Questions matter

GCSE

Combined Science: Trilogy

8464/P/1F Combined Science: Trilogy Physics Paper 1F

Report on the exam

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Contents

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Overview

This paper is one of the six examined components for Combined Science: Trilogy. All of these papers follow a similar structure and test the same assessment objectives.

This paper has 70 marks available to students and is made up of six questions.

- Approximately 40% of marks assess AO1; 40% of marks assess AO2; and 20% of marks assess AO3.
- Approximately 60% of marks target Low demand and 40% of marks target Standard demand.

Questions 5 and 6 on this paper and questions 1 and 2 on the Higher Tier paper are common. These questions are identical and are targeted at standard demand.

Questions are set at two levels of demand for this paper:

- **Low demand** questions are designed to broadly target grades 1–3.
- **Standard demand** questions are designed to broadly target grades 4–5.

A student's final grade is based on their attainment across all six papers.

Summary of overall performance

On the whole, students found this paper to be accessible, with the vast majority attempting to answer all questions.

Students were provided with a Physics Equations Sheet that included all equations needed. This considerably eased the demand of one of the calculation questions. For example, Question **04.3** asked students to recall the equation and **04.4** to use the equation. The calculation in Question **06.1** was more demanding due to the rearrangement required and many students struggled to use their calculator correctly on this question.

There were some instances where students were not reading the question carefully enough and were not answering the question asked. Question **05.6** was an example of this; many students wrote that the resources were unreliable and did not give a negative environmental impact.

Question **06.1** asked students to describe how three measurements could be made. This was not very well answered. The majority of students did not give the equipment they would need to take the measurements. With all practical method questions students should always state the equipment and describe what they are measuring with which piece of equipment.

Several questions highlighted gaps in knowledge and understanding. The recall questions on radioactivity in **01.8** and **01.9** were not well answered. Likewise, in Question **02.1** students had to select three named circuit symbols and draw a circuit diagram, many students selected the incorrect symbols.

Question 1 (Low demand)

01.1 Approximately one third of students knew the difference between the atoms of different isotopes of lead.

01.2 Approximately two thirds of students knew what is meant by 'lead-210 is radioactive'.

01.3 Approximately one third of students knew what beta radiation is.

01.4 80% of students were able to read the initial activity correctly from the graph.

01.5 Just under 20% of students answered this question correctly. There was a very wide range of incorrect answers indicating that many students struggled to understand how to answer the question.

01.6 This question was well answered with a little over 50% giving the correct age of the painting.

01.7 Half of the students knew that the estimated age would be lower if the other radioactive substances were not removed.

01.8 60% of students correctly selected gamma as the type of radiation with the greatest range in air.

01.9 80% of students correctly selected alpha as the type of radiation that is the least penetrating.

Question 2 (Low demand)

02.1 This question discriminated well and produced a good spread of marks. 35% of students gained 3 marks for selecting the correct circuit symbols and drawing a simple complete series circuit. 70% of students made one error and were awarded 2 marks. Most of the students that scored 2 marks selected an incorrect circuit symbol, but some did select them correctly but could not draw a simple complete series circuit. 10% of students gained 1 mark for 2 correct circuit symbols.

02.2 65% of students correctly identified the cell as the source of energy for the circuit.

02.3 This low demand calculation was well answered with 90% of students gaining both marks. Some students did an unusual conversion of time, dividing 30 by 100.

02.4 85% of students correctly calculated the resistance of the filament lamp and gained both calculation marks. The unit mark was awarded independently, and 60% of students selected the correct unit.

02.5 65% of students gained a mark for describing the current increasing as the potential difference increases. Only a small number of students described the relationship as being non-linear.

02.6 Only 30% of students described the resistance of the filament lamp increasing as the temperature increases.

02.7 This question discriminated well and produced a good spread of marks. Approximately 50% of students wrote Level 2 responses and gained either 3 or 4 marks. 40% of students wrote Level 1 responses because they did not include a calculation. Only a very small number of students did not write anything creditworthy, and a very small number did not attempt the question.

Question 3 (Low demand)

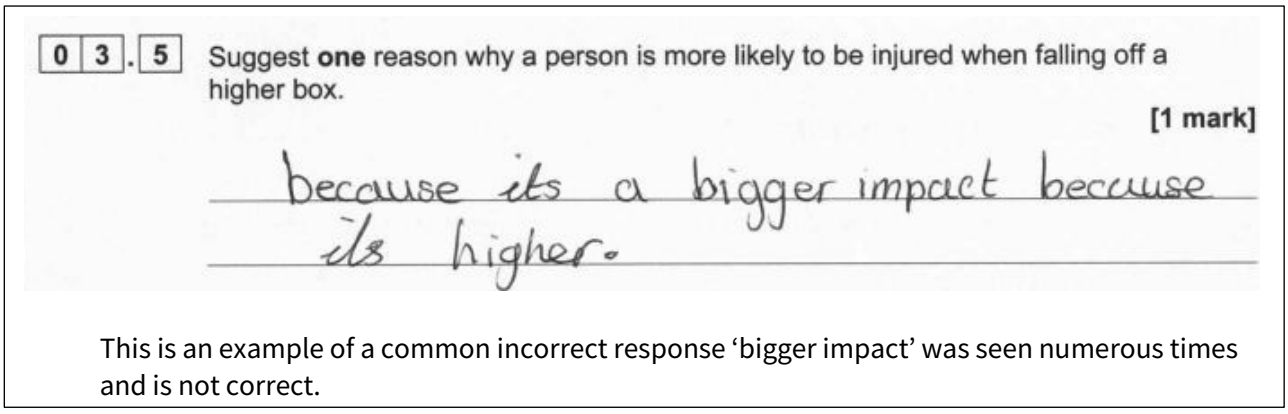
03.1 Only approximately 10% of students gained 2 marks on this question. 50% did get 1 mark for either identifying the stage with least gravitational potential energy, or the stage with the greatest kinetic energy.

03.2 This calculation was well answered. Nearly 85% of students gained both marks. The vast majority of students that correctly substituted into the equation evaluated it correctly.

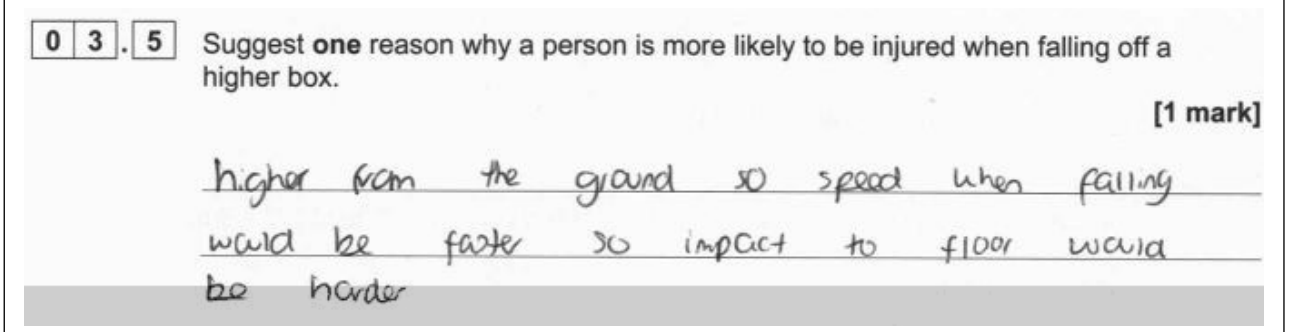
03.3 The calculation was slightly less demanding with a little over 90% of students gaining 2 marks.

03.4 Approximately half of students gained 2 marks for correctly explaining that both the gravitational potential energy and the kinetic energy increase. Only 15% also explained that this means that speed must be greater. 25% of students scored 1 mark for either the gravitational potential energy increasing or the kinetic energy increasing.

03.5 20% of students gained the mark for either greater velocity or speed or greater force. Most students did not use scientific terminology in their answer so were not able to be awarded the mark.



This is an example of a common incorrect response 'bigger impact' was seen numerous times and is not correct.



The word 'impact' is an example of a word that is ignored. This response is still awarded the mark as 'faster' is taken to mean the same as greater speed.

0 3 . 5 Suggest **one** reason why a person is more likely to be injured when falling off a higher box.

[1 mark]

When falling from a higher place the resultant force of impact is higher

This is an example of a response that does gain the mark for the correct use of scientific terminology. Again, the word 'impact' is ignored.

Question 4 (Low and standard demand)

04.1 45% of students selected the correct answer for the frequency of the UK mains electricity supply.

04.2 Just over 20% of students gained 1 mark for correctly identifying the colour of the insulation on one of the wires. 35% of students were able to identify both the colours of the insulation.

04.3 Students now have the equation sheet to select the equation from, so 90% of students gained the mark on this question. Approximately 5% of students selected the incorrect equation.

04.4 The vast majority of students who correctly substituted into the equation scored the 3 calculation marks. Approximately 75% of students gained 3 marks, but only 35% of students gained the mark for the significant figures. Many students gave their answer to 2 decimal places and not to two significant figures.

0 4 . 4 The power of the heating element in the kettle is 2100 W.

The potential difference across the heating element is 230 V.

Calculate the current in the heating element.

Give your answer to 2 significant figures.

[4 marks]

2100 ÷ 230 = 9.130434783

Current (2 significant figures) = 9.13 A

9.13 was a very common answer where students rounded to 2 decimal places and not to 2 significant figures due to not understanding the difference between the two.

04.5 This calculation proved to be more challenging with approximately 50% of students gaining 3 marks. The vast majority of students who substituted correctly were able to rearrange the equation correctly and then arrive at the correct answer. Most students who did not gain any marks either did not select the correct equation from the equation sheet or did an incorrect initial substitution.

0 4 . 5 The kettle is designed to switch off when the water reaches boiling point.

Before the kettle switches off, 0.0080 kg of water changes state.

The energy transferred to change the state of the water is 18 000 J.

Calculate the specific latent heat of vaporisation of the water.

Use the Physics Equations Sheet.

[3 marks]

$E = m \times L \quad L = E \div m$

$180,000 \div 0.0080 =$

$22\,500\,000$

Specific latent heat of vaporisation = 22,500,000 J/kg

Students should take care to use the correct number of zeros. Transcription errors where an incorrect number of zeros is used prevent the awarding of one of the marks.

04.6 This calculation was well answered with approximately 90% of students gaining 2 marks.

04.7 40% of students gained a mark on this question, but only 3% gained both marks. Very few explained that higher efficiency means less energy is wasted. Many students answered in terms of a kettle due to the previous question and explained that the appliance would complete its task in less time. This was awarded a mark due to the context of the question.

Question 5 (Standard demand)

05.1 25% of students gained marks on this question. 15% of students gained one mark, mostly for either stating that a thermal store of energy increased or that a kinetic store of energy increased. 10% of students gained 2 marks for making both statements, only a small number of students identified that a chemical store of energy was decreasing.

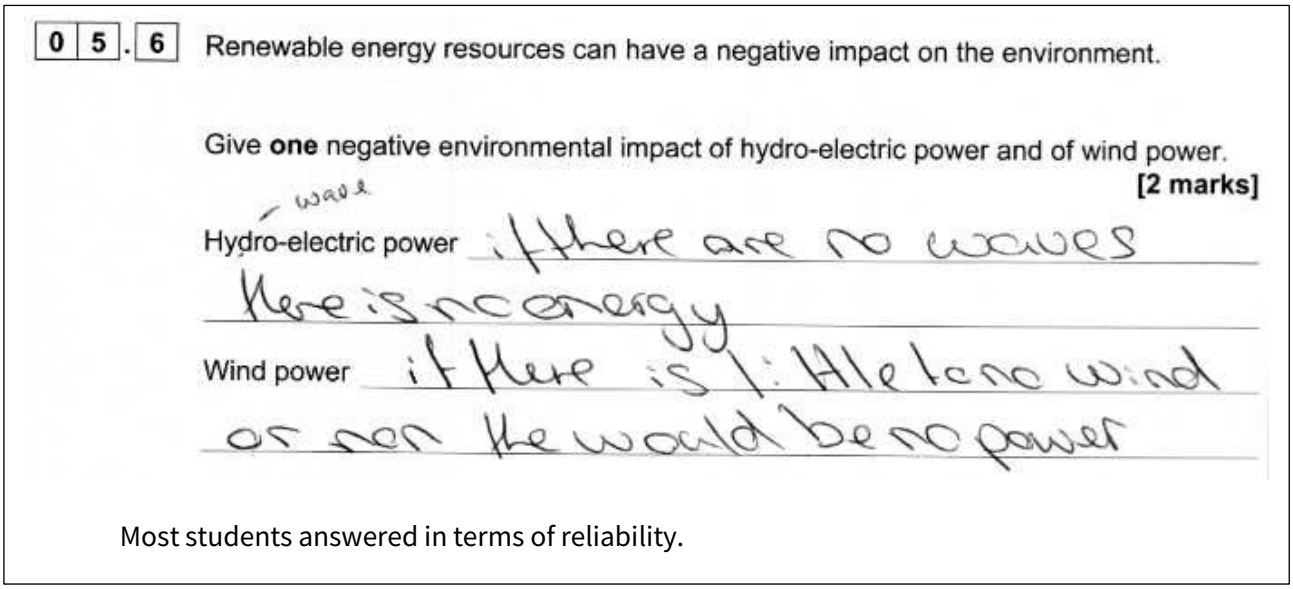
05.2 This question was not well answered, with only approximately 20% of students answering correctly.

05.3 This question was well answered with 85% of students answering correctly by stating that the cars are powered by a battery or by electricity.

05.4 65% of students could correctly analyse the bar chart to conclude that the amount of fossil fuel that is burned to generate electricity each year has decreased.

05.5 Only a very small number of students gained 2 marks on this question. 22% of students gained one mark for identifying that it is expensive, but the vast majority of those students did not state that *many* generators or resources are required

05.6 Most students did not give a negative impact on the environment in their answer and described both types of resource as being unreliable. 30% of students were able to gain 1 mark mostly for giving a negative impact on the environment for wind power. Many students suggested that hydro-electric power has a damaging impact on habitats in the sea. Very few students gained 2 marks.



0 5 . 6 Renewable energy resources can have a negative impact on the environment.

Give **one** negative environmental impact of hydro-electric power and of wind power.

[2 marks]

Hydro-electric power wave if there are no waves there is no energy

Wind power if there is no wind or not the would be no power

Most students answered in terms of reliability.

Question 6 (Standard demand)

06.1 This standard demand calculation performed as expected with 40% of students gaining at least one mark. Many students that did a correct substitution found the rearrangement difficult or could not use their calculator correctly

0 6 . 1 Calculate the specific heat capacity of aluminium.

Use the Physics Equations Sheet.

[3 marks]

F change in thermal = mass x heat cap x temp change
I 13800 = 0.75 x heat x 20
F 13800 ÷ 0.75 x 20
A 368 000

Specific heat capacity = 368 000 J/kg °C

This was a very common error. The student has shown their working clearly, but the rearrangement is ambiguous. Where a rearrangement is ambiguous examiners will look at the final answer to decide if the students means 13800/(0.75×20) or (13800/0.75) × 20.

06.2 Students found this question very demanding. Over 20% of students did not attempt the question. 40% of students were able to write something creditworthy. The majority of Level 1 answers gained some credit for suggesting that the temperature could be measured with a thermometer. The 10% of students that wrote Level 2 or 3 answers went on to describe measuring the energy transferred with either a joulemeter or other method and/or measuring mass using a top pan balance.

0 6 . 2 Describe a method the student could have used to obtain the results in **Table 2**.

[6 marks]

outside the box

1. Calculate the mass in kg of our aluminium block.
2. Set up our electric heater gacing the aluminium block and turn it on.
3. Calculate the energy transferred in joules from the heater from what it was before the experiment until after.
4. Measure the temperature change in °C from before the experiment until after.
5. Use these results to calculate our specific heat capacity which is $c = \Delta E \div m \times \Delta \theta$.
6. See the outcome and compare our results on a table.

All of the quantaties to be measured were given in the question, so no credit is given for simply stating that they need to be measured.

0 6 . 2 Describe a method the student could have used to obtain the results in **Table 2**.

[6 marks]

outside box

- Place aluminium on top pan balance to find its mass
- place a thermometer in the aluminium to find its starting temperature
- Connect a power supply and a joulemeter to the aluminium
- leave to aluminium to heat for 5 minutes
- Use thermometer to find its new temperature and joulemeter to find how much energy was needed to increase the temperature.

In this response the students has given the equipment needed and stated what it is measuring.

Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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