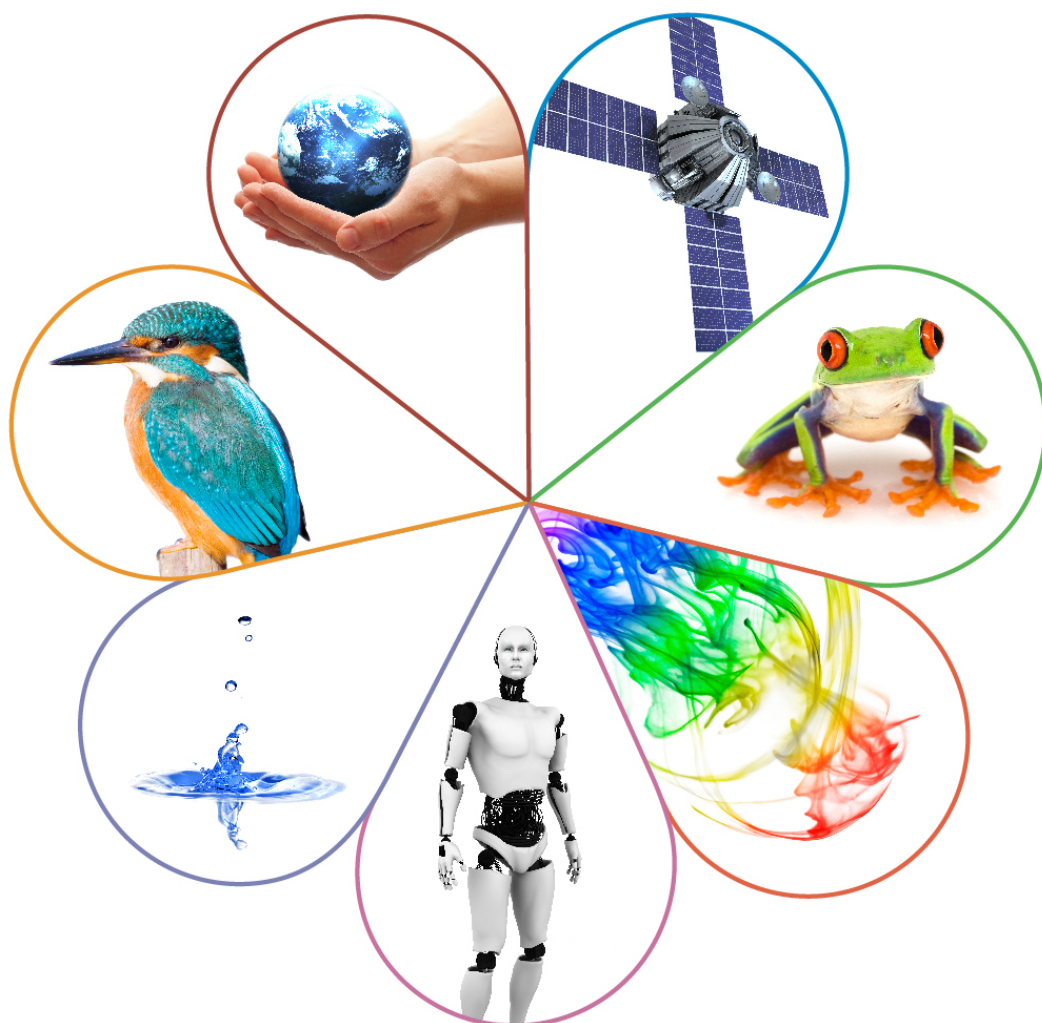


GCSE SCIENCE

Virtual communities

Supporting materials

Published: Autumn 2020



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The situation for 2020/2021

- Although students sitting exams in 2021 should have as much hands-on experience as possible, for this year they're permitted to observe demonstrations or simulations to cover required apparatus and techniques.
- The Ofqual statement in their consultation about the number of required practicals (minimum of eight for each separate science and 16 for Combined Science) may mislead teachers into thinking that they need to cover only some of the required practicals in the AQA specifications. However, the Ofqual statement referred to the original reform requirements to cover the apparatus and techniques criteria. In order to cover these criteria, the AQA specifications contain more than these minima (21 in Combined Science; 10 in Biology; eight in Chemistry; 10 in Physics).
- Students will be expected to have experience of **all** of these practicals over their two-year GCSE course.
- Students will have covered some of the required practicals already in Year 10, although they won't have covered all of them. There are ideas and guidance on practicals in [Focus on Success Pack 3: Practical questions](#).
- Ofqual has stated that there will be no change to the format or content of the exams for 2021, so we'll still assess practical and other skills in the same way as in previous exam series.

Practical work

Points to consider

To help with your discussions, on the following pages we've provided an example question for each subject, and tables mapping the apparatus and techniques (AT) criteria that would be covered by following the required practical activities (RPA) method suggested in the *Required practical handbook* for the subject.

- What are you doing in terms of practicals with your Year 11s? eg Are you intending to work with a combination of demonstrations, simulations and hands-on work? If so, what sort of split are you looking at?
- The RPAs were developed to cover the AT criteria, such as using a microscope, using appropriate apparatus to carry out a titration or setting up a circuit to measure resistance.
 - How do you think reducing the amount of hands-on practical work will affect students' ability to answer the exam questions?
- Look at the example questions on the following pages, each of which is based on the ATs.
 - Which aspects of the question do you think might be more challenging to cover without doing hands-on work?
 - Share some ideas: what are you planning to do, or could you do, to mitigate any gap?
- You might also want to think about what you are doing/could be doing with your Year 10s, who won't be sitting exams until 2022.

Biology

Example question based on RPA 6 (Photosynthesis)
GCSE Biology Q9 Paper 1F, May 2019

0 9 This question is about photosynthesis.

0 9 . 1 Complete the word equation for photosynthesis:

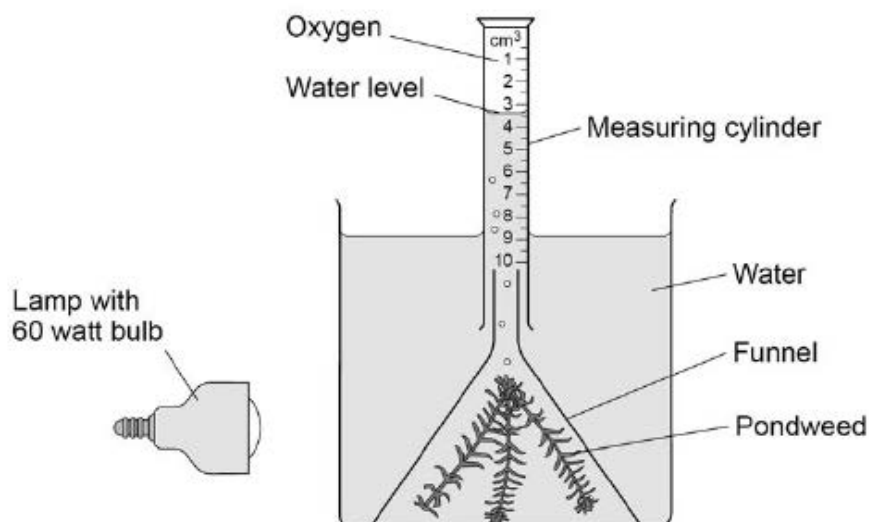
[2 marks]

_____ + _____ → _____ + oxygen

A student investigated photosynthesis using pondweed.

Figure 14 shows the apparatus the student used.

Figure 14



This is the method used.

1. Set up the apparatus as shown in **Figure 14**.
2. Switch on the lamp.
3. After 20 minutes, record the volume of oxygen collected in the measuring cylinder.
4. Repeat steps 1–3 using bulbs of different power output.

0 9 . 2 What was the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

Power output of bulb

Rate of photosynthesis

Time to collect oxygen

Volume of oxygen collected

0 9 . 3 Suggest **two** ways the method could be improved so the results would be more valid.

[2 marks]

1 _____

2 _____

Table 9 shows the student's results.

Table 9

Power output of bulb in watts	Volume of oxygen collected in 20 minutes in cm ³	Rate of photosynthesis in cm ³ /hour
60	0.5	1.5
100	0.8	2.4
150	1.1	X
200	1.2	3.6
250	1.2	3.6

0 9 . 4 Calculate value X in Table 9.

[1 mark]

X = _____ cm³/hour

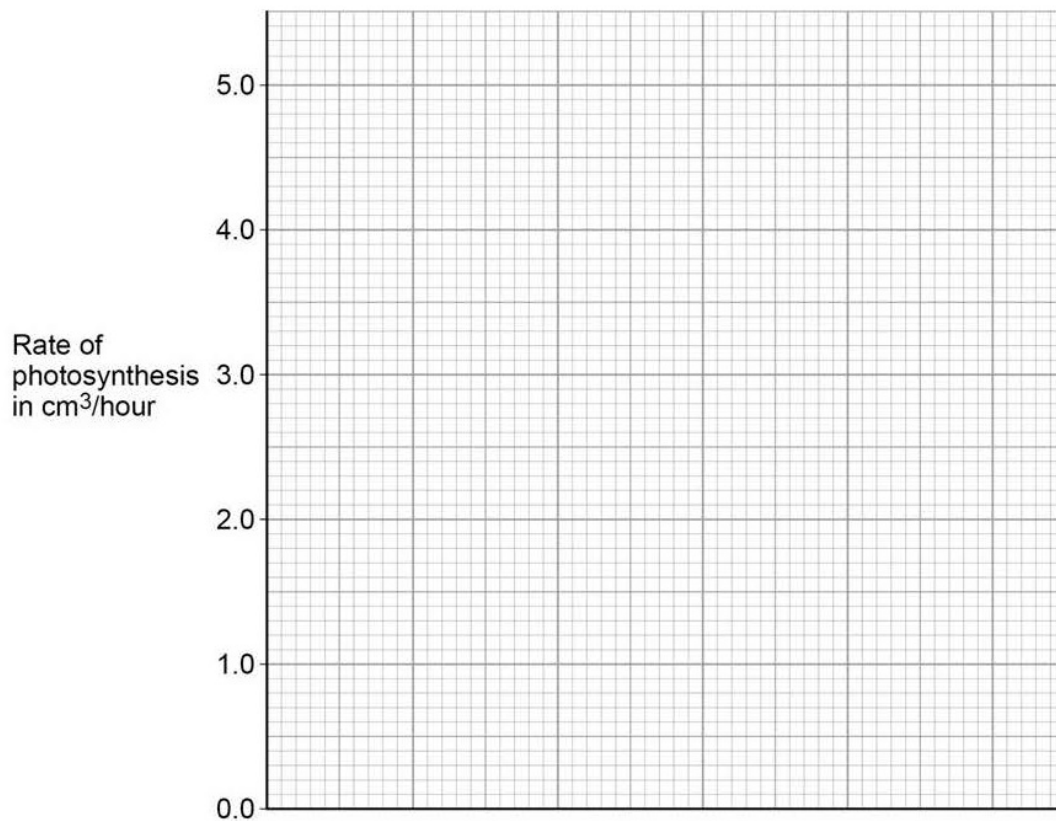
09.5 Complete **Figure 15**.

[4 marks]

You should:

- label the x-axis
- use a suitable scale
- plot the data from **Table 9** and your answer to **Question 09.4**
- draw a line of best fit.

Figure 15



09.6 Determine the expected rate of photosynthesis with a bulb of power output 75 watts.

Use **Figure 15**.

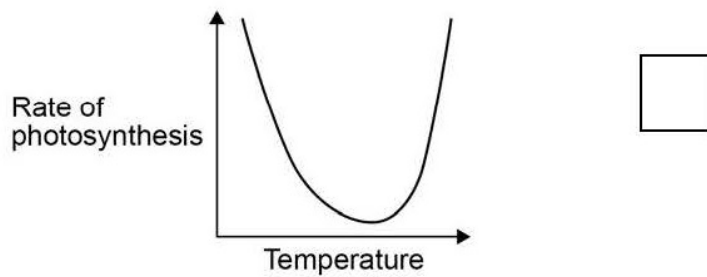
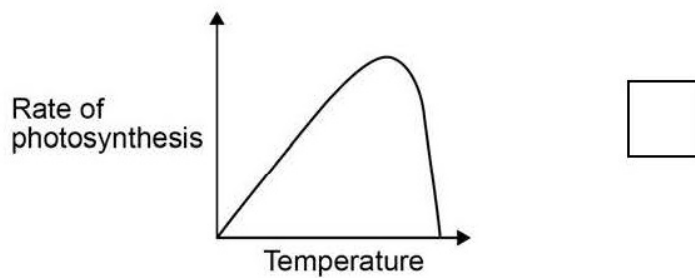
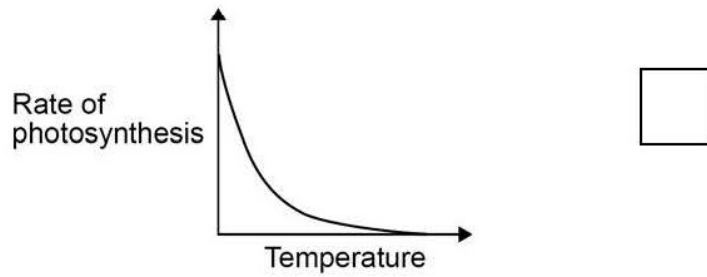
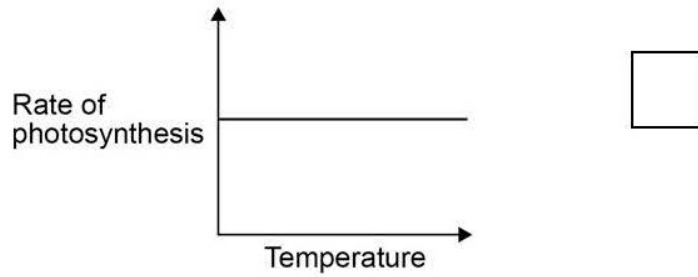
[1 mark]

Rate of photosynthesis at 75 watts = _____ cm³/hour

09.7 Which graph shows the effect of temperature on the rate of photosynthesis?

[1 mark]

Tick (✓) one box.



Biology AT criteria covered in each RPA

Students who do the methods suggested in the *Required practical handbook* will have the opportunity to access the following aspects of the Ofqual criteria.

Teachers should ensure that all of the AT criteria are covered for each student.

Individual practical activities won't cover all aspects of a criterion. It's only by doing all of the RPAs that all aspects of each AT criterion will be covered. Some of the AT criteria are very specific, and will be addressed only by doing a particular activity.

	Required practical activity									
	Microscopy	Microbiology (Biology only)	Osmosis	Food tests	Enzymes	Photosynthesis	Reaction time	Plant responses (Biology only)	Field investigations	Decay (Biology only)
AT1 Use of appropriate apparatus to make and record a range of measurements accurately, including:	length	✓	✓			✓	✓	✓	✓	
	area		✓						✓	
	mass			✓						
	time					✓	✓	✓		✓
	temperature					✓				✓
	volume of liquids			✓		✓				
	volume of gases						✓			
	pH.					✓				✓

AT2 Safe use of appropriate heating devices and techniques including Bunsen burner and water bath or electric heater.					✓	✓					
AT3 Use of appropriate apparatus and techniques for the observation and measurement of biological changes and/or processes.			✓	✓			✓	✓	✓		✓
AT4 Safe and ethical use of living organisms (plants or animals) to measure physiological functions and responses to the environment.	physiological functions							✓			✓
	response to environment		✓				✓		✓	✓	
AT5 Measurement of rates of reaction by a variety of methods including:	production of gas						✓				
	uptake of water			✓							
	colour change of indicator					✓					✓
AT6 Application of appropriate sampling techniques to investigate the distribution and abundance of organisms in an ecosystem via direct use in the field.										✓	
AT7 Use of appropriate apparatus, techniques and magnification, including microscopes, to make observations of biological specimens and produce labelled scientific drawings.		✓							✓		
AT8 (biology only) Use appropriate techniques and qualitative reagents to identify biological molecules and processes in more complex and problem-solving contexts including continuous sampling in an investigation.			✓								

Chemistry

Question: based on RPA 4 (Energy changes in reactions)
GCSE Chemistry Q7 Paper 1F, May 2019

0 7

This question is about energy changes in reactions.

0 7 . 1

Ammonium nitrate dissolves in water.

The change is endothermic.

Which piece of equipment uses this change?

[1 mark]

Tick (✓) **one** box.

Hand warmer

Self-heating can

Sports injury pack

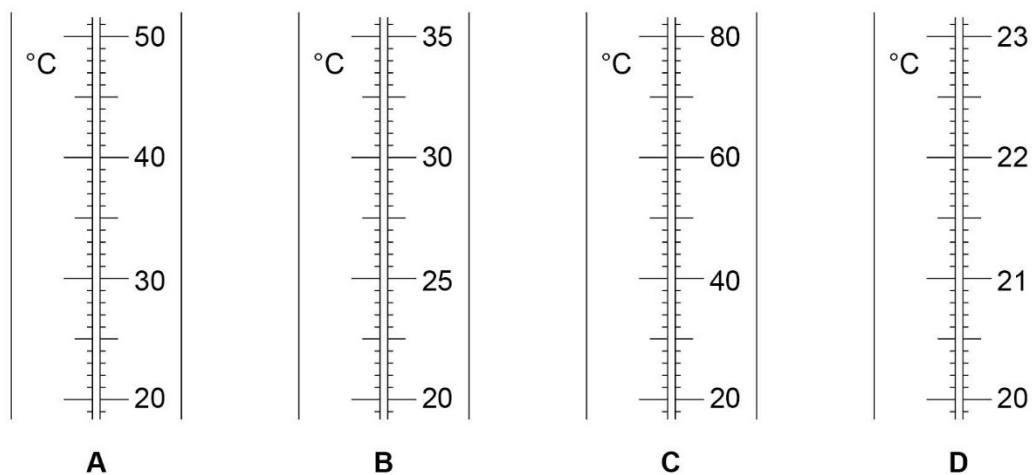
A student investigated the temperature change in the reaction between dilute sulfuric acid and potassium hydroxide solution.

This is the method used.

1. Measure 25 cm³ of potassium hydroxide solution into a glass beaker.
2. Add 5 cm³ of dilute sulfuric acid.
3. Stir the solution.
4. Measure the temperature of the solution.
5. Repeat steps 2 to 4 until a total of 30 cm³ of dilute sulfuric acid has been added.

0 7 . 2 Figure 9 shows part of the scales of four thermometers, A, B, C and D.

Figure 9



The student wanted to measure the temperature to a resolution of 0.1 °C

Which thermometer should the student use?

[1 mark]

Tick (✓) **one** box.

A B C D

0 7 . 3 Energy is lost to the surroundings during the reaction.

What type of error does this cause in the results?

[1 mark]

Tick (✓) **one** box.

Human error

Random error

Systematic error

Zero error

0 7 . 4 The student used a glass beaker for the reaction.

Name a container the student could use instead of the glass beaker to improve the accuracy of the results.

[1 mark]

0 7 . 5 Table 3 shows the student's results.

Table 3

Volume of dilute sulfuric acid added in cm ³	Temperature in °C
5	21.2
10	22.0
15	22.8
20	23.6
25	24.4
30	25.2

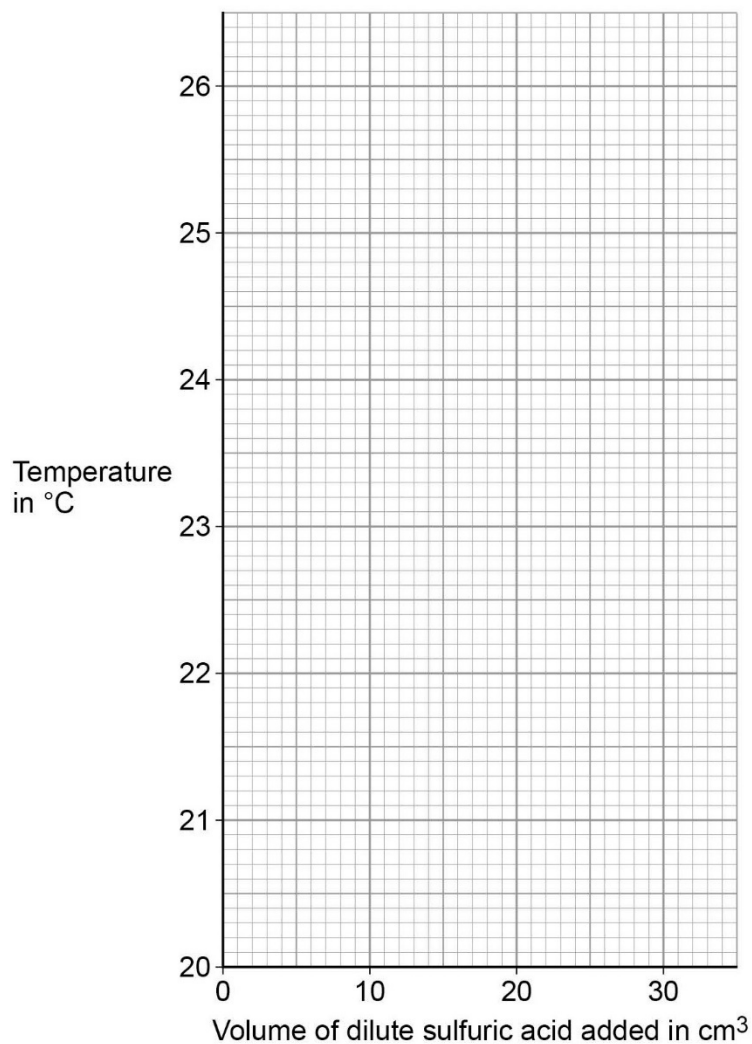
Plot the data from Table 3 on Figure 10.

You should:

- draw a line of best fit
- extend your line of best fit to the y-axis.

[4 marks]

Figure 10



0	7	6
---	---	---

 The intercept on the y-axis of **Figure 10** shows the starting temperature of the potassium hydroxide solution.

Give the starting temperature of the potassium hydroxide solution.

[1 mark]

Starting temperature = _____ °C

0 7 . 7

Another student repeated the investigation and obtained an anomalous result.

This result was lower than expected.

What could have caused the anomalous result?

[2 marks]

Tick (✓) **two** boxes.

The mixture was not stirred.

The temperature in the room increased.

The thermometer was not accurate.

Too little sulfuric acid was added.

Too much potassium hydroxide solution was used.

Chemistry AT criteria covered in each RPA

Students who do the methods suggested in the *Required practical handbook* will have the opportunity to access the following aspects of the Ofqual criteria.

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	Required practical activity							
	Making salts	Neutralisation (Chemistry only)	Electrolysis	Temperature change	Rates of reaction	Chromatography	Identifying ions (Chemistry only)	Water purification
AT1 Use of appropriate apparatus to make and record a range of measurements accurately, including:	mass			✓	✓			✓
	time				✓			
	temperature			✓	✓			
	volume of liquids		✓	✓	✓			
	volume of gases					✓		
AT2 Safe use of appropriate heating devices and techniques including use of a Bunsen burner and water bath or electric heater.	✓						✓	✓

AT3 Use of appropriate apparatus and techniques for conducting and monitoring chemical reactions, including appropriate reagents and/or techniques for the measurement of pH in different situations.				✓		✓			✓
AT4 Safe use of a range of equipment to purify and/or separate chemical mixtures including:	evaporation	✓							✓
	filtration	✓							
	crystallisation	✓							
	chromatography						✓		
	distillation								✓
AT5 Making and recording of appropriate observations during chemical reactions including changes in temperature and the measurement of rates of reaction by a variety of methods such as production of gas and colour change.	temperature change				✓				
	production of gas					✓			
	colour change					✓			
AT6 Safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes and/or products.		✓			✓	✓			
AT7 Use of appropriate apparatus and techniques to draw, set up and use electrochemical cells for separation and production of elements and compounds.				✓					

AT8 (Chemistry only) Use of appropriate qualitative reagents and techniques to analyse and identify unknown samples or products including:	gas tests							✓	
	flame tests							✓	
	precipitation reactions							✓	
	determination of concentration		✓						

Physics

Question: based on RPA 4 (I–V characteristics)

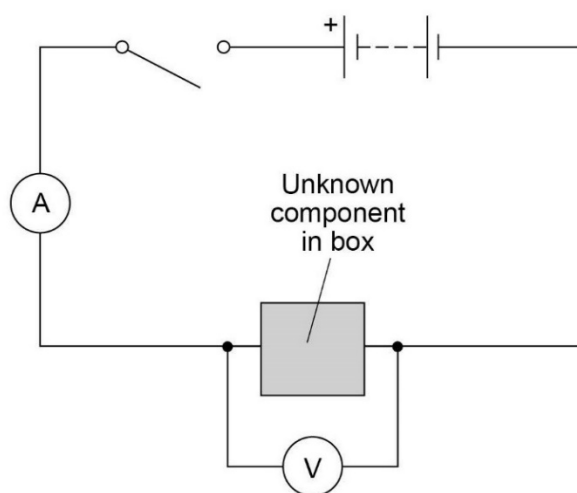
GCSE Combined Science: Synergy Q4 Paper 4H, June 2019

0 4

A teacher gave a student an unknown electrical component hidden in a box.

The student connected the box in the circuit shown in **Figure 4**.

Figure 4



0 4 . 1

The student measured the potential difference across the component and the current in the component.

She repeated this for several values of potential difference.

Give **one** way the circuit could be altered so that the potential difference across the component could be varied.

[1 mark]

0 4 . 2

Explain why the student needed to switch the circuit off between readings.

[2 marks]

Table 2 shows the student's results.

Table 2

Potential difference in volts	Current in amps
0.00	0.00
0.20	0.00
0.40	0.00
0.60	0.13
0.80	0.68
1.00	1.50

0 4 . 3 What was the resolution of the ammeter?

[1 mark]

Tick (✓) one box.

- 0.01 A
- 0.05 A
- 0.10 A
- 1.50 A

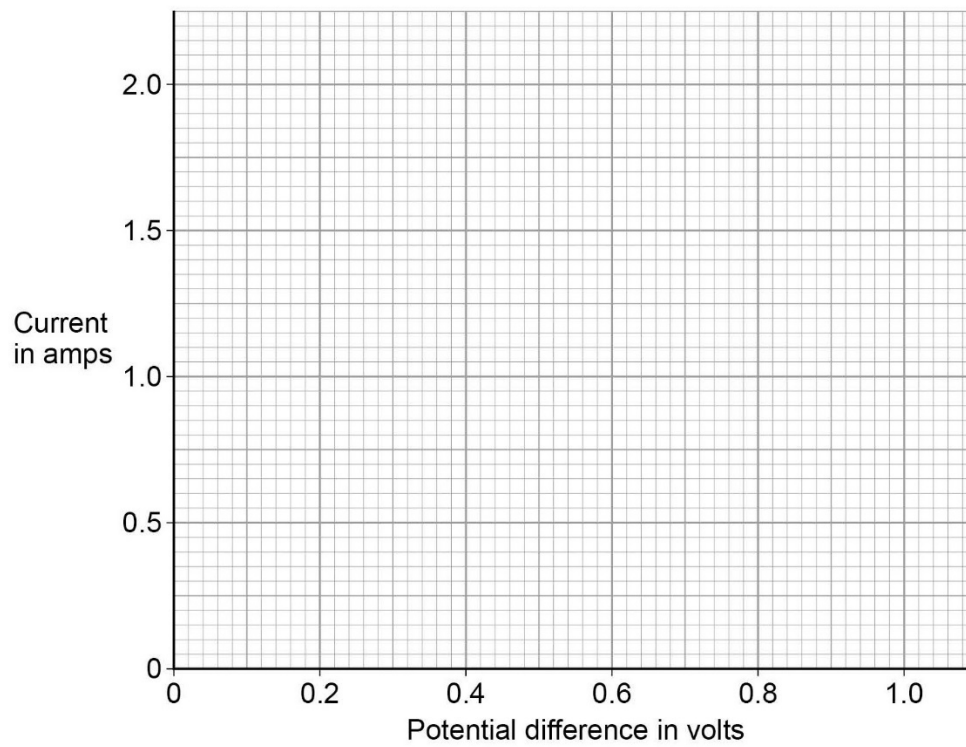
0 4 . 4 Complete Figure 5.

You should:

- plot the data from Table 2
- draw a line of best fit.

[3 marks]

Figure 5



0 4 . 5 What was the unknown electrical component given to the student?

[1 mark]

Tick (✓) **one** box.

Diode

Filament lamp

Resistor

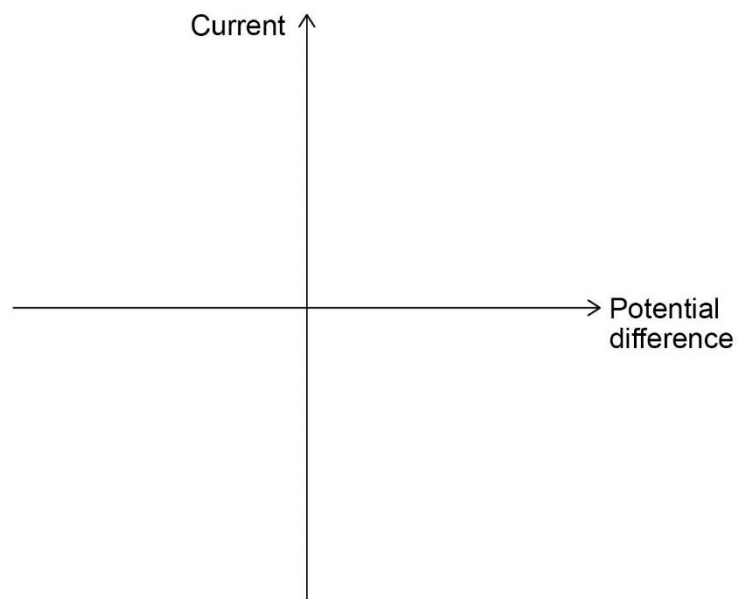
Thermistor

0 4 . 6 An ohmic conductor has constant resistance when its temperature is constant.

Sketch a current-potential difference graph for an ohmic conductor at constant temperature on **Figure 6**.

[2 marks]

Figure 6



Physics AT criteria covered in each RPA

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		Required practical activity									
		Specific heat capacity	Thermal insulation (Physics only)	Resistance	I-V characteristics	Density	Force and extension	Acceleration	Waves	Light (Physics only)	Radiation and absorption
AT1 Use of appropriate apparatus to make and record a range of measurements accurately, including length, area, mass, time, volume and temperature. Use of such measurements to determine densities of solid and liquid objects.	length			✓		✓	✓	✓			
	area										
	mass	✓				✓		✓			
	time	✓	✓					✓			
	temperature	✓	✓								✓
	volume		✓			✓					
AT2 Use of appropriate apparatus to measure and observe the effects of forces including the extension of springs.							✓	✓			

<p>AT3</p> <p>Use of appropriate apparatus and techniques for measuring motion, including determination of speed and rate of change of speed (acceleration/deceleration).</p>								✓			
<p>AT4</p> <p>Making observations of waves in fluids and solids to identify the suitability of apparatus to measure speed/frequency/wavelength. Making observations of the effects of the interaction of electromagnetic waves with matter.</p>									✓	✓	✓
<p>AT5</p> <p>Safe use of appropriate apparatus in a range of contexts to measure energy changes/transfers and associated values such as work done.</p>		✓	✓								
<p>AT6</p> <p>Use of appropriate apparatus to measure current, potential difference (voltage) and resistance, and to explore the characteristics of a variety of circuit elements.</p>				✓	✓						
<p>AT7</p> <p>Use of circuit diagrams to construct and check series and parallel circuits including a variety of common circuit elements.</p>				✓	✓						
<p>AT8</p> <p>Make observations of waves in fluids and solids to identify the suitability of apparatus to measure the effects of the interaction of waves with matter.</p>										✓	

The importance of mocks

Points to consider

- What are you thinking of doing (eg running mocks as normal, in reduced format, different times, open/closed book)?
- What would you like to get out of your mocks? For example:
 - high-level analysis, identifying areas of weakness such as particular AOs or maths skills
 - question-level analysis, looking at mistakes that would mean marks not gained, eg not using precise language or forgetting to label an axis
 - student motivation: "Yes, I can do this!"
- Do students need to do a full paper? Is it worth putting students through the stress of whole-paper exams?
- Do the grades students get really matter? How will they feel if they get low marks?
- When are you planning to run mock exams?
 - Before or after Christmas?
 - If before Christmas, how realistic is this timing likely to be? What will results from such early tests actually show you about students' progress/needs?
- Are you thinking of just the one set of mocks, or doing a second?
 - If a second, when will that be?

Contact us

Our friendly team will be happy to support you between 8am and 4pm, Monday to Friday.

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