EZY SCIENCE

REQUIRED PRACTICALS PRACTICE QUESTIONS

NOVEMBER EDITION

This monthly document contains one exam-style question per science surrounding the required practical activities that need to be carried out as part of the AQA/Edexcel specifications.

We have created these questions and mark schemes based on the content of the exam board's specification(s), sample assessment materials and other published material. Therefore, EzyEducation Ltd. takes no responsibility for the relevance of this document to actual examinations set.

Inside this Month's Edition

Question 1 – Biology Required Practical

In this question students are required to use a scale, make measurements and apply the equation for magnification. They then must identify and explain the advantages of using an electron microscope over a normal light microscope.

Question 2 – Chemistry Required Practical

In this question students are required to describe and explain how to obtain a pure, dry sample of copper chloride crystals and then explain why the same method cannot be used to produce a different salt from two soluble reactants.

Question 3 – Physics Required Practical

In this question students are required to explain how the specific heat capacity of copper can be determined from experimental results and then evaluate the result obtained.

Disclaimer

The questions in this document are in a similar style to what you would typically see in an exam paper. There can be no guarantee of the extent to which these questions will reflect the actual examination questions students will sit.

The mark schemes have been presented in a format that allows students to mark their own responses to the questions in this document. These mark schemes contain more detail than would normally be found in a normal mark scheme. Any comments reflect our opinions and not those of the exam board.

We are providing opportunities for students to apply skills that will be required to achieve a Grade 5 or above. Therefore, this content is suitable for both Foundation and Higher Tier students.

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Question 1

Figure 1 is an electron microscope image of a blood clot.

The black line in the image has a real length of 10 μm.

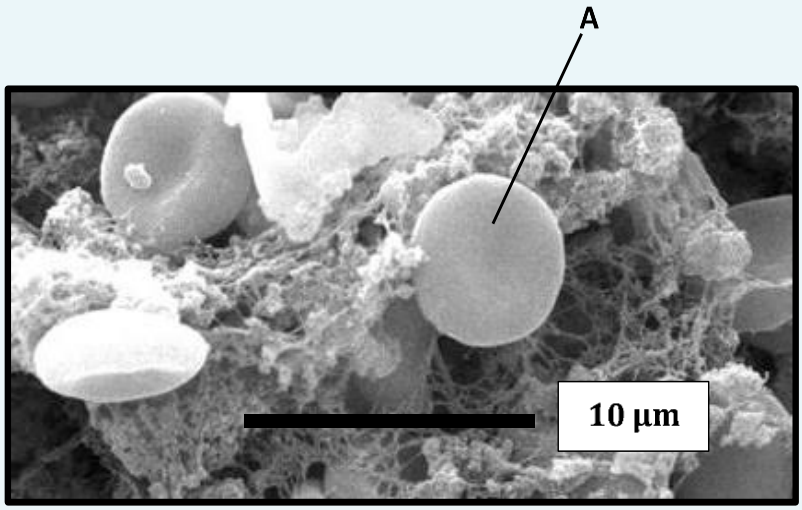

Figure 1

(a) (i) Use information in the image to estimate the diameter of structure **A**.

Diameter of structure **A** ≈ ..... μm

[1 mark]

(ii) **Figure 2** shows a ruler being used to measure the diameter of the image of structure **A**.

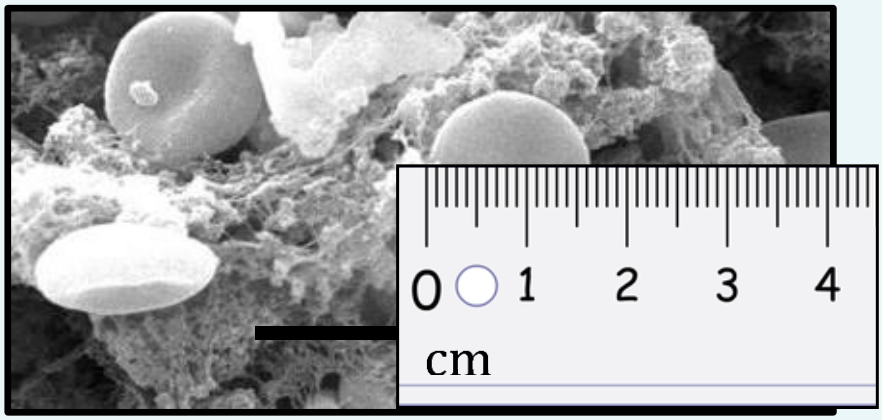

Figure 2

Use the information in **Figure 2** and your answer to **(a) (i)** to estimate the magnification of this image.

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

Magnification ≈ .....

[3 marks]

(b) Explain how the development of the electron microscope has increased our understanding of sub-cellular structures.

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[4 marks]

Question 2

(a) The equation shows the reaction between copper oxide and hydrochloric acid.

$$CuO(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(l)$$

Describe and explain how to obtain a pure, dry sample of copper chloride crystals using this reaction.

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[6 marks]

(b) The equation shows the reaction between sodium hydroxide and sulfuric acid.

$$2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$$

Explain why the method you described in **(a)** could not be used to obtain a pure sample of sodium sulfate crystals using this reaction.

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[2 marks]

Question 3

A student used the equipment shown in **Figure 1** to determine the specific heat capacity of copper.

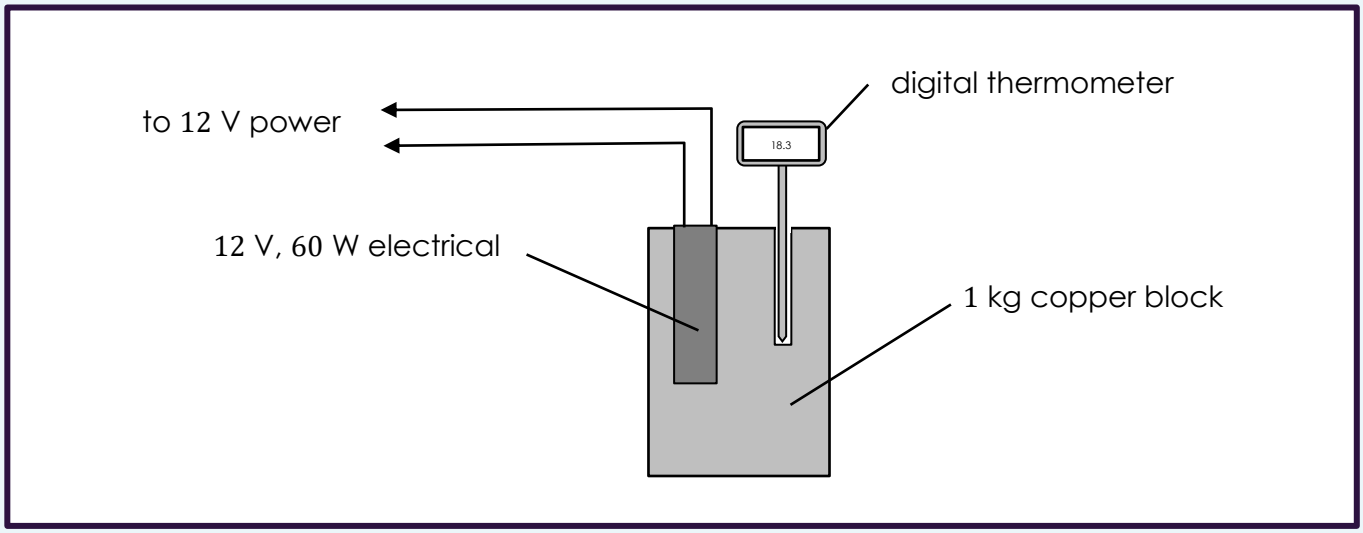

Figure 1

The heater was switched on for 10 minutes and it was found that the temperature rose by 50 °C in that time.

The student calculated that the energy supplied by the heater was 36,000 J.

(a) Explain how the student arrived at the value of 36,000 J for the energy supplied by the heater.

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[2 marks]

(b) Use the equation $\Delta E = mc\Delta\theta$ and the results given above to calculate a value for the specific heat capacity of copper.

specific heat capacity =..... J/kg°C

[2 marks]

(c) The value of the specific heat capacity of copper obtained by this student is not accurate.

Explain whether the value is too high or too low.

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[3 marks]

Mark Scheme – Q1

	Answers	Extra Guidance	Mark	AO/Spec. Ref
a) i)	4, 5, 6 or 7 (μm)	Whole number answers only to be accepted	**1**	**AO2/ AQA: 4.1.1.5 Edexcel: 1.3 - 1.6**
a) ii)	Correct values substituted into equation: $\frac{1.6\text{ cm}}{\text{answer to (a)(i)}}$	This mark can be scored even if the units are not consistent and as long as the answer for (a) (i) is clearly identified as the size of the object and the size of the image is the equivalent to 1.6 cm. For example: $\frac{1.6}{50{,}000}$, $\frac{1.6}{5}$, $\frac{16}{0.005}$ are all acceptable – power of ten errors can be ignored for this mark. Allow error carried forward from (a) (i) for the width of **A**.	**1**	**AO2/ AQA: 4.1.1.5 Edexcel: 1.3 - 1.6**
a) ii)	Units of correct values substituted into equation are consistent.	The size of the image and the size of the real object must both be in the same unit for this mark. For example, $\frac{1.6\text{ (cm)}}{0.0005\text{ (cm)}}$, $\frac{16\text{ (mm)}}{0.005\text{ (mm)}}$, $\frac{16{,}000\text{ (μm)}}{5\text{ (μm)}}$, $\frac{1.6\times10^{-2}\text{ (m)}}{5\times10^{-6}\text{ (m)}}$ are all acceptable	**1**	

a) ii)	Correct answer based on the answer to (a) (i) and $1.6\ \text{cm}$ for the size of the image and consistent units.	Answers should be in the range 2,300 – 4,000, but answers outside this range can be accepted with any error being carried forward from (a) (i) for the diameter of **A**. A correct answer on its own scores all three marks.	**1**	
b	Greater magnification	Magnification must be linked to the idea of smaller objects being seen for the 2nd mark and higher resolving power must be linked to the idea of finer detail being observed for the 4th mark to be scored.	**1**	**AO1/** **AQA: 4.1.1.5** **Edexcel: 1.3**
b	Allows smaller structures to be observed (seen / studied)		**1**	
b	Higher resolving power (better resolution)		**1**	
b	Allows cells / structures to be observed / studied in finer detail (seen more clearly)		**1**	
Total marks			**8**	

EzyScience Additional Feedback:

(a) (i) – To answer this correctly the size of the image of structure **A** must be compared to the line of real length $10\ \mu\text{m}$, preferably with a ruler. Doing this will show that the diameter of structure A is about half the length of the line. A range of values has been accepted here to allow a reasonable judgement by eye to be made, but using a ruler is by far the better method.

(a) (ii) – This is really about converting units so that the numerator and denominator in the fraction are in the same units. This can be done by converting both to mm (using the facts that $1\ \text{cm} = 10\ \text{mm}$ and $1\ \text{mm} = 1{,}000\ \mu\text{m}$), the denominator to cm (using the fact that $1\ \mu\text{m} = 0.0001\ \text{cm}$), the numerator to μm (using the fact that $1\ \text{cm} = 10{,}000\ \mu\text{m}$) or both to metres using the fact that $1\ \text{m} = 100\ \text{cm} = 1{,}000{,}000\ \mu\text{m}$). A sound understanding of standard form makes it far easier to answer questions like this – the ideal answer to this question is

$$\text{magnification} = \frac{1.6 \times 10^{-2}}{5.0 \times 10^{-6}} = 3{,}200$$

(b) The specification requires you to recognise the significance of the magnification and resolving power of a microscope. The idea of resolving power is quite a difficult one to explain (It is the ability of a microscope to separate or distinguish between small objects that are close together), but the important point to remember about resolving power is that it allows structures to be seen in clearer detail.

Mark Scheme – Q2

	Answers	Extra guidance	Mark	AO/ Spec. Ref
a	**Add excess copper oxide**	Accept alternatives to 'excess' such as 'until no more reacts'	1	**AO1/2/ AQA: 4.4.2.3 Edexcel: 3.15, 3.17**
a	To completely neutralise the acid	Accept the idea of using up all the acid	1	
a	**Filter the mixture**		1	
a	To remove excess copper oxide		1	
a	**Heat filtrate**	Allow 'heat remaining liquid' or just 'heal liquid'	1	
a	To evaporate some water / bring to the point of crystallisation / bring to the point of saturation		1	
a	**Leave remaining filtrate to cool / stand**		1	
a	To allow crystals to form		1	
a	Use filter paper to dry the crystals		1	
Maximum 6 marks available. The first four marks are for the main steps (in bold) in the correct order – deduct one mark if the steps are not in the correct order The remaining two marks are for any two explanation points (not in bold)				
b	Both reactants are aqueous		1	**AO2/ AQA: 4.2.2.2 Edexcel: 0.3**
b	It would not be possible to tell when the acid has been completely neutralised / you would not know when an excess of one of the reactants has been added / the crystals would be contaminated with sulfuric acid or sodium hydroxide		1	

Total marks	8	

EzyScience Additional Feedback:

(a) – Knowledge of the basic steps involved in the production of an aqueous salt from an insoluble metal oxide and an acid is essential and you should be able to adapt them to any combination of appropriate reactants, but you must also understand the purpose of each step.

(b) – This part of the question is really about knowledge and understanding of the state symbols. When given a symbol equation with state symbols always look at those state symbols carefully – the answer will almost certainly depend on them.

Mark Scheme – Q3

	Answers	Extra guidance	Mark	AO/ Spec. Ref
a	$P = E/t$ or $E = P \times t$		1	AO1/2 AQA: 4.1.1.4 Edexcel: 14.8, 14.11
a	$60 = \frac{E}{600}$ or $E = 60 \times 600$	E = 60 x 600 on its own scores both marks. The correct conversion of minutes to seconds scores one mark even if used incorrectly.	1	
b	$36{,}000 = 1 \times c \times 50$	Accept $c = 36{,}000/50$ BUT do not accept substitution into an equation that has been rearranged incorrectly.	1	
b	$c = 720$	Correct answer must be seen for this mark – no error carried forward. Correct answer on its own scores both marks	1	
c	Not all of the thermal energy is absorbed by the copper / some thermal energy will escape to the surroundings		1	
c	The temperature rise will be smaller than it should be.		1	
c	$c = E/m\theta$ will be larger	The idea that the energy is being divided by a smaller temperature rise must be clear.	1	
Total marks			7	

EzyScience Feedback:

(a) – It is essential that the steps in the calculation are laid out clearly.

(b) – Trying to rearrange the equation before substituting in can cause problems – if the rearrangement is incorrect both marks are lost. If the correct values are substituted into the correct equation before it is rearranging, then at least one mark will be scored, even if the final answer is incorrect.

(c) – It is sometimes better in situations like this to start with the equation and then work backwards.