GCSE

Combined Science: Trilogy

8464/P/2F Combined Science: Trilogy Physics Paper 2F

Report on the exam

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Contents

The below table is interactive. You can press the control button and click on the title of the question to go directly to that page.

Contents	Page
Overview	4
Summary of overall performance	4
Question 1	5
Question 2	5
Question 3	6
Question 4	6
Question 5	7
Question 6	8
Question 7	11

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 seven 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 6 and 7 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

Whilst the questions that were common with the Higher tier proved quite challenging for students on this tier, they performed as expected and students who got a grade 4 or 5 were able to access these questions. Questions requiring students to describe changes in energy stores were not well answered.

Most students performed well on the 6-mark extended response question (05.3). Most students made simple judgements and many made good comparisons; however a large number did not include data from the bar chart in their evaluation.

In some cases AO1 questions that were just assessing knowledge were not well answered. Most students could not select two magnetic materials from a list (question 04.3).

Students were given all the equations again this year, so the questions requiring them to recall an equation (05.4, 06.2) were well answered. Having the equations makes the calculation questions (05.5, 06.3) more accessible too, and an increasing number of students are able to perform a simple rearrangement.

Questions that required students to describe or explain proved to be the most challenging on the paper. Often in questions like 02.5 students were not answering the question and did not describe weight changing or did not use the graph at all. Question 05.6 required students to explain how changing one factor affected another; students again often did not answer the question, but just described braking.

Question 1 (low demand)

01.1 This was a very accessible opening question with over 95% of students correctly selecting gravitational force as the force that causes the skydiver to accelerate.

01.2 This was more demanding but still nearly 90% of students correctly selected air resistance.

01.3 Half of students determined the resultant force acting on the skydiver correctly. The majority of students that do so just multiplied the two numbers together rather than subtracting them.

01.4 This question was not as well answered with approximately 40% of students knowing that the resultant force at constant velocity was zero. The most popular incorrect answer was 600 N.

01.5 Approximately 50% of students knew that the constant velocity reached by the skydiver is called terminal velocity. The most common incorrect answer was average velocity.

01.6 Students found reading the time off the graph quite challenging. Because it is difficult to judge when the line becomes horizontal, a wide range of values was allowed. This meant that even though most did not write 20 seconds, 40% of students did get the mark.

01.7 Approximately 40% of students correctly gave the constant velocity as 46 m/s. As there was no tolerance on this question, the common incorrect answer of 45 did not get the mark.

01.8 This simple calculation was very well answered. Over 90% of students correctly substituted into the equation and the vast majority went on to calculate the distance correctly. A small number of students did not get the second mark as they either did not have a calculator, or their calculator displayed the answer as a fraction.

Question 2 (low demand)

02.1 This question was assessing Newton's third law. 25% of students knew that the two forces were the same size, the majority selecting the incorrect option that the force on the suitcase was bigger.

02.2 About two-thirds of students correctly selected the answer that the forces act in opposite directions.

02.3 Two-thirds of students read the correct value of the scale on the newtonmeter. There was a range of incorrect answers, but 198 was the most common mistake.

02.4 The calculation of mass was reasonably well answered, with two-thirds of students being awarded 2 marks. There was an error carried forward applied from the previous question so students who read the scale incorrectly could still gain full marks on this question.

02.5 This question asked for a description of how the weight changed; many students described how the gravitational field strength changed, or did not use the graph at all and answered in terms of air resistance or pressure. The majority of the 40% of students that gained marks only scored 1 mark for stating that the weight would decrease. The vast majority of students did not quote any values from the graph.

Question 3 (low demand)

03.1 Over 90% of students knew that waves transfer energy.

03.2 A little over 30% of students knew the speed of sound in air.

03.3 This question required students to compare two different waves. 80% of students gained at least 1 mark and 45% gained both marks. The majority of students that only gained 1 mark correctly stated that wave A had a greater frequency but did not identify that both waves had the same amplitude.

03.4 About three-quarters of students correctly selected 4000 Hz as the same as 4 kHz.

03.5 Just over half of students correctly calculated the period using the equation given. Students who correctly used their incorrect answer from question 03.4 were still able to gain full marks for this question.

03.6 About 80% of students scored at least 1 mark on this question, and 25% of students scored 2 marks. There was approximately an even number of 1-mark answers that selected either compression or rarefaction.

Question 4 (low demand)

04.1 About 70% of students knew that the poles of a permanent magnet are called North and South. However, most named them the wrong way round and so only received the 'allow' mark.

04.2 Only about a third of students were able to draw the arrow in the correct direction.

04.3 25% of students were able to select the two magnetic materials from the list. A number of students selected an incorrect number of responses despite being instructed to tick two boxes.

04.4 Just under 40% of students knew that the force between a magnet and a magnetic material is always attractive.

04.5 This calculation of resultant force on the tag was well answered, with just over 80% of students gaining 2 marks. Some students appeared to find the unit of acceleration (m/s^2) confusing and squared 9.8. There were also a large number of spurious conversions of mass into grams.

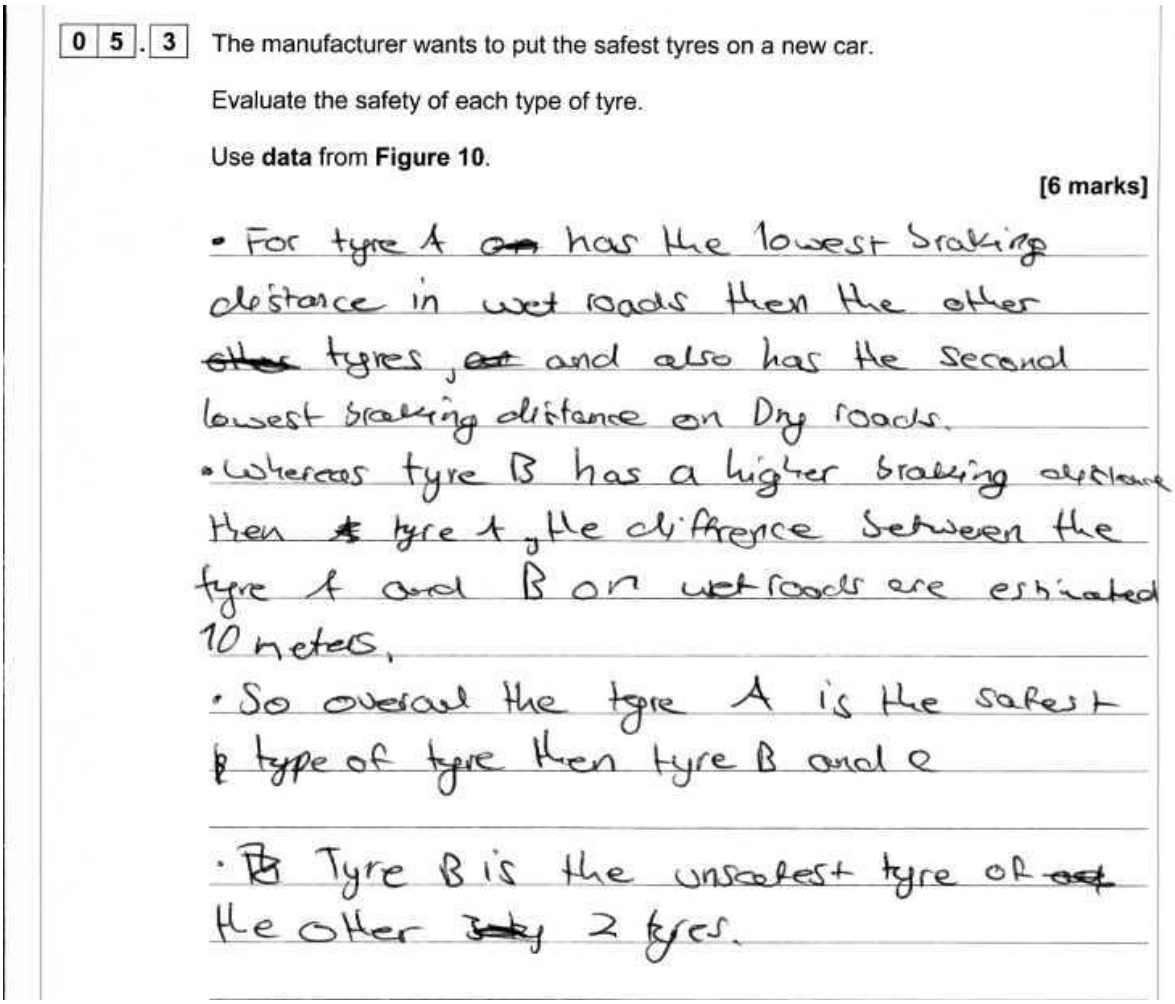
Question 5 (low & standard demand)

05.1 This question was well answered with the vast majority of students able to identify that the reaction time affects the thinking distance.

05.2 30% of students were able to correctly give a variable that should be kept the same. Many students wrote incorrect answers such as 'same driver'.

05.3 Most students attempted this extended response evaluation, with two-thirds gaining marks in Level 2 and a quarter reaching Level 3.

To access Level 3, students needed to give a judgement and support it with data from the bar chart. The majority of students that wrote Level 2 answers did not get into Level 3 because even though they clearly evaluated the data correctly, they did not include data in support of their arguments.



0 5 . 3 The manufacturer wants to put the safest tyres on a new car.

Evaluate the safety of each type of tyre.

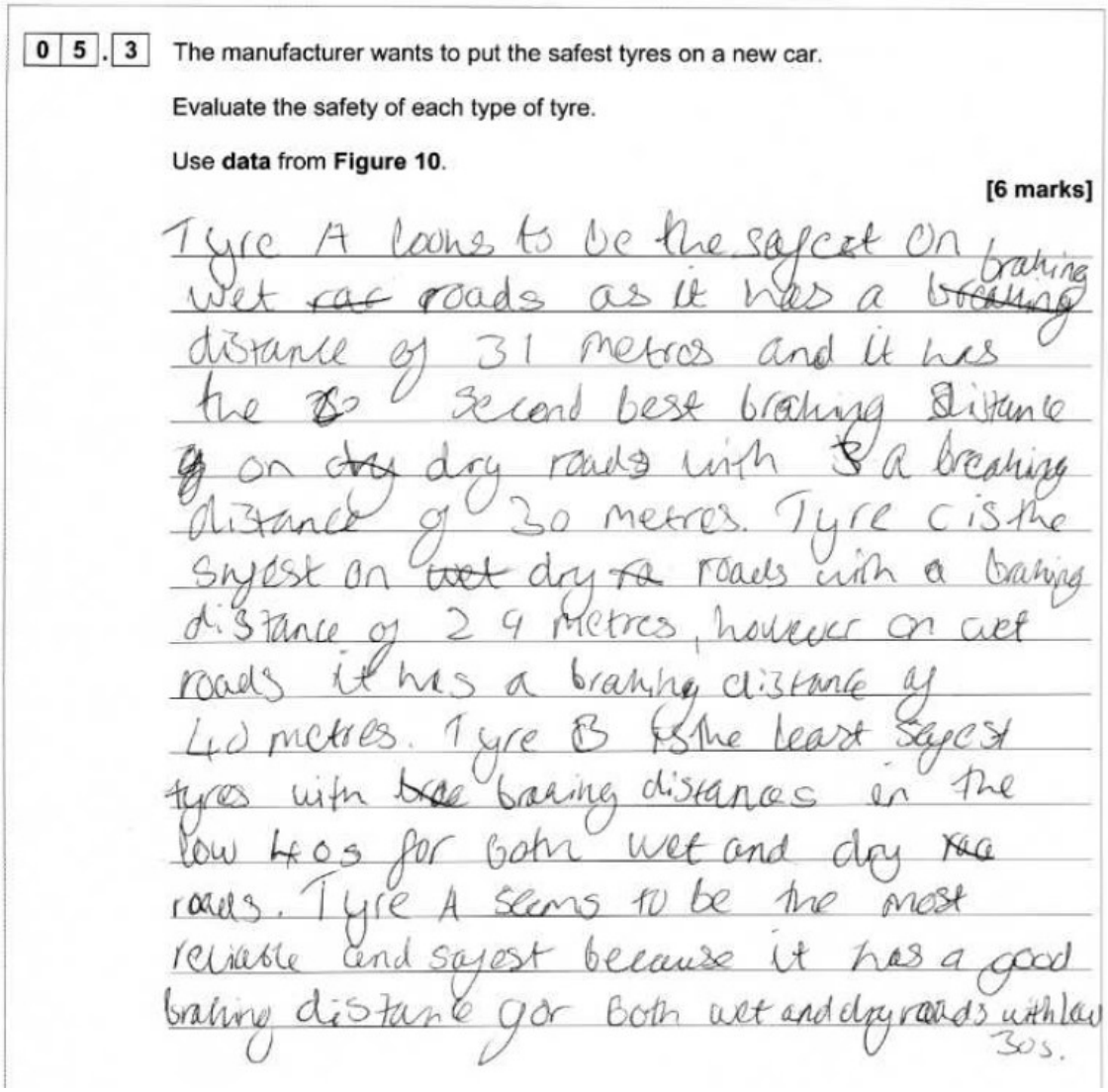
Use **data** from **Figure 10**.

[6 marks]

- For tyre A ~~on~~ has the lowest braking distance in wet roads then the other ~~other~~ tyres, ~~on~~ and also has the second lowest braking distance on Dry roads.
- Whereas tyre B has a higher braking distance then ~~a~~ tyre A, the difference between the tyre A and B on ~~wet~~ roads are estimated 10 meters.
- So overall the tyre A is the safest ~~&~~ type of tyre then tyre B and C

- ~~B~~ Tyre B is the unsafest tyre of ~~out~~ the other ~~3~~ 2 tyres.

This student has made a clear comparison of each tyre type and has given a judgement. However, the student did not include data from the bar chart so is limited to the top of Level 2 and awarded 4 marks.



0 5 . 3 The manufacturer wants to put the safest tyres on a new car.

Evaluate the safety of each type of tyre.

Use **data** from **Figure 10**.

[6 marks]

Tyre A looks to be the safest on wet ~~car~~ roads as it has a ~~breaking~~ braking distance of 31 metres and it has the ~~2~~ second best braking distance ~~of~~ on ~~dry~~ dry roads with ~~3~~ a breaking distance of 30 metres. Tyre C is the ~~sy~~ safest on ~~wet~~ dry ~~ro~~ roads with a braking distance of 24 metres, however on wet roads it has a braking distance of 40 metres. Tyre B ~~is~~ the least safest tyres with ~~brae~~ braking distances in the low 40s for both wet and dry ~~race~~ roads. Tyre A seems to be the most reliable and safest because it has a good braking distance for both wet and dry roads with low 30s.

This student has made a clear comparison of each tyre type, using data from the bar chart. The student has included an overall judgement. This is a Level 3 response and was awarded 6 marks.

05.4 This question was well answered with 89% of students writing the correct equation.

05.5 To calculate the braking distance of the car, 70% of students were able to rearrange the equation correctly and score full marks.

05.6 This question proved extremely challenging, with 30% of students gaining a mark. and very few gaining both marks. Most students wrote vague responses about braking.

Question 6 (standard demand)

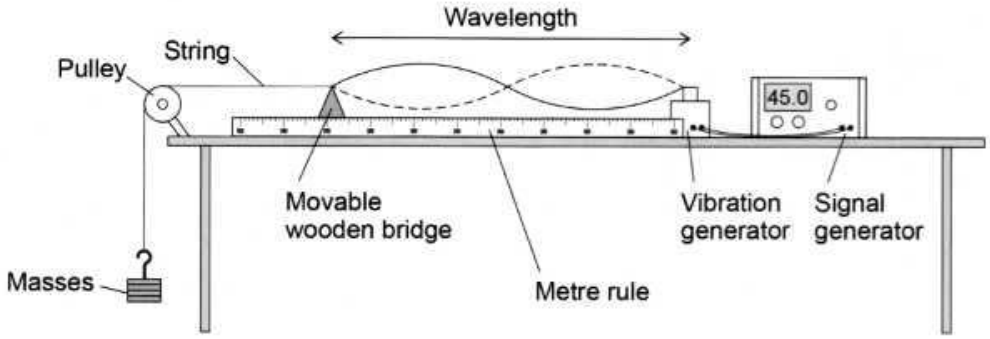
06.1 Students found this question difficult, and fewer than 10% gained more than 1 mark. Although based on Required Practical Activity 20, for most students this appeared to be an unfamiliar experiment and they were unable to answer the question.

To access Level 2, the method needed to lead to a *valid* outcome: most students just described what was shown to them in Figure 11 and did not add anything of value. Most of the students that did score marks were able to describe changing the frequency with the signal generator or measuring the wavelength with a ruler.

0 1 A teacher demonstrated how the frequency of a wave on a string affects the wavelength of the wave.

Figure 1 shows the equipment used.

Figure 1



The frequency of the signal generator is adjusted so that the wave shown in **Figure 1** is seen.

At this frequency the string vibrates between the two positions shown in **Figure 1**.

0 1 . 1 Describe a method the teacher could use to investigate how the frequency of the wave affects the wavelength.

[4 marks]

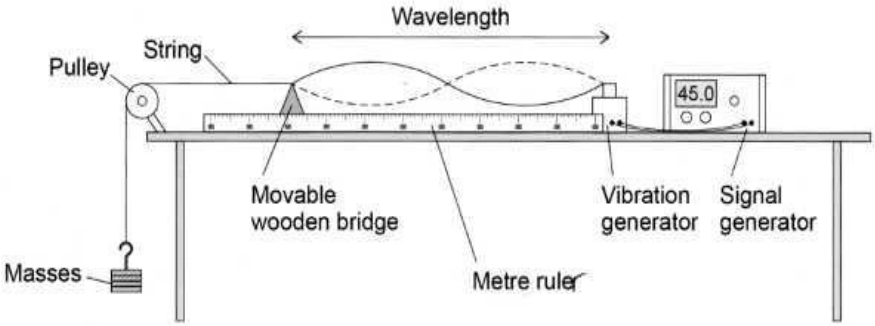
you would first set up by putting ~~[illegible]~~ a metre ruler on the table place a signal generator and connect it to the vibration generator then connect a piece of string along the top of the vibration generator attaching it to the pulley adding masses to keep it ~~[illegible]~~ strained then move the movable wooden bridge to increase/decrease the string length and use the results on the signal generator to record the measurements.

In this response (from a Higher tier paper) the student has mostly written a description of the equipment set-up in the diagram. There is nothing of relevance to a method here, so no marks.

0 6 A teacher demonstrated how the frequency of a wave on a string affects the wavelength of the wave.

Figure 11 shows the equipment used.

Figure 11



The frequency of the signal generator is adjusted so that the wave shown in **Figure 11** is seen.

At this frequency the string vibrates between the two positions shown in **Figure 11**.

0 6 . 1 Describe a method the teacher could use to investigate how the frequency of the wave affects the wavelength.

[4 marks]

To investigate how the frequency of the wave- affects the wave, the teacher could adjust the frequency of the signal generator and measure the wavelength of the string with the metre ruler, recording the results. Repeating this a few times; everytime adjusting the frequency of the signal generator, the teacher can then look at the results and see if there is any correlation between the two (the frequency of the wave and the wavelength.)

This student has described how to change the independent variable and then how to measure the dependent variable. This answer does not quite get into Level 2 as it is not clear that this is repeated at different frequencies and so would not lead to a valid outcome. However, 2 marks are awarded.

06.2 This question was well answered with the majority of students selecting the correct equation.

06.3 This calculation proved more demanding than the ones earlier on in the paper. A little over half of students scored marks, most of whom scored all 3 marks for correctly rearranging the equation and calculating the wavelength. Of the students that did not score any marks, most just multiplied the two numbers together.

Question 7 (standard demand)

07.1 This question was not well answered with nearly 90% of students gaining no marks and 1% gaining full marks. Students find the idea of energy stores very confusing. As in previous series, the mark scheme allows students to be awarded marks for answering in term of transfers or transformations: this is the only way students were able to score marks on this question.

07.2 Two-thirds of students scored 2 or 3 marks for this calculation. Very few students converted the centimetres into metres, so less than 1% of students scored full marks.

07.3 15% of students described measuring the length of the spring and were awarded marks; 5% of students gained 2 marks. Most students did not describe measuring anything and wrote vague answers about energy.

07.4 Approximately 20% of students identified that the large masses meant that the experiment should be done on the laboratory floor rather than on the table for safety reasons. However, most students gained no marks as they wrote that the table would not be level or that as it was higher that would affect the readings.

07.5 Just under 30% of students correctly used the values from the graph to determine the value for Δy. Most incorrect answers gave it as either 300 or 330.

07.6 About a quarter of students correctly determined Δx. The most common incorrect answer was 0.52.

07.7 This question was reasonably well answered with 35% of students gaining at least 1 mark. The error carried forward (ecf) meant that students could use their answers from questions 07.5 and 07.6 and many students were able to gain 2 marks for doing so, even if their previous answers were wrong.

The spring constant is the gradient of the line of best fit shown on **Figure 4**.

0 2 . 5 Determine the value Δy on **Figure 4**.

[1 mark]

330 - 80 = 250

Δy = 250 N

0 2 . 6 Determine the value Δx on **Figure 4**.

[1 mark]

0.01 - 0.092 - 0.01 = 0.041

Δx = 0.041 m

0 2 . 7 Determine the spring constant of the spring.

Use your answers to Question **02.5** and Question **02.6**.

Give your answer to 3 significant figures.

[2 marks]

$\frac{250}{0.041} = 6097.560976$

Spring constant (3 significant figures) = 6100 N/m

When ecf is allowed, students who give one value incorrectly can still gain subsequent marks in the next part of the question.

In this example from a Higher tier paper, the student gained the mark for question 02.5 but not for question 02.6. In their answer to question 02.7 they were awarded the first mark for dividing their answer to question 02.5 by their answer to question 02.6 and the second mark for giving the correct answer to this calculation to the correct number of significant figures.

Contact us

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