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Examiners' Report
June 2019

GCSE Combined Science 1SC0 2PF

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Introduction

This was the second examination of paper 2, at foundation Level, for the new specification. 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, especially where they were asked to propose improvements to a procedure. The six-mark question, Q06c, tested their ability to apply their knowledge of the structure of atoms to interpreting some given data.

Candidates coped well with most questions and did particularly well in the questions asking for calculations using equations. Students' knowledge of practical work shows improvement.

Successful candidates were:

- well-acquainted with the content of the specification
- had been engaged with practical work during their course
- competent in quantitative work, especially in using equations
- willing to apply physics principles to the novel situations presented to them
- recognised 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.

Less successful candidates:

- had gaps in their conceptual knowledge of the topics of this paper
- had gaps in their procedural knowledge, relating to their practical work
- misread and/or misunderstood the symbols used in equations
- failed to set out calculations in a logical way that could be easily followed
- did not focus sufficiently on what the question was asking
- found difficulty in applying their knowledge to new situations.

This report will provide exemplification of candidates' work, together with tips and/or comments, for a selection of questions. The exemplification will come from responses which highlight successes and misconceptions, with the aim of aiding future teaching of these topics.

Question 1 (a)

Nearly all candidates scored at least 1 mark, matching atomic particles to the appropriate description and many of them went on to score all 3 marks.

Question 1 (b)

The majority of candidates were able to determine the missing current at a junction in a circuit.

Question 1 (c)

The majority of candidates could calculate charge using the given equation but only a small number were able to give a correct unit for charge.

(c) A wire in a circuit carries a current of 0.9 A.
Calculate the quantity of charge that flows through the wire in 50 s.

State the unit of charge with your answer.

Use the equation

charge = current × time

(3)

0.9 x 50 = 45

quantity of charge = 45 unit Coulombs

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Examiner Comments

Correct answer and correct unit.

3 marks.

Question 2 (b)

This was a challenging practical question and examiners were looking for the standard method involving a current-carrying wire through a flat card sprinkled with iron filings.

Other variations on this method were also acceptable.

(b) A student has

- a power pack
- a long piece of wire
- a stiff card
- iron filings

Describe how the student could use this equipment to show the shape of the magnetic field produced by a current in the wire.

You may draw a diagram to help with your answer.

(4)

By placing the card down along with the power pack with the wires attached to the power pack, you will be able to se the magnetic field produced by putting the iron fillings around the card near the wire. The iron fillings will then form around the wire, and when filled with current the fillings will form a shape of a magnetic field, indicating that a magnetic field in definitly current is put through

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Examiner Comments

This response scores 4 marks eventually but a diagram would have helped.

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Examiner Tip

If the question suggests drawing a diagram, then it is an idea to do so. It will help the examiner follow your answer and often help you to write your answer.

Question 2 (c)

Examiners were looking for at least 3 straight, equidistant lines between the poles with the direction marked from the North Pole to the South Pole and no contradictions.

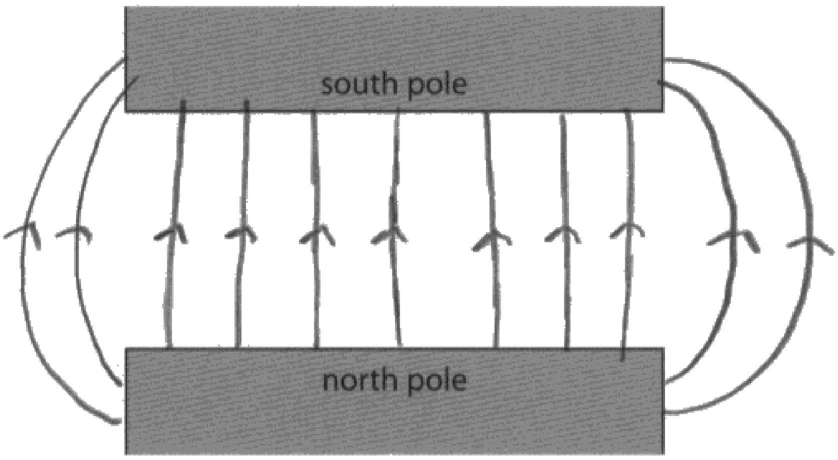
Many candidates were able to score at least 1 mark and some scored 2 but few scored all 3 marks.

(c) Figure 3 shows two magnetic poles facing each other.

The magnetic field between the poles is uniform.

On Figure 3, draw the magnetic field lines between the two poles and show the direction of this magnetic field.

(3)



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Examiner Comments

At least 3 of the lines between the poles are equally spaced and the direction is consistently correct.

3 marks.

Question 3 (a)

A downward pointing arrow from the middle of the weight or the bottom of the spring would score both marks.

Question 3 (b) (i)

Rearrangement was the main problem in this calculation.

Although a good number scored all 3 marks, most scored zero.

Some of those who scored zero may have scored 1 mark for substitution if they had shown their working or their working had been clear enough.

(b) A weight of 4.0 N is used to extend a spring.
The extension of the spring is 0.06 m.

(i) Calculate the spring constant, k, of the spring.

Use the equation

$$F = k \times x$$

(3)

$F = K \times X$

$K = F \div X$

$4 \div 0.06 = 66.6$

spring constant = 66.6 N/m

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Examiner Comments

Clear working, correct answer, all 3 marks.

(i) Calculate the spring constant, *k*, of the spring.

Use the equation

$$F = k \times x$$

(3)

F / k x   4 / 0.6

spring constant = 6.6 N/m

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Examiner Comments

Rearrangement and substitution are correct here, the error is in the evaluation.

2 marks.

Question 3 (b) (ii)

Examiners were looking for a measurement of the original length and a measurement of the final or stretched length.

A vague 'measure the spring' with no mention of length was not sufficient. Most candidates scored zero for this practical question.

Question 3 (c)

It was encouraging to see that most candidates could score both marks for this calculation involving a squared value.

Fewer candidates, however, went on to score all 3 marks by also giving the correct unit for work done.

(c) Another spring has a spring constant of 250 N/m.

Calculate the work done in stretching the spring by 0.30 m.

State the unit.

Use the equation

$$E = \frac{1}{2} \times k \times x^2$$

(3)

$\frac{1}{2} \times 250 \times 0.30^2$

$= 11.25$

work done in stretching the spring = 11.25 unit J

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Examiner Comments

All 3 marks for the calculation and the unit.

Question 4 (b) (i) - (ii)

This required candidates to read values from a measuring cylinder and a balance.

Most were able to do both successfully.

Question 4 (b) (iv)

Candidates were required to state two improvements that could be made to this investigation.

Examples of these such as tare the balance or use a greater volume of water are given in the mark scheme.

This proved challenging for most candidates but some scored 1 mark and a small number scored both marks.

(iv) State **two** improvements the student could make to this investigation.

(2)

1 'Tare' the scale in order for it to ignore the weight of the measuring cylinder.

2 Fill the measuring cylinder more and calculate the density using this data for a more accurate results.

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Examiner Comments

This gets the 'tare' and larger volume marks.

2 marks.

1 Do the experiment multiple times so it's accurate.

2 Make sure you put the scale at zero at the beginning.

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Examiner Comments

'Repeating' alone does not score. It should be 'repeat and average' here.

Putting the scale to zero is acceptable.

1 mark.

Question 4 (c) (i)

The relevant equation from the end of the paper was given in symbols in the question. Given the unfamiliar Δ symbol and the large numbers involved, it was encouraging to see that most candidates scored full marks for this question.

Some candidates lost 1 mark for converting kilograms to grams.

(c) (i) Figure 6 shows an electric kettle.

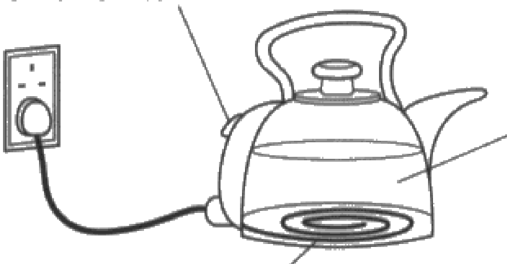

Figure 6

The kettle contains 1.5 kg of water.

The kettle is switched on.

Calculate the energy needed to raise the temperature of the water by 50 °C.

Specific heat capacity of water = 4200 J/kg °C

Use the equation

$$\Delta Q = m \times c \times \Delta\theta$$

(2)

1. 5 × 50 × 4200 = 315,000

energy needed = 315000 J

ResultsPlus Examiner Comments

Clear, correct working and final answer.

Full marks.

Question 4 (c) (ii)

It was pleasing to see that many candidates scored full marks in this question involving the rearrangement of a given equation.

Some of those who scored zero may have scored 1 mark for substitution if their working had been clear enough.

(ii) The amount of energy, *E*, needed to bring the water to boiling point is 670 000 J.

The kettle has a power of 3500 W.

Calculate the time, *t*, it takes to bring the water to boiling point.

Use the equation

$$P = \frac{E}{t}$$

(3)

$$T = \frac{E}{P}$$

$$\frac{670000}{3500} = 191.42|8571$$

time to bring the water to boiling point = 191.43 s

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Examiner Comments

A typical example of full marks, which is always good to see.

Question 5 (b) (i)

The equation for change in gravitational potential energy was given in the question but candidates had to recall a value for gravitational field strength.

Those who did usually went on to score full marks.

Unfortunately many candidates simply missed out g in their calculation and so scored no marks.

(b) A ball has a mass of 0.046 kg.

(i) Calculate the change in gravitational potential energy when the ball is lifted through a vertical height of 2.05 m.

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

(2)

$= 0.046 \times 10 \times 2.05$

$=$

change in gravitational potential energy = 0.943 J

ResultsPlus
Examiner Comments

This candidate recalls g as 10 (N/kg) and goes on to get full marks.

(2)

0·046 × 2.05 ~~×12.1294~~

= ~~2.01.128~~ 0.0943

change in gravitational potential energy = 0.0943 J

ResultsPlus

Examiner Comments

This response misses out a value of g completely and so scores no marks.

Question 5 (b) (ii)

A straightforward recall and use of the equation for kinetic energy.

(ii) The ball is released.

Calculate the kinetic energy of the ball when the speed of the ball is 3.5 m/s.

(3)

$KE = \frac{1}{2} \times m \times v^2$

$KE = \frac{1}{2} \times 0.046 \times 3.5^2$

$KE = \frac{1}{2} \times 0.046 \times 12.25$

$KE = 0.28175$

kinetic energy of the ball = 0.28 J

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Examiner Comments

Here the equation and subsequent working are clearly shown.

Full marks.

Question 5 (b) (iii)

The accepted range for this estimate was between 0.80 (m) and 0.95 (m).

Question 5 (b) (iv)

Many candidates could say that the ball had 'lost energy' for the first mark but few went on to say what had happened to the energy, as the word ‘explain’ requires.

(iv) Explain why the ball does not bounce back to its starting height of 2.05 m.

(2)

It transfers energy into the ground when it makes contact with it. This means it will not go up to the same height because it doesn't have the right energy to do it.

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Examiner Comments

This explanation starts with the reason and ends with the statement about the ball losing energy - implied in the last sentence.

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Examiner Tip

The word 'explain' in a question usually requires a statement and a reason.

the ball has lost energy when going down and bouncing. The ball does not have energy to go back up.

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Examiner Comments

This gets the first mark but not the second.

Question 5 (c)

Examiners were looking for a description of the graph that included the height decreasing with bounce number and the idea of the decrease being non-linear.

Most candidates scored the first mark but only a small number went on to score the second.

(c) A student plots a graph showing the height at the start and the maximum height reached after each bounce.

Figure 8 shows the student's graph.

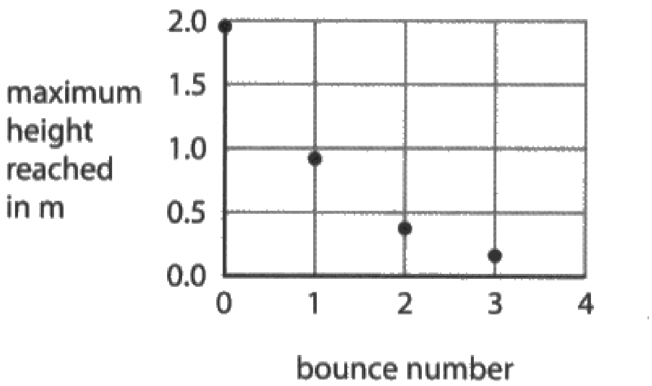

Figure 8

Describe how the maximum height reached changes with the bounce number in Figure 8.

(2)

the hight of the ball after each bounce gets half less. For example After the second bounce it is 0.4 metres, then after the ~~third~~ third bounce it goes to 0.2 m. So it halfs each time.

(Total for Question 5 = 11 marks)

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Examiner Comments

The height 'halfs each time' with each bounce, with examples, was accepted as a non-linear decrease.

2 marks.

Question 6 (b) (i)

Here candidates had to recall V = IR and apply it, using data from the table, to calculate resistance.

Most candidates did this successfully and it was pleasing to see an improvement in working clearly shown.

(b) A student investigates how the current in a lamp changes with the potential difference across the lamp.

The student uses the results to calculate the resistance of the lamp.

The results are shown in the table in Figure 9.

potential difference in V	current in A	resistance in Ω
1.0	0.09	11
2.0	0.14	14
3.0	0.18	17
4.0	0.22	18
5.0	0.26	
6.0	0.30	20

Figure 9

(i) One value of resistance is missing from the table in Figure 9.

Calculate the value of resistance that is missing from the table.

(3)

$\frac{5.0}{0.26}$ = 19|23

missing resistance = 19 Ω

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Examiner Comments

With this well-known equation, many people just remember R = V/I, as it seems that this candidate did.

3 marks

Question 6 (b) (ii)

This was a difficult analysis and evaluation of a table of data that proved to be too challenging for most.

Candidates had to refer to the non-linearity of the relationship, supported with data from the table.

(ii) The student writes this conclusion:

'The resistance of the lamp is directly proportional to the potential difference.'

Comment on the student's conclusion.
Use information from Figure 9 in your answer.

(3)

The resistance isn't proportional to the potential difference because the Potential goes up equally in 1.0 but the resistance goes up in 3 for ~~2~~ ~~two~~ 1.0 and 2.0 potential difference and then goes up in 1.

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Examiner Comments

This is a well-developed explanation. It says that, although the pd goes up by the same amount each time, the resistance increases by different amounts at different stages. It backs this up with data from the table.

3 marks.

Question 6 (c)

To achieve level 3 in this 6 mark question, candidates had to give some detail about the movement of charged particles and the energy transfer in the circuit.

Detail about only one of these would limit the marks to level 2.

Most candidates were able to score some marks and of those that did, most reached level 2 and some reached level 3.

*(c) Figure 10 shows a battery connected to a filament lamp.

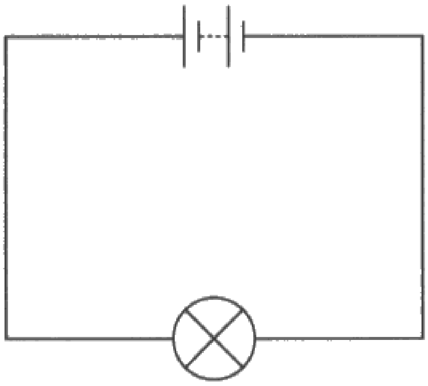

Figure 10

Explain, in terms of the movement of charged particles, how energy is transferred from the battery, through the lamp, to the surroundings.

(6)

It goes from possitive to negative. In a wire there is copper wiring in the form of a lattice. The particles have to get pass them, howevere there are ~~&~~ collisions and that is the current (the number of times a particle collides against the copper latice. ~~B~~ The picture shows a series ~~circ~~ circuit and that means the flow of charge is the same throughout the ~~circ~~ curcuit. Energy ~~is~~ from the lamp gets transferred into the surrounds like heat. Thermal energy is in the lamp and ~~goes to~~ goes to others surroundings.

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Examiner Comments

Although some of this is a little confusing, the response provides sufficient detail about particle collisions with the lattice and the energy transfer to the surroundings.

Level 3, 6 marks.

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Examiner Tip

It is a good idea to highlight key words or phrases in a question to help you to answer it fully. Here, that might be 'movement of charged particles' and 'energy transfer.'

*(c) Figure 10 shows a battery connected to a filament lamp.

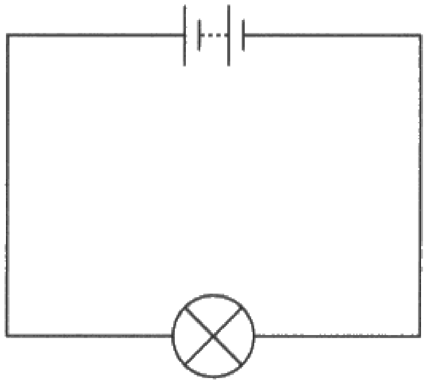

Figure 10

Explain, in terms of the movement of charged particles, how energy is transferred from the battery, through the lamp, to the surroundings.

(6)

The ~~cell~~ battery releases electrons out of the negative side to move around the ~~cir~~ circuit towards the positive side of the battery as electrons are negative so are ~~attract~~ attracted to the positive charge. On the way around the electrons run through the bulb causing it to turn on emitting light. ~~This then causes heat energy~~ the If the ~~tun~~ bulb is ~~a~~turned on for an extended amount of time then heat energy will be emitted causing ~~a~~ the area and some objects around the bulb to become hotter

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Examiner Comments

This response identifies the charged particles as electrons in the wire and the lamp and successfully describes the energy transfer from the lamp to the surroundings.

Level 3, 6 marks.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- 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 in previous examination papers
- when describing a practical procedure, draw a labelled diagram to help their answer. (Q02b)
- when suggesting improvements or extensions to a practical procedure, make sure they are relevant to the context of the question. (Q04biv)
- where a question involves a calculation, 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.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

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