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Examiners' Report
June 2022

GCSE Combined Science 1SC0 2PF

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June 2022

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Introduction

This was the first examination of paper 2, at Foundation level, for this specification in a summer series, since Summer 2019.

Questions were set to test candidates ' knowledge, application and understanding from these topics in the specification:

- Topic 1 – Key concepts of physics.
- Topic 8 – Energy – forces doing work.
- Topic 9 – Forces and their effects.
- Topic 10 – Electricity and circuits.
- Topic 12 – Magnetism and the motor effect.
- Topic 13 – Electromagnetic Induction.
- Topic 14 – Particle model.
- Topic 15 – Forces and Matter.

It was intended that the examination paper would allow every candidate to show what they knew, understood and were able to do. Within the question paper, a variety of question types were included such as objective questions, short answer questions worth one or two marks each and longer questions worth three or four marks each. The inclusion of questions designed at targeting candidates ' knowledge and understanding of practical work continued. This included assessing their fundamental knowledge of practicals specified in the specification, together with further application. The six-mark question, Q6(d), tested their knowledge and understanding of scientific enquiry techniques and procedures relating to a core practical.

Candidates coped well with most questions and did particularly well in the questions asking for calculations using equations.

Candidates ' knowledge of practical work showed improvement, particularly in Q2(b)(iii) and in Q6(d).

Successful candidates were:

- well-acquainted with the content of the specification.
- had been engaged with practical work at some stage during their course.
- competent in quantitative work, especially in using equations.
- willing to apply physics principles to the novel situations presented to them.
- able to recognise key command words such as 'describe' and 'explain' and constructed their responses accordingly.
- willing to apply physics principles to the novel situations presented to them.

Question 1 (a)

This question required the identification of some common circuit symbols.

The vast majority of candidates scored at least 1 of the 3 marks available with most scoring all 3 marks.

Question 1 (b)(ii)

This was a calculation involving substitution into a given equation and recall of the unit of the final answer.

Nearly all candidates scored 2 marks for substitution and evaluation but only a very small number were able to recall the correct unit for charge.

(ii) The current in the lamp is 0.21 A.

Calculate the charge that flows through the lamp in a time of 300 s.

State the unit of charge.

Use the equation

$$\text{charge} = \text{current} \times \text{time}$$

(3)

0.21 × 300 = 63

charge = 63 unit V

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Examiner Comments

Correct calculation with clear working shown but the unit is not correct.

V or volt was a common error.

(ii) The current in the lamp is 0.21 A.

Calculate the charge that flows through the lamp in a time of 300 s.

State the unit of charge.

Use the equation

$$\text{charge} = \text{current} \times \text{time}$$

(3)

0.21 x 300 = 63

charge = 63 unit C

ResultsPlus Examiner Comments

Correct calculation and the correct unit, scores all 3 marks.

Question 2 (a)(i)

Candidates had to suggest a suitable material to use in an investigation of electromagnetism.

A disappointing number were able to give a correct suggestion, even though the mark scheme allowed some tolerance.

The most common incorrect answer was copper.

2 (a) A teacher prepares some equipment to demonstrate electromagnetism.
Figure 2 shows the equipment.

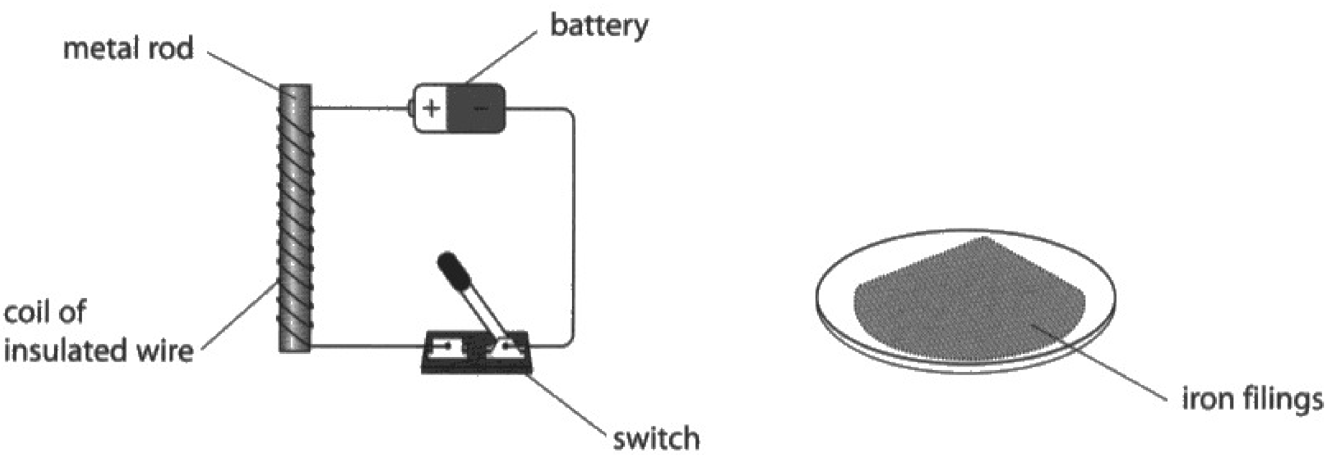

Figure 2

The teacher wants to show that iron filings

- are picked up by the metal rod when the switch is closed
- fall off the metal rod when the switch is opened again.

(i) Suggest a suitable metal for the rod.

(1)

steel

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Examiner Comments

This scored the mark, showing the tolerance allowed in the mark scheme.

Question 2 (a)(ii)

In giving reasons for their choice of material in Q2(a)(i), more candidates knew that the material must be magnetic than could suggest a magnetic material.

Question 2 (b)(i)

Here examiners were expecting candidates to realise that the reason the magnetic field strength was not zero was due to the presence of the Earth's magnetic field.

Only a few candidates scored the mark for this question.

Question 2 (b)(ii)

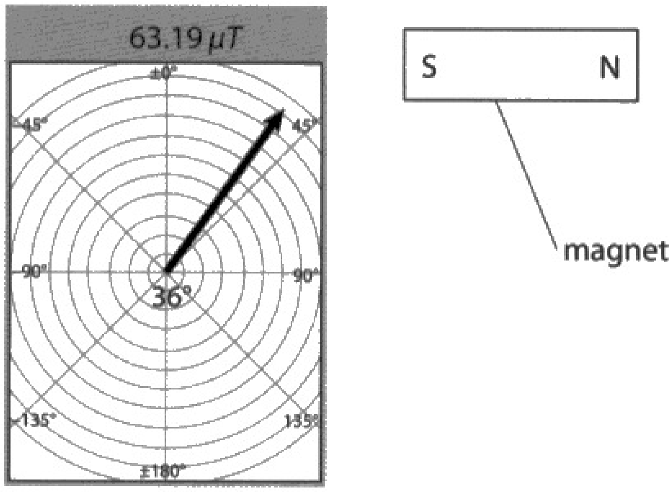
The two changes in the magnetic field (measured by the phone) that examiners were looking for were:

- a change in the direction of the field.
- an **increase** in the strength of the magnetic field.

Most candidates scored at least 1 of these 2 marks, usually for the change in direction.

The student places a magnet near to the phone on the table.

Figure 4 shows the magnet and the new display on the screen.



(Source: adapted from MGS Lite app for iPhone)

Figure 4

(ii) State **two** changes in the magnetic field measured by the phone from Figure 3 to Figure 4.

(2)

1 the direction of the magnetic ~~fieo~~ field has changed

2 the Strength of the magnetic field has also Changed

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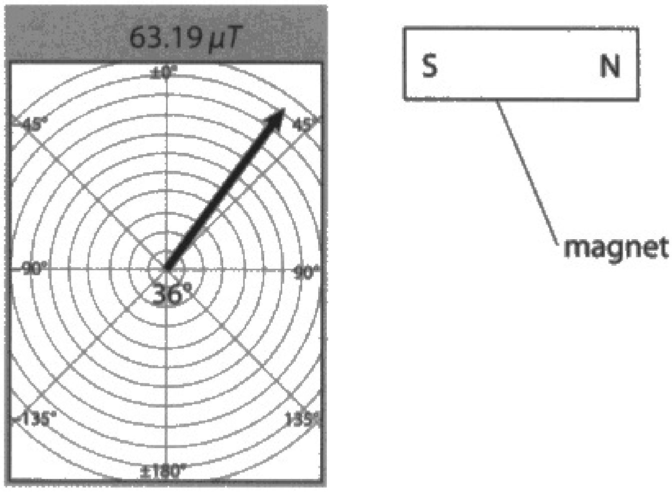
Examiner Comments

This response scores the change in direction mark but does not say the strength of the field has **increased.**

1 mark.

The student places a magnet near to the phone on the table.

Figure 4 shows the magnet and the new display on the screen.



(Source: adapted from MGS Lite app for iPhone)

Figure 4

(ii) State **two** changes in the magnetic field measured by the phone from Figure 3 to Figure 4.

(2)

1 The magnetic field's angle is now different!

2 The strength has now incredsed!

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Examiner Comments

'angle is now different' is acceptable for change in direction and the 2nd mark is also clearly scored.

2 marks.

Question 2 (b)(iii)

This practical based question required a description of a possible method to use in an investigation into how field strength changes with distance.

Full marks could be gained by mentioning 3 of these 4 points:

- use a ruler/tape measure to measure distance.
- measure/record the magnetic field strength.
- change the conditions (eg move the phone).
- process the results (eg table, compare readings).

An encouraging number of candidates scored at least 2 of the 3 marks available.

(iii) Describe how the student could use the mobile phone to investigate the strength of the magnetic field at different distances from the magnet.

(3)

measure the stregnth of the ~~gravitational~~ magnetic field close and repeat the measurments while moving furthur away. Also measure with a ruler how far away you are each time you measure.

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Examiner Comments

This scores 3 marks, the 2nd, 3rd and 1st marks.

(iii) Describe how the student could use the mobile phone to investigate the strength of the magnetic field at different distances from the magnet.

(3)

The student would hold a magnet near the phone and write down the magnetic field. They would then move the magnet further away and record the results then. They would repeat this and compare results.

(Total for Question 2 = 9 marks)

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This also scores all 3 marks, the 2nd, 3rd and 4th marks.

Question 3 (a)(ii)

Many candidates were able to identify the fuse in the diagram but few were able to describe its purpose.

(ii) Describe the purpose of the component labelled X.

(2)

The fuse is used as a safety feature so when there is any problems with the circuit the wire in the fuse melts, breaking the circuit.

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Examiner Comments

This description was sufficient to score both marks here.

Question 3 (b)

This was a calculation involving a substitution into a given equation. The time was given in minutes and candidates needed to be familiar enough with the use of this equation to know that the time must be in seconds.

An encouraging number of candidates were aware of this and scored all three marks. Most of the other candidates scored 2 marks, using the time in minutes.

(b) The 230 V mains supply transfers 9000 J of energy to the pump motor in 1 minute.

Calculate the current in the pump motor.

Use the equation

$$I = \frac{E}{V \times t}$$

(3)

$\frac{9000}{230 \times 1} = 39.13$

$\frac{9000}{230 \times 60} = 0.65$

current = 39.13 A

ResultsPlus
Examiner Comments

This response shows the calculation done twice, using minutes and then seconds.

Unfortunately, the candidate made the wrong choice, putting the 'minutes' answer in the answer space.

2 marks.

(b) The 230V mains supply transfers 9000J of energy to the pump motor in 1 minute.

Calculate the current in the pump motor.

Use the equation

$$I = \frac{E}{V \times t}$$

(3)

$\frac{9000}{230 \times 60}$

current = 0.65 A

230 × 60 = 13 800

9000 ÷ 13 800

ResultsPlus Examiner Comments

This response shows clear working and the correct answer.

3 marks.

Question 3 (c)(i)

Examiners would accept a range of answers in this energy transfer question, covering the ideas that:

- not all the energy is transferred to the pump.
- what happens to this energy.

Most candidates scored at least 1 of the 2 marks.

(c) The system transfers 8400 J of useful kinetic energy to the water passing through the pump in 1 minute.

Figure 6 shows a diagram of the energy transfers.

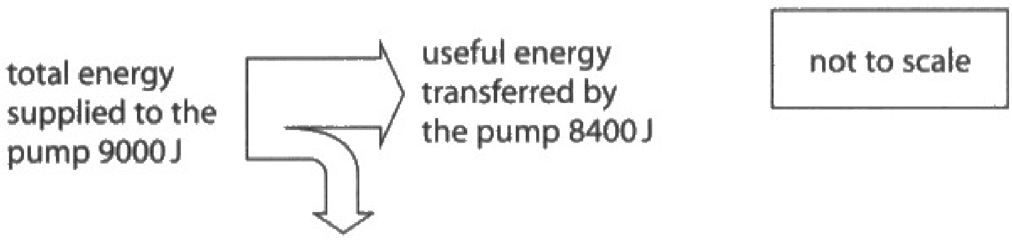

Figure 6

(i) Explain why the useful energy transferred to the water is different from the total energy supplied to the pump.

(2)

because the pump ~~tat~~ can have wastefull energy ~~fg~~ like thermal and the wast would be 600 J.

ResultsPlus Examiner Comments

An acceptable answer in this context covering 'wasted' energy and thermal energy.

2 marks.

(c) The system transfers 8400 J of useful kinetic energy to the water passing through the pump in 1 minute.

Figure 6 shows a diagram of the energy transfers.

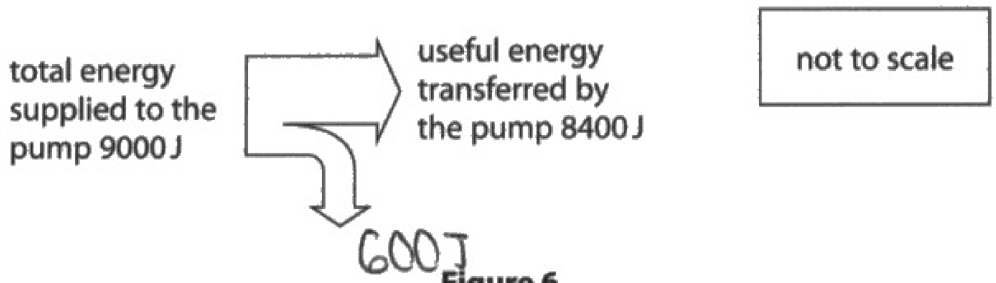

Figure 6

(i) Explain why the useful energy transferred to the water is different from the total energy supplied to the pump.

(2)

The other 600 J of energy is wasted energy and is dissipated into the surroundings as heat energy.

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Examiner Comments

2 marks.

Question 3 (c)(ii)

This was an efficiency calculation, using a given equation and data taken from a diagram.

The vast majority of candidates scored both marks.

Question 4 (b)(i)

Few candidates could recall the unit for work done.

Question 4 (b)(ii)

This was a challenging calculation involving substituting data from a table into an equation selected from the equation sheet and rearranging the equation.

An encouraging number of candidates were able to score both marks for this question.

(ii) Use the data for student B to calculate his estimated weight.

(2)

$1960 \div 4.0$

$= 490.$

weight = 490 N

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Examiner Comments

Clear working, showing rearrangement and the correct answer.

2 marks.

Question 4 (b)(iii)

Another calculation, this time involving a slightly more challenging rearrangement, again with encouraging results.

(iii) Use the data for student C to calculate the time she takes.

(2)

$2040/425 = 4.8$

time taken = 4.8 s

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Examiner Comments

It is good to see clear working in all calculations but especially in those involving rearrangement of equations.

2 marks.

Question 4 (c)

Here candidates had to identify a significant source of error and state how the error could be reduced.

Most candidates did not score on this question. Those that did, usually scored both marks by referring to the estimated weight and suggesting measurement using a balance or 'scales'.

Question 5 (a)(ii)

In this calculation, candidates could use any of two possible equations:

$P = I \times V$

$P = I^2 \times R$

Both of these were on the equation sheet.

Pleasingly, many candidates scored both marks.

(ii) Calculate the power supplied to the lamp.

(2)

electrical power = $(\text{current})^2 \times$ resistance

$(0{\cdot}30)^2 \times 15 = 1{\cdot}35$

power = 1·35 W

ResultsPlus
Examiner Comments

Using $P = I^2 \times R$ scores both marks.

(ii) Calculate the power supplied to the lamp.

(2)

4.5 × 0.30 = 1.35

power = 1.35 W

ResultsPlus
Examiner Comments

Using $P = I \times V$ scores both marks.

Question 5 (b)

This was a challenging question where candidates had to provide an explanation that linked 3 of the following points:

- lamp in second circuit is dimmer (than lamp in first circuit).
- current in second circuit is less (than in first circuit).
- potential difference / voltage across each lamp (in second circuit is) less / shared.
- idea that power of each lamp (in second circuit) is less / shared.
- the (total) resistance of the second circuit is more (than in first circuit).

Only a few candidates scored all 3 marks. Many candidates scored the 1st marking point only.

(b) Another **identical** lamp is added to the circuit, as shown in Figure 10.

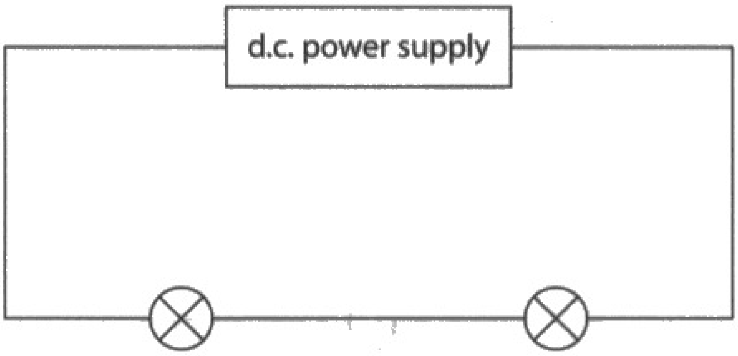

Figure 10

The power supply provides the same potential difference as it provided in the circuit in Figure 9.

State and explain the difference between the brightness of the lamp in Figure 9 and the brightness of a lamp in Figure 10.

(3)

The voltage will split and the lamps in Figure 10 will be twice as dim as the single light in figure 9, not as much power to each lamp when voltage splits.

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Examiner Comments

This scored 3 marks linking the 3rd, 1st and 4th points.

(b) Another **identical** lamp is added to the circuit, as shown in Figure 10.

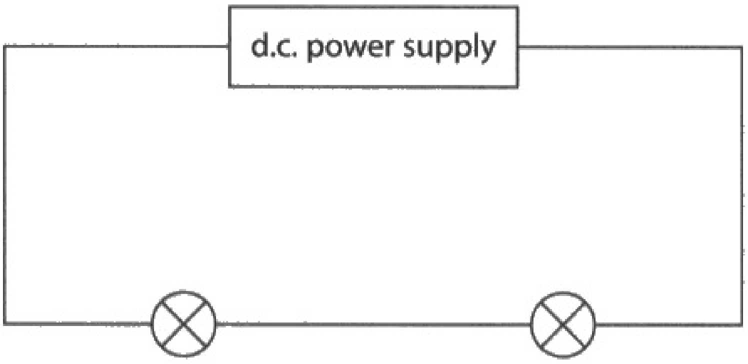

Figure 10

The power supply provides the same potential difference as it provided in the circuit in Figure 9.

State and explain the difference between the brightness of the lamp in Figure 9 and the brightness of a lamp in Figure 10.

(3)

Figure 9 is brighter as it only has one bulb/lamp however figure 10 is not brighter because it has two bulbs which have to share the energy and brightness.

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Examiner Comments

This scores 1 mark only, for the first point.

Question 5 (c)

This proved to be a more challenging question than expected.

Given a low voltage power supply and a piece of resistance wire, candidates were asked to draw a diagram of a circuit that could be used to measure the resistance of 50 cm of the wire.

Examiners were looking for an ammeter and a voltmeter connected in the circuit that would make it possible to measure the resistance.

The vast majority of candidates did not score on this question.

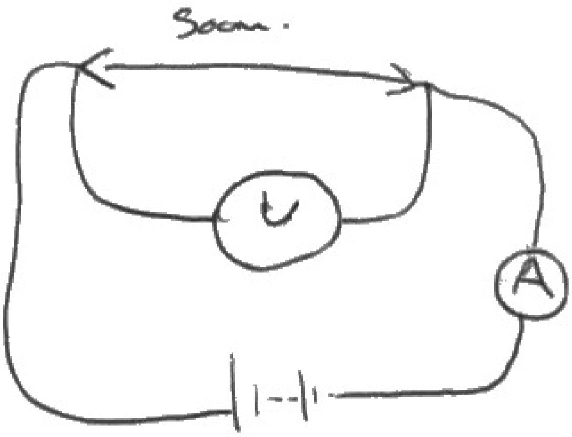
(c) A student is given a low voltage power supply and 1 m of resistance wire.

The student uses these and other pieces of equipment to measure the resistance of just 50 cm of the resistance wire.

Draw a diagram of the circuit that the student should use.

Your circuit diagram should identify the pieces of equipment that the student uses.

(3)



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This scored all 3 marks.

Question 5 (d)

Describing the difference between d.c. and a.c. proved to be too challenging for most of the candidates.

(d) Describe the difference between direct current (d.c.) and alternating current (a.c.) in electrical circuits.

(2)

direct current means it doesnt change direction. Alternating current means it changes direction

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This was a clear example of a 2 mark response.

(d) Describe the difference between direct current (d.c.) and alternating current (a.c.) in electrical circuits.

(2)

Direct current is going one way Alternating current is going different ways.

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This scores the d.c. mark but 'different ways' was insufficient for 'changes direction' for the a.c. mark.

1 mark.

Question 6 (b)

This was a challenging calculation, targeted at grades 4 and 5.

Candidates first had to calculate the change in volume, using the diagram and the data below it. This volume then had to be substituted into the equation which then had to be rearranged. The final answer had to be given to 2 s.f.

Only a few candidates scored all 4 marks but many more scored 1, 2 or 3 marks.

(b) Figure 11 shows some water in a measuring cylinder and a lump of iron.

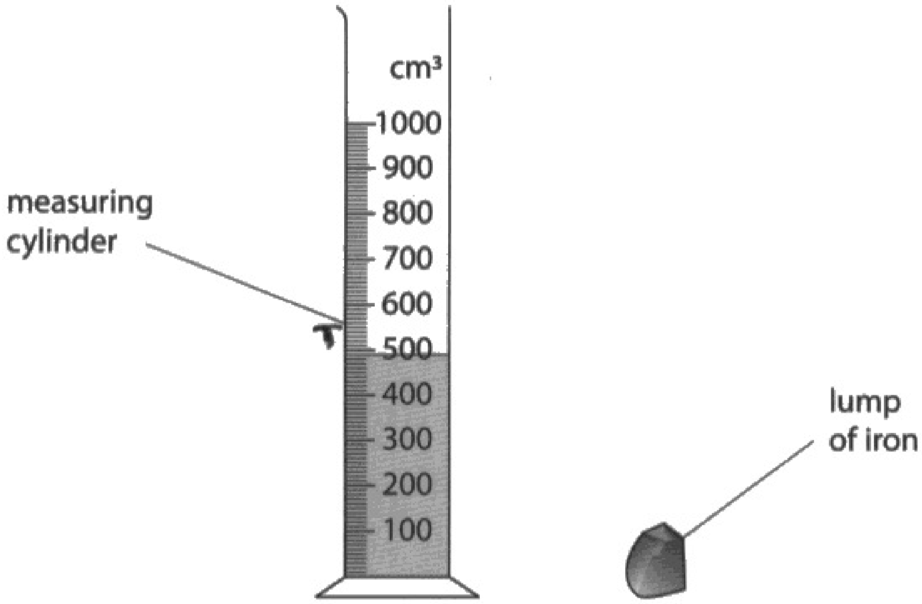

Figure 11

The lump of iron is lowered fully into the water.

The water level in the measuring cylinder rises to 530 cm³.

The density of iron is 7.9 g / cm³.

Calculate the mass of the lump of iron.

Use the equation

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Give your answer to 2 significant figures.

(4)

7.9 x 530 = 4187

4200

mass = ~~4187~~ .... g

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This response uses the wrong volume (a common error) but goes on to successfully manipulate the equation giving the final answer to 2 s.f.

3 marks.

(b) Figure 11 shows some water in a measuring cylinder and a lump of iron.

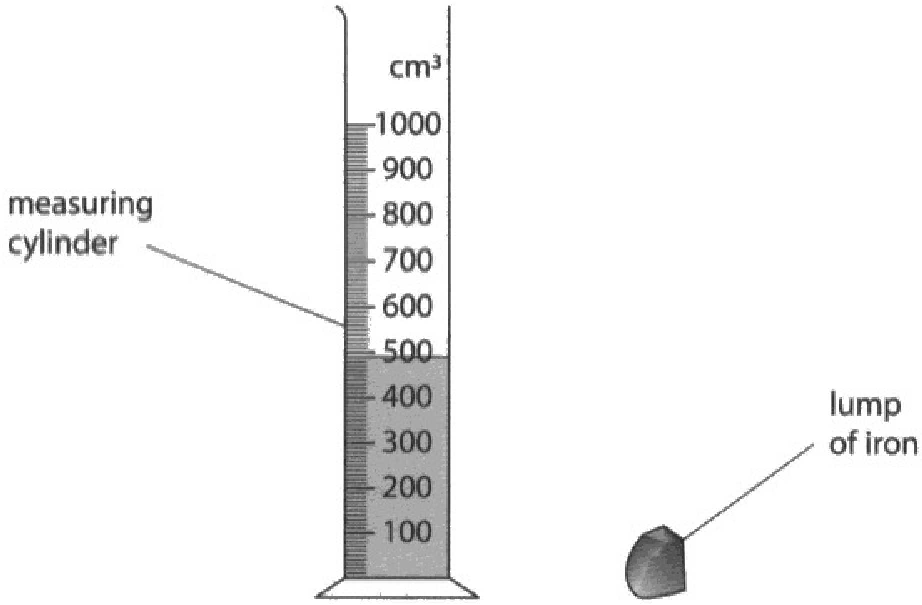

Figure 11

The lump of iron is lowered fully into the water.

The water level in the measuring cylinder rises to 530 cm³. ← from what? 490

The density of iron is 7.9 g / cm³.

Calculate the mass of the lump of iron.

Use the equation

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Mass
D | V

Give your answer to 2 significant figures.

(4)

Mass = 7.9 × ~~530~~ 40

530 − 490
= 40

~~[illegible]~~

= 316g

≈ 320

mass = 320 g

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This is an excellent response, showing all the working, finishing with the correct answer given to 2 s.f.

4 marks.

Question 6 (c)

Targeted at grades 4 and 5, there were more scores of 2 marks than expected.

(c) A piece of wood has a similar shape and volume to the lump of iron.

The density of the wood is 0.82 g/cm³.

The density of water is 1.00 g/cm³

Explain why the method used in part (b) cannot be used to determine the mass of the piece of wood.

(2)

Because wood floats so there won't be a big and accurate change in volume of water.

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A sensible explanation, scoring both marks.

Question 6 (d)

This extended open response question was centred on a core practical, determining the specific heat capacity of water.

To reach level 3, 6 marks, candidates had to mention at least two items of equipment and describe two of the essential measurements to be taken. In addition, reference had to be made to the equation used or some extra detail eg reducing heat loss.

A significant number of candidates scored zero on this question but for the ones who did score, marks were distributed across the levels as expected.

*(d) A student needs to determine the specific heat capacity of water.

Figure 12 shows some of the equipment the student uses.

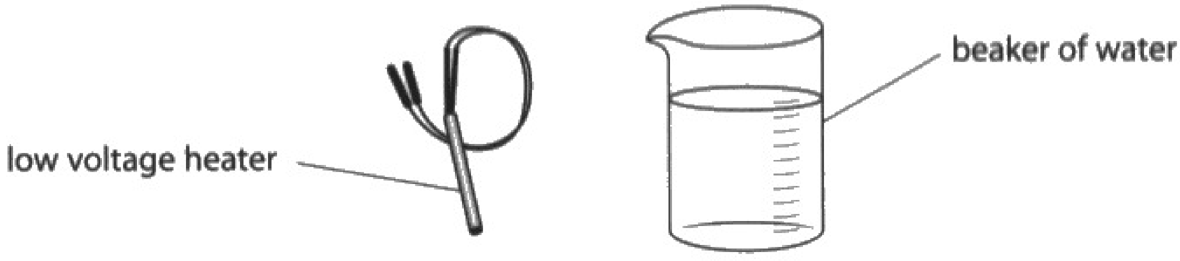


Figure 12

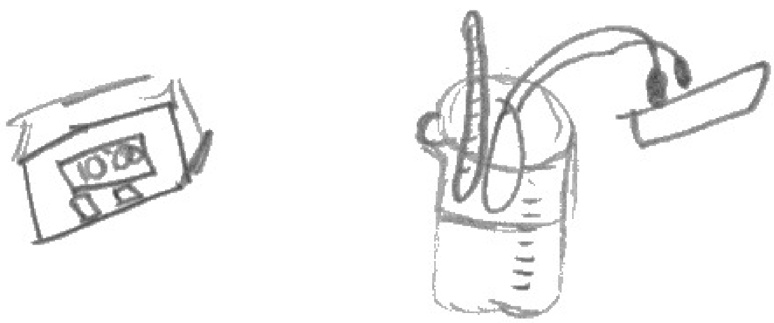
Describe the method the student should use to determine the specific heat capacity of water.

Your description should include, with reasons,

- any other equipment needed
- the measurements needed.

You may draw a diagram if it helps your answer.

(6)



The student would also need a thermometer. The student should put the thermometer and low valtage heater inside the beaker they will also need something to connect the low voltage heater too and when the heater ~~start~~ starts producing energy the student should record the ~~tha~~ temperature change every 10 seconds after this the student could use the equation $\Delta Q = m \times c \times \Delta\Theta$, students should also have a stop watch and pen and paper to read off the stop watch every 10 seconds, and record ~~the~~ their awnser

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Examiner Comments

Even though this response is a bit jumbled, it has the equipment, details of the measurements, and use of the equation so level 3, 6 marks awarded.

Paper Summary

Based on their performance on this paper, candidates should:

- make sure that they have a sound knowledge of the fundamental ideas in all the topics.
- get used to the idea of applying their knowledge to new situations by attempting questions from previous examination papers.
- draw a labelled diagram to help their answer, especially when describing a practical procedure, such as in Q6(d).
- note that where a question involves a calculation, they should make sure they write down the equation they are using (if not given in the question) and show each step in their working.
- make sure that they recognise SI prefixes such as m and k and n and how to handle these in calculations.
- use the marks at the side of a question as a guide to the form and content of their answer.

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