is sufficient time for insulin to have acted on any glucose from food eaten **or** so that there is a low starting point to show the effect		1	AO2/1 4.5.3.2
09.6	(patient **A**) glucose level much higher (than **B**) and remains high / does not fall	no mark for identifying **A**	 1 1	 AO3/2a 4.5.3.2 AO3/2a 4.5.3.2
Total			**14**	

B2H Question 10

Question	Answers	Extra information	Mark	AO / Spec.
10.1	too much thyroxine is released into the blood		1	AO1/1 4.5.3.7
	which raises BMR		1	AO1/1 4.5.3.7
	causing increase in formation of glycogen / lipids / proteins **or** increase in rate of respiration **or** increase in breakdown of excess proteins		1	AO1/1 4.5.3.7
10.2	FSH causes eggs to mature and stimulate ovaries to produce oestrogen		1	AO1/1 4.5.3.4
	LH stimulates the egg to be released		1	AO1/1 4.5.3.4
10.3	(missing a dose causes a) dip / drop in progesterone levels		1	AO2/1 4.5.3.4
	(therefore) FSH is not inhibited anymore		1	AO2/1 4.5.3.4
	(therefore) LH is not inhibited anymore		1	AO2/1 4.5.3.4
	(and consequently) an egg is matured and released	allow (and consequently) an egg is available to be fertilised	1	AO3/1 b 4.5.3.4
Total			**9**	

C1H Question 8

Question	Answers	Extra information	Mark	AO / Spec.
08.1	(sulfuric acid is) completely/fully ionised In aqueous solution **or** when dissolved in water		1 1	AO1/1 4.4.2.6
08.2	$H^{+}(aq) + OH^{-}(aq) \rightarrow H_2O(l)$	allow multiples **1** mark for equation **1** mark for state symbols	2	AO1/1 4.4.2.4
08.3	adds indicator, eg phenolpthalein/methyl orange/ litmus added to the sodium hydroxide (in the conical flask) (adds the acid from a) burette with swirling **or** dropwise towards the end point **or** until the indicator just changes colour until the indicator changes from pink to colourless (for phenolphthalein) or yellow to red (for methyl orange) or blue to red (for litmus)	do **not** accept universal indicator	1 1 1 1	AO1/2 4.3.4 4.4.2.5
08.4	titrations 3, 4 and 5 **or** $\frac{27.05 + 27.15 + 27.15}{3}$ 27.12 cm^3	accept 27.12 with no working shown for **2** marks allow 27.1166 with no working shown for **2** marks	1 1	AO2/2 4.3.4 4.4.2.5

Question 8 continued

Question	Answers	Extra information	Mark	AO / Spec.
08.5	Moles H_2SO_4 = conc × vol = 0.00271	allow ecf from 8.4	1	AO2/2
	Ratio H_2SO_4:NaOH is 1:2 **or** Moles NaOH = Moles H_2SO_4 × 2 = 0.00542		1	AO2/2
	Concentration NaOH = mol/vol = 0.00542/0.025 = 0.2168		1	AO2/2
	0.217 (mol/dm^3)		1	AO2/2
		accept 0.217 with no working for **4** marks accept 0.2168 with no working for **3** marks		4.3.4 4.4.2.5
08.6	$\frac{20}{1000}$ × 0.18 = no of moles **or** 0.15 × 40 g		1	AO2/2 4.3.4 4.4.2.5
	0.144 (g)	accept 0.144g with no working for **2** marks	1	
Total			**16**	

C1H Question 9

Question	Answers	Extra information	Mark	AO / Spec.
09.1	line goes up before it goes down energy given out correctly labelled activation energy labelled correctly		1 1 1	AO1/1 4.5.1.2
09.2	electrostatic force of attraction between shared pair of negatively charged electrons and both positively charged nuclei		1 1	AO1/1 4.2.1.1
09.3	bonds formed = 348 +4(412) + 2(276) = 2548 kJ/mol bonds broken – bonds formed = 612 + 4(412) + (Br-Br) – 2548 = 95 kJ/mol 193 (kJ/mol)	Alternative approach without using C-H bonds For step 1 allow = 348 + 2(276) = 900 kJ/mol Then for step 2 allow 612 + (Br-Br) – 900 = 95 kJ/mol accept (+)193 (kJ/mol) with no working shown for **3** marks -193(kJ/mol) scores **2** marks allow ecf from step 1 and step 2	1 1 1	AO2/1 4.5.1.3

Question 9 continued

Question	Answers	Extra information	Mark	AO / Spec.
09.4	**Level 3:** A detailed and coherent explanation is given, which demonstrates a broad understanding of the key scientific ideas. The response makes logical links between the points raised and uses sufficient examples to support these links. A conclusion is reached.		5–6	AO3/2a X 2
	Level 2: An explanation is given which demonstrates a reasonable understanding of the key scientific ideas. A conclusion may be reached but the logic used may not be clear or linked to bond energies.		3–4	AO2/1 X 2
	Level 1: Simple statements are made which demonstrate a basic understanding of some of the relevant ideas. The response may fail to make logical links between the points raised.		1–2	AO2/1 X 2
	No relevant content.		0	
	Indicative content Size and strength • chlorine atoms have fewer electron energy levels/shells • chlorine atoms form stronger bonds • Cl−Cl bond stronger then Br−Br • C−Cl bond stronger that C−Br Energies required • more energy required to break bonds with chlorine • more energy given out when making bonds with chlorine • overall energy change depends on sizes of energy changes Conclusions • if C−Cl bond changes more, then less exothermic • if C−Cl bond changes more then more exothermic • can't tell how overall energy change will differ as do not know which changes more.			4.1.1.7 4.5.1.1

Total			**14**	

P1H Question 11

Question	Answers	Extra information	Mark	AO / Spec.
11.1	g.p.e. = mass × gravitational field strength × height	accept $E_p = mgh$	1	AO1/1 4.1.1.2
11.2	$E_p = 50 \times 9.8 \times 20$ 9800 (J)	allow 9800 (J) with no working shown for **2** marks answer may also be correctly calculated using W = Fs ie allow W = 490 x 20 for **1** mark or answer of 9800 (J) using this method for **2** marks	1 1	AO2/1 4.1.1.2
11.3	7840 (J)	allow ecf from '11.2'	1	AO2/1 4.1.1.2
11.4	$7840 = \frac{1}{2} \times 50 \times v^2$ $v = \sqrt{\frac{7840}{1/2 \times 50}}$ 17.7(0875) (m/s) 18 (m/s)	allow $v^2 = \frac{7840}{(1/2 \times 50)}$ for this point allow ecf from '11.3' correctly calculated for **3** marks allow 18 (m/s) with no working for **2** marks answer may also be correctly calculated using	1 1 1 1	AO2/1 4.1.1.2

		$v^2 - u^2 = 2as$		

11.5	extension = 35 (m) and conversion of 24.5 kJ to 24500 J 24 500 = ½ x k x 35^2 40	allow 40 with no working shown for **3** marks an answer of '16.2' gains **2** marks	1 1 1	AO2/2 4.1.1.2 WS4.3

Total			**11**

P2H Question 11

Question	Answers	Extra information	Mark	AO / Spec.
11.1	in a longitudinal wave the oscillations/vibrations are parallel to the direction of energy transfer.	accept wave travel for energy transfer throughout	1	AO1/1 4.6.1.1
	in a transverse wave the oscillations/vibrations are perpendicular to the direction of energy transfer.		1	AO1/1 4.6.1.1
11.2	accept any sensible suggestion eg. a vibrating drum skin does not move the air away to create a vacuum (around the drum)		1	AO1/2 4.6.1.1

Question 11 continued

11.3	**Level 3:** A detailed explanation linking variations in current to the pressure variations of a sound wave, with a logical sequence.	5-6	6	AO1/2 4.6.1.1 4.7.2.4
	Level 2: A number of relevant points made, but not precisely. A link between the loudspeaker and a sound wave is made.	3–4		
	Level 1: Some relevant points but fragmented with no logical structure.	1–2		
	No relevant content	0		
	Indicative content the current in the electrical circuit is varying the current passes through the coil the coil experiences a force (inwards or outwards) reversing the current reverses the force the size of the current affects the size of the force the varying current causes the coil to vibrate the (vibrating) coil causes the cone to vibrate the vibrating cone causes the air molecules to move the movement of the air molecules produces the pressure variations in the air needed for a sound wave the air molecules bunch together forming compressions and spread apart forming rarefactions			

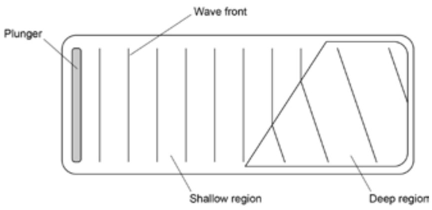
Total			**9**

P2H Question 12

Question	Answers	Extra information	Mark	AO / Spec.
12.1	motor effect		1	AO1/1 4.7.2.2
12.2	increase the strength of the magnet **or** increase the current		1	AO2/1 4.7.2.2
12.3	$4.8 \times 10^{-4} = F \times 8 \times 10^{-2}$ $F = 6 \times 10^{-3}$ (N) $6 \times 10^{-3} = B \times 1.5 \times 5 \times 10^{-2}$ $B = \frac{6 \times 10^{-3}}{7.5 \times 10^{-2}}$ $B = 8 \times 10^{-2}$ or 0.08	allow 8×10^{-2} **or** 0.08 with no working shown for **5** marks a correct method with correct calculation using an incorrect value of F gains **3** marks	1 1 1 1 1	AO2/1 4.7.2.2 4.5.4
	Tesla	accept T do not accept t	1	AO1/1 4.7.2.2

Total		8

Synergy 1H Question 9

Question	Answers	Extra information	Mark	AO / Spec.
09.1		lines should be further apart with the bottom of the wave fronts further to the right than the top	1	AO2/1 RPA5
09.2	they will speed up so wave (fronts) move further apart		1 1	AO2/1 RPA5
09.3	longitudinal waves: • the oscillations are parallel to the direction of energy transfer • show areas of compression and rarefaction transverse waves: • the oscillations / movement are perpendicular to the direction of energy transfer.		1 1 1	AO1/1 4.1.4.1
09.4	place a floating object / plastic duck on the surface of the water it will stay in the same place **or** only bob up and down if the water doesn't move		1 1	AO2/2 RPA5
09.5	0.42 = 1/f f = 2.38 v = 2.38 × 0.34 = 0.809 m/s	allow 0.809 with no working shown for **4** marks incorrect sig. figs max **3** marks correct unit	1 1 1 1 1	AO2/1 AO2/1 AO2/1 AO2/1 AO1/1 4.1.4.2
Total			**13**	

Synergy 2H Question 8

Question	Answers	Extra information	Mark	AO / Spec.
08.1	$6CO_2 + 6H_2O \longrightarrow$	correct reactants	1	AO1/1 4.2.2.5
	$C_6H_{12}O_6 + 6O_2$	correct products	1	
08.2	correct scale and label on x axis		1	AO2/2 RPA10
	all 5 plots correct	tolerance ±½ small square	2	
		allow 2 or 3 plots correct for **1** mark		
08.3	no	no mark		AO3/1a RPA10
	although as distance increases, rate decreases		1	
	the line curves **or** line should be straight		1	
	suitable data quoted	examples: • supports conclusion between 20–40 (cm) • does not support conclusion between 10–20 (cm)	1	
08.4	volume of 1 bubble = 4/3 × 3.14 × $(0.1)^3$		1	AO2/2 4.2.2.6
	= 0.00419		1	
	at 40 cm there are 7 bubbles		1	
	vol at 40 cm = 0.02933	allow ecf from incorrect value taken from table	1	
	Rate per minute = × 2			
	= 5.86×10^{-2} (cm^3 per min)	allow 5.86×10^{-2} with no working shown for **5** marks	1	
		answer not given in standard form or to incorrect number of sig. figs max **4** marks		
Total			**13**	

Synergy 2H Question 9

Question	Answers	Extra information	Mark	AO / Spec.
09	**Level 3:** A full explanation is given that is coherent and logically structured, linking effect of increase in carbon dioxide to climate change and effects on biodiversity.		5–6	AO1/1
	Level 2: An attempt is made to link the effects of rising carbon dioxide levels to climate change and biodiversity. The logic may be inconsistent at times but builds towards a coherent explanation.		3–4	
	Level 1: Discrete relevant points made. The logic may be unclear and attempts at reasoning may not be consistent.		1–2	
	No relevant content.		0	
	Indicative content • rise in carbon dioxide increases atmospheric temperature / causes global warming • global warming causes extreme weather patterns • such as rise in sea levels • increased or decreased rainfall • frequency of storms / droughts • rise in sea levels means habitats will change due to flooding • rise in sea levels could increase salt in soil • increased rainfall will increase water levels • severity of storms/droughts could affect photosynthesis • consequences of changes are loss of or damage to habitats • which will affect animal and plant distributions • by increasing migration or species dying off • which decreases biodiversity			4.4.1.5 4.4.1.3 4.4.2.3

Synergy 3H Question 6

Question	Answers	Extra information	Mark	AO / Spec.
06.1	1 950/2 500 x 100 78 (%)		1 1	AO2/1 4.8.2.2
06.2	expected mass of aluminium 1950 × 54/102 = 1032.35 mass not collected 1032.35 – 1 000 =32.4	allow 32.4 with no working shown for **3** marks incorrect number of sig. figs max **2** marks	1 1 1	AO2/1 4.5.2.3
06.3	because oxygen is formed at the anode which reacts with the carbon anode to produce carbon dioxide and wears it away		1 1 1	AO1/2 4.8.2.2
06.4	power = $1.5 \times 10^5 \times 4$ $= 6.0 \times 10^5$ W 24 hours = $24 \times 60 \times 60 = 8.64 \times 10^4$ seconds energy transferred = $6.0 \times 10^5 \times 8.64 \times 10^4$ $= 5.184 \times 10^{10}$	allow ecf from power calculation allow 5.184×10^{10} with no working for **5** marks	1 1 1 1 1	AO2/1 4.7.2.7 AO2/1 4.7.2.7 AO2/1 4.7.2.8 AO2/1 4.7.2.8 AO2/1 4.7.2.8

Question 6 continues on the next page

Question 6 continued

Question	Answers	Extra information	Mark	AO / Spec.
06.5	3 moles of electrons are needed to produce 27 g or 0.027 kg aluminium		1	AO2/1 4.5.2.5
	so moles of electrons to produce 1 000 kg = 1 000/0.027 x 3		1	
	= 111 000	allow 111 000 with no working shown for **3** marks incorrect no. of sig. figs max **2** marks	1	
Total			**16**	

Synergy 4H Question 10

Question	Answers	Extra information	Mark	AO / Spec.
10	**Level 3:** A detailed, coherent and logical justification of the scientist's statement, with relevant links made between statements in the question, phytomining and the effects of other methods of metal production on the environment.		5–6	AO3/2b
	Level 2: An attempt to justify the scientist's statement is made, with some attempt at linking statements. The logic may be inconsistent at times but builds towards a coherent argument.		3–4	
	Level 1: Discrete relevant points made. The logic may be unclear and may not be consistent with the reasoning. Links are not made.		1–2	
	No relevant content		0	
	Indicative content • phytomining conserves supplies of ores • copper will be available for longer as at present rate of use copper ores will run out in about 35 years • phytomining conserves supplies of fossil fuels or energy • less fuel used at a lower cost • mining scars landscape or produces noise pollution • mining destroys wildlife habitats • with more phytomining less need to mine ores • with phytomining less habitat destroyed or less scarring of landscape • with phytomining less need to use landfill for waste • burning fossil fuels produces carbon dioxide/greenhouse gas • burning fossil fuels causes global warming or climiate change • extraction from ores produces sulfur dioxide which causes acid rain			4.8.2.3 4.8.2.4 4.8.1.2 4.4.1.4 4.4.1.5 4.4.1.6
Total			**6**	

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