OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL GCSE COMBINED SCIENCE PHYSICS DOUBLE AWARD

(9204)

Core and extension

Example responses with commentary

For teaching from September 2016 onwards
For GCSE exams in May/June 2018 onwards

This guide includes some examples of student responses to a selection of questions from the summer 2018 Combined Physics Science.

The question parts are reproduced, along with the final mark scheme, student responses and a commentary from the Lead Examiner on each of the students' answers.

PHYSICS EXTENTION PAPER

QUESTION

04.5

0 4 . 5 The maximum velocity of the cage is 150 km/h.
The mass of the cage and passengers is 390 kg.
Gravitational field strength = 9.8 N/kg.

Calculate the maximum height the cage reaches above the ground.
Use the correct equations from the Physics equation sheet.

[4 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
04.5	Initial velocity = 41.7 m / s	1	an answer of 88.7 (m) **or** 90 (m) scores 4 marks
	initial E_k = final E_p	1	an answer of 1150 (m) scores 3 marks
	½ × (390) × 41.7^2 = 9.8 × (390) × h	1	
	88.7 (m)	1	allow 90 (m)

STUDENT A

0 4 . 5 The maximum velocity of the cage is 150 km/h.
The mass of the cage and passengers is 390 kg.
Gravitational field strength = 9.8 N/kg.

Calculate the maximum height the cage reaches above the ground.
Use the correct equations from the Physics equation sheet.

[4 marks]

$\Delta E_k = \Delta E_p = m \times g \times h = \frac{1}{2} \times m \times v^2$

$9.8\,N/kg \times h = \frac{1}{2} \times (150\,km/h)^2 = \frac{1}{2} \times (41.7\,m/s)^2$

$h = 3.13\,m$ $150km/h = 41.7\,m/s$

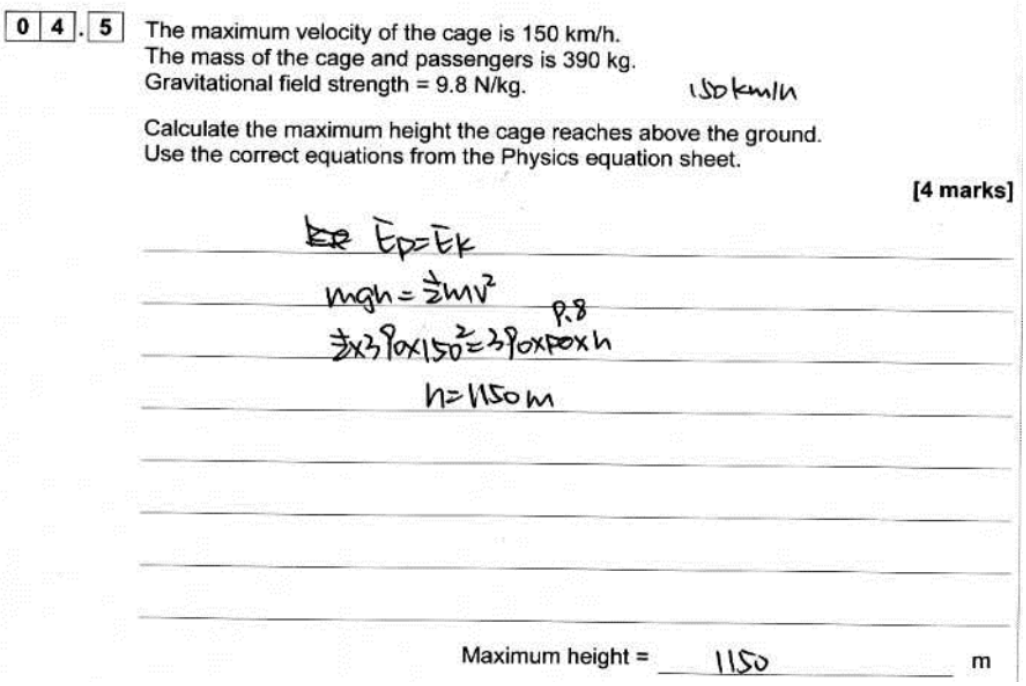
Maximum height = 3.13 m

EXAM COMMENTARY

The student has correctly given the relationship required for the calculation and has converted km/h into m/s. Their substitution is correct but unfortunately an arithmetic error has prevented them from scoring full marks.

3 marks awarded.

STUDENT B



0 4 . 5 The maximum velocity of the cage is 150 km/h.
The mass of the cage and passengers is 390 kg.
Gravitational field strength = 9.8 N/kg.

150 km/h

Calculate the maximum height the cage reaches above the ground.
Use the correct equations from the Physics equation sheet.

[4 marks]

$E_p = E_k$

$mgh = \frac{1}{2}mv^2$

$\frac{1}{2} \times 390 \times 150^2 = 390 \times 9.8 \times h$

$h = 1150\ m$

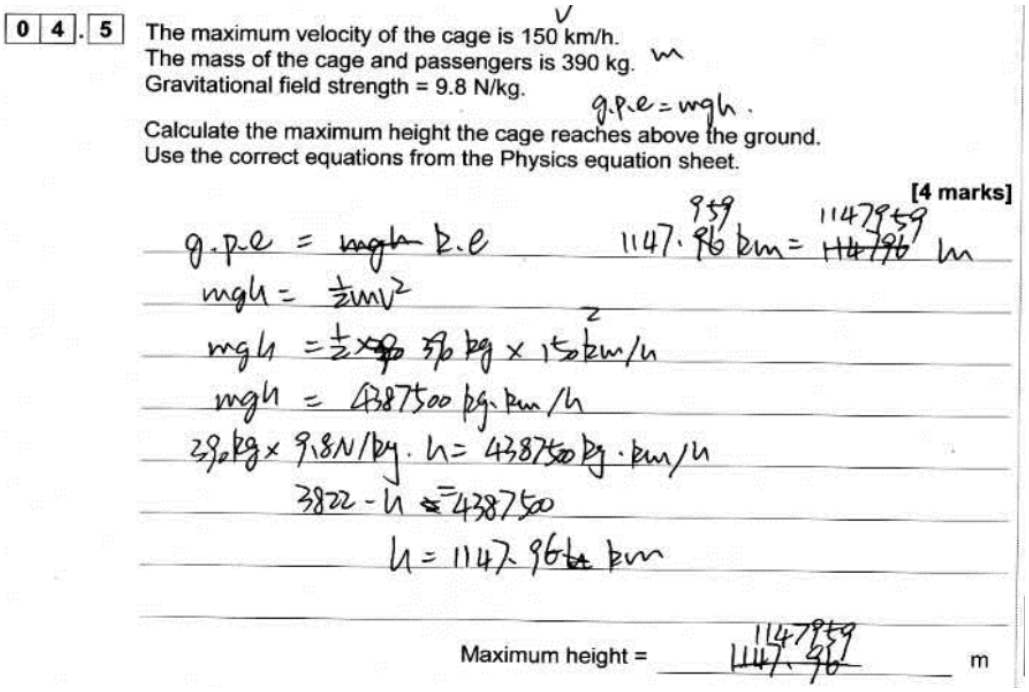
Maximum height = 1150 m

EXAM COMMENTARY

The student has correctly identified the relationship required for the calculation but has failed to convert km/h into m/s. The substitution and rearrangement are correct so they only miss out on the first marking point.

3 marks awarded.

STUDENT C



0 4 . 5 The maximum velocity of the cage is 150 km/h.
The mass of the cage and passengers is 390 kg.
Gravitational field strength = 9.8 N/kg.

Calculate the maximum height the cage reaches above the ground.
Use the correct equations from the Physics equation sheet.

[4 marks]

g.p.e = ~~mgh~~ k.e

mgh = $\frac{1}{2}mv^2$

mgh = $\frac{1}{2}$ × ~~390~~ 390 kg × 150 km/h

mgh = 438750 kg.km/h

39.0 kg × 9.8 N/kg . h = 438750 kg.km/h

3822 . h = 438750

h = 1147.96 km

Maximum height = 1147.96 m

EXAMINER COMMENTARY

The student has correctly identified the relationship required for the calculation but has failed to convert km/h into m/s. The substitution and rearrangement are correct however, they have misunderstood the use of km/h and assumed that the answer they have is in km. They have then multiplied their answer by 1000 to 'convert' to m.

2 marks awarded.

QUESTION

04.2

0 4 . 2 The student obtained the results in **Table 3**.

Table 3

Force in N	Mean extension in mm
0	0
1	20
2	58
3	115
4	181
5	225
6	240

Plot a graph of extension (*y*-axis) against force (*x*-axis) and draw a line of best fit.

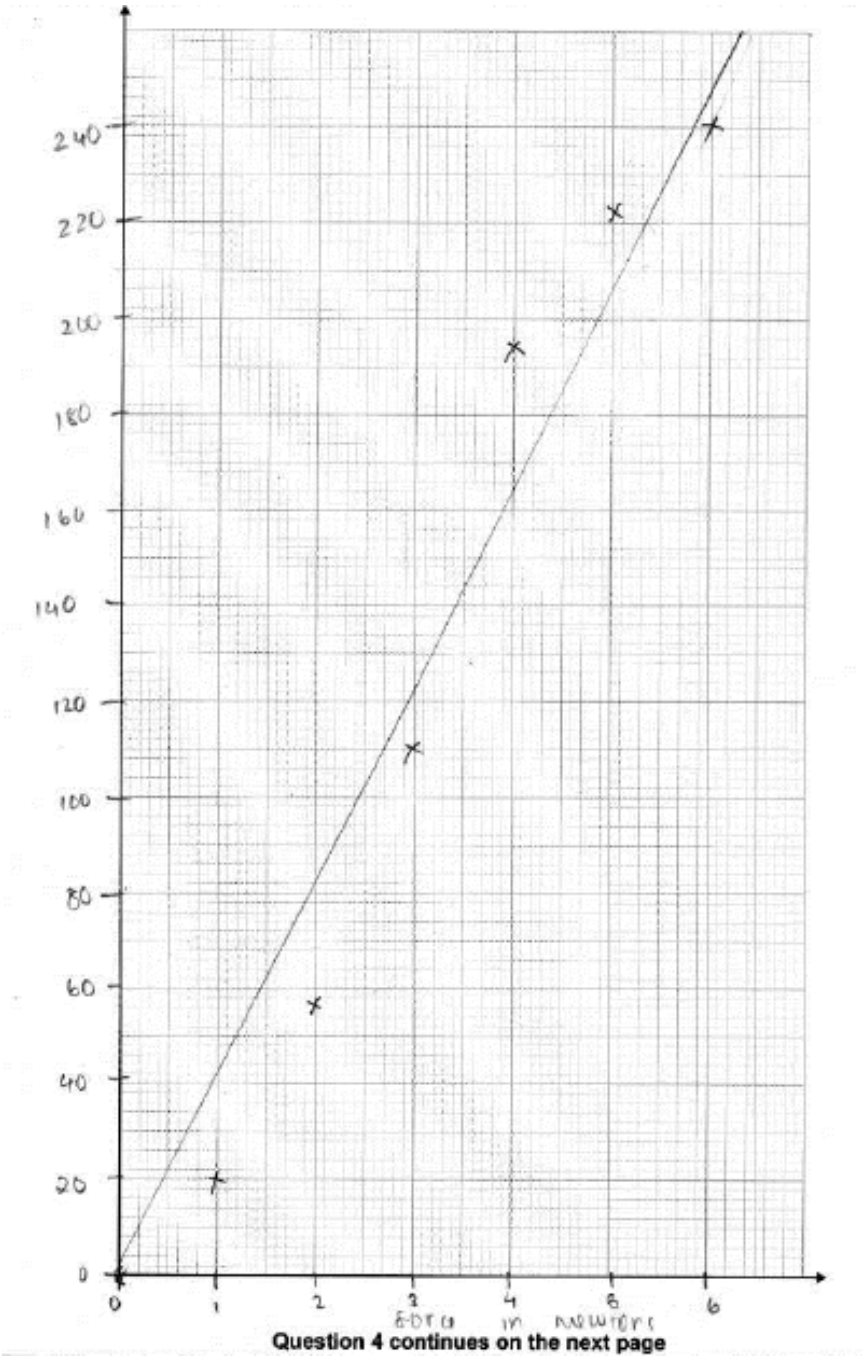
Use the grid on page 17.

[4 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
04.2	axes labelled with quantities and units	1	
	scales chosen so that the points fill at least half of the paper scales in sensible increments eg. 10, 20	1	
	points plotted correctly	1	
	smooth curve of best fit drawn	1	

STUDENT A



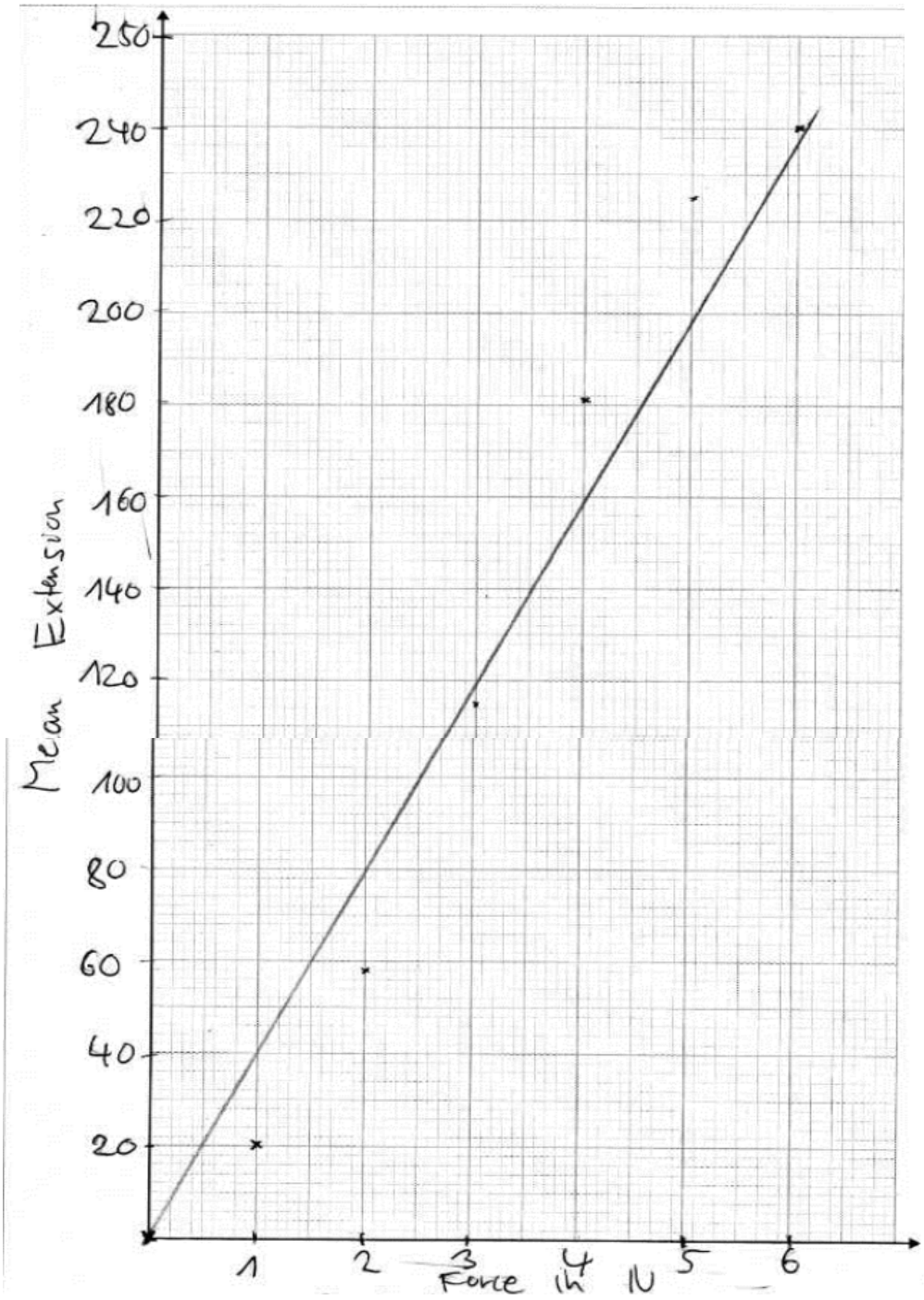
Question 4 continues on the next page

EXAMINER COMMENTARY

The student has not fully labelled the axes with quantities and units although they have given a correct scale to score the second marking point. A number of points have been plotted incorrectly and the line of best fit has been drawn as a straight line rather than a curve.

1 mark awarded.

STUDENT B

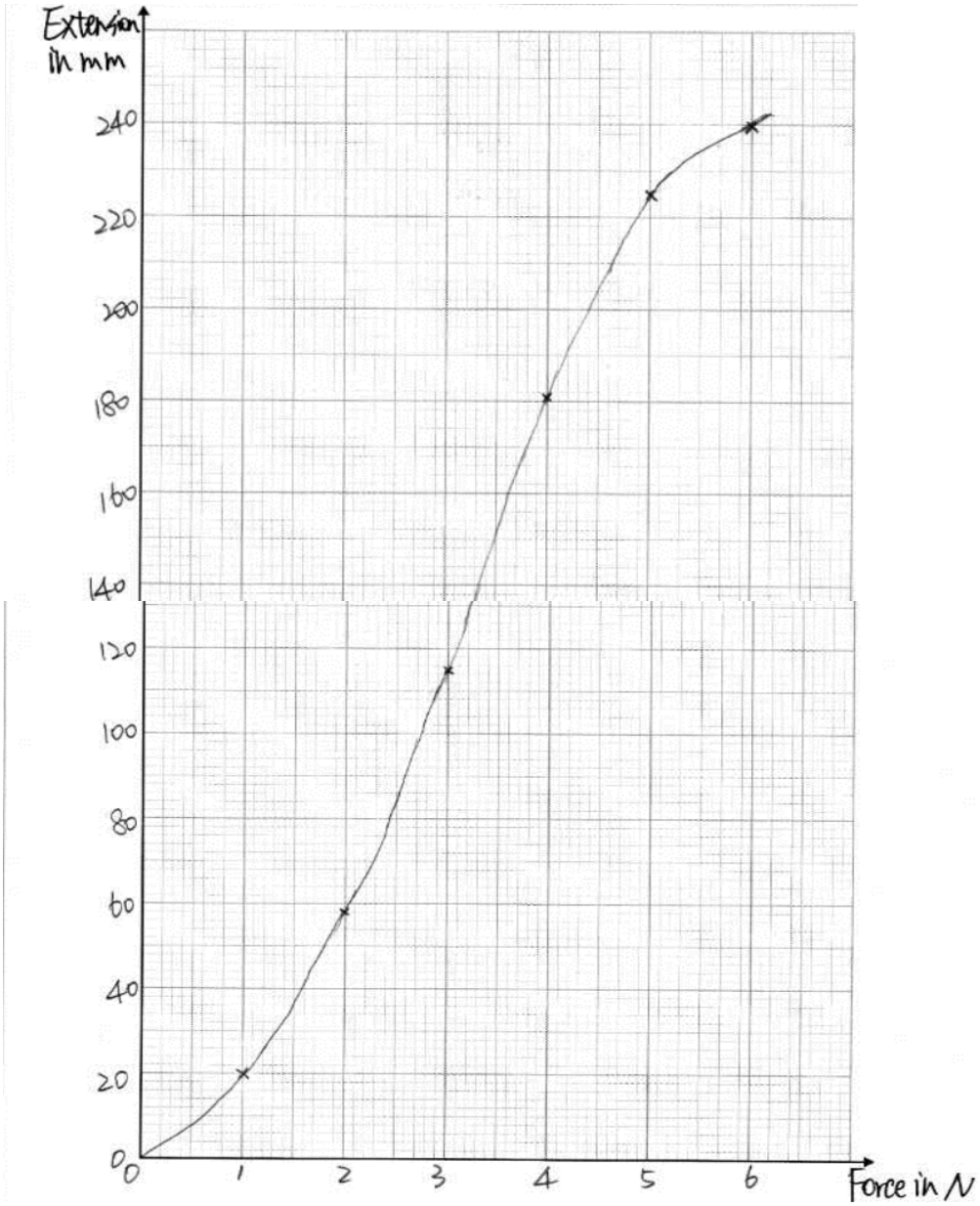


EXAMINER COMMENTARY

The student has not fully labelled the axes by missing the unit for mean extension.
Their scale is appropriate and points are correctly plotted but their line of best fit is incorrect.

2 marks awarded.

STUDENT C



EXAMINER COMMENTARY

The student has labelled the axes with quantities and units and has chosen an appropriate scale.
Their points are correctly plotted and a curve has been drawn for the line of best fit.

4 marks awarded.

QUESTION

01.1, 01.2 AND 01.3

0 1 The stopping distance of a vehicle is equal to thinking distance plus braking distance.

0 1 . 1 What is meant by the term **thinking distance**?

[1 mark]

0 1 . 2 The speed of a vehicle affects thinking distance.

State **one other** factor that affects a driver's thinking distance.

[1 mark]

0 1 . 3 Explain why this factor affects thinking distance.

[2 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
04.1	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account. **Level 1:** Facts, events or processes are identified and simply stated but their relevance is not clear. **No relevant content** **Indicative content** **Reducing errors** • Ensure that the metre ruler is vertical in the clamp stand • Take readings at eye level to avoid parallax errors • Ensure that the elastic stops moving before taking a reading **Increasing accuracy** • Use a pointer • between the elastic and the hanging mass to increase the accuracy of the reading from the ruler • Use a set square • to ensure that the metre ruler is vertical in the clamp stand	3-4 1-2 0	ignore references to repeating readings
04.2	axes labelled with quantities and units scales chosen so that the points fill at least half of the paper scales in sensible increments eg. 10, 20 points plotted correctly smooth curve of best fit drawn	1 1 1 1	
04.3	does not obey Hooke's law because the relationship is not directly proportional only one elastic band has been tested	1 1	allow because it's not a straight line through the origin

STUDENT A

0 1 The stopping distance of a vehicle is equal to thinking distance plus braking distance.

0 1 . 1 What is meant by the term **thinking distance**?

[1 mark]

The time it takes for a driver to react

0 1 . 2 The speed of a vehicle affects thinking distance.

State **one other** factor that affects a driver's thinking distance.

[1 mark]

Alcohol

0 1 . 3 Explain why this factor affects thinking distance.

[2 marks]

Alcohol slows down the brain and affects your co-ordination which affects the thinking distance, ~~too~~ because you think slower.

EXAMINER COMMENTARY

There are a number of misconceptions in the answers to these questions. In 01.1the student has incorrectly stated that thinking distance is a 'time'. This is a common error.

In 01.2 there are a range of acceptable answers, this being one example. Students should describe factors that affect reaction time rather than giving reaction time as a factor.

In 01.3 the student has referred to 'thinking slower'. This is not sufficient to describe reaction time increasing. They have not made the link between increased reaction time and travelling further before braking so don't score the second marking point.

1 mark awarded.

STUDENT B

0 1 The stopping distance of a vehicle is equal to thinking distance plus braking distance.

0 1 . 1 What is meant by the term **thinking distance**?

[1 mark]

[redacted] the distance travelled until the driver reacts and presses on brakes

brakes

0 1 . 2 The speed of a vehicle affects thinking distance.

State **one other** factor that affects a driver's thinking distance.

[1 mark]

Alcohol and drugs

0 1 . 3 Explain why this factor affects thinking distance.

[2 marks]

It slows down the thinking distance as driver isn't able to think properly and fast enough so being on drugs or Alcohol slows down reaction.

EXAMINER COMMENTARY

In 01.1 the student has correctly identified the link between distance travelled and the driver's reaction time.

In 01.2 both examples given are acceptable answers.

In 01.3 the student has talked about thinking distance 'slowing down' which is a common, but incorrect idea. Another common, incorrect idea is that reaction time 'slows down'.

2 marks awarded.

STUDENT C

0 1 The stopping distance of a vehicle is equal to thinking distance plus braking distance.

0 1 . 1 What is meant by the term **thinking distance**?

[1 mark]

The time it takes for the driver to think about stopping

0 1 . 2 The speed of a vehicle affects thinking distance.

State **one other** factor that affects a driver's thinking distance.

[1 mark]

Alcohol

0 1 . 3 Explain why this factor affects thinking distance.

[2 marks]

The influence of alcohol alters a humans brain and makes us slower thinkers which would increase the thinking distance as we would have to think for a bigger time before reacting.

EXAMINER COMMENTS

In 01.1 this student has incorrectly stated that thinking distance is a time. Their description of reaction time as being 'time to think' is insufficient.

In 01.2 a correct response has been given.

In 01.3 thinking for a longer time before reacting scores 1 mark but there is no link to distance travelled during this time so this does not gain a second mark.

2 marks awarded.

QUESTION

07.3

0 7 . 3 **Table 4** shows the expected life span of stars of different masses.

Table 4

Relative mass of star (solar masses)	Expected lifespan (million years)
60	3
30	11
10	33
3.0	370
1.5	3000

A student is given the data and makes the conclusion:

"the relative mass of the star is inversely proportional to the expected lifespan."

Explain whether the data support this conclusion.

[4 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
07.3	calculation of k from one line of data calculating a second value of k **or** using calculated k in a second set of data correct conclusion based on their values further calculation leading to some data does and some does not fit the relationship **OR** most of the data does not support the conclusion (1) (because) when the relative mass of the star doubles the expected lifespan does not half (1) (however) the data for relative masses 10 and 30 does support the conclusion (1) (because) the mass triples and the expected lifespan is one third (1)	1 1 1 1	

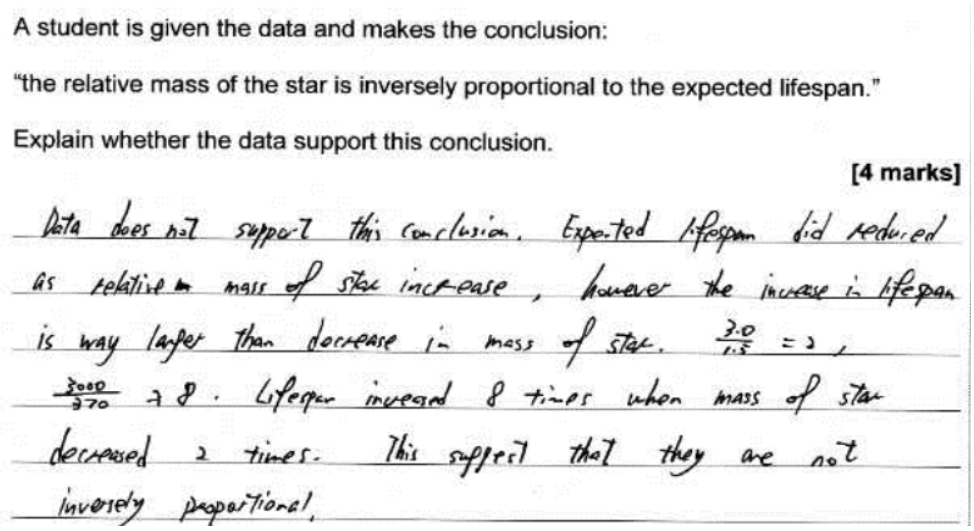
STUDENT A

A student is given the data and makes the conclusion:

"the relative mass of the star is inversely proportional to the expected lifespan."

Explain whether the data support this conclusion.

[4 marks]


Data does not support this conclusion. Expected lifespan did reduced as relative mass of star increase, however the increase in lifespan is way larger than decrease in mass of star. $\frac{3.0}{1.5} = 2$, $\frac{3000}{370} \approx 8$. Lifespan increased 8 times when mass of star decreased 2 times. This support that they are not inversely proportional.

EXAMINER COMMENTARY

The student has identified data that does not support the conclusion and has gone on to compare the relationship between two sets of data. They have not recognised that there are two sets of data that do support the conclusion so do not gain the marks for this.

2 marks awarded.

STUDENT B

A student is given the data and makes the conclusion:

"the relative mass of the star is inversely proportional to the expected lifespan."

Explain whether the data support this conclusion.

[4 marks]

$60 = \frac{k}{3}$

$60 \times 3 = 180$

EXAMINER COMMENTARY

The student has calculated a value for 'k' from one set of data so gains the first marking point. To gain further marks the student would need to calculate 'k' for a second set of data and draw a conclusion from their values.

1 mark awarded.

STUDENT C

A student is given the data and makes the conclusion:

"the relative mass of the star is inversely proportional to the expected lifespan."

Explain whether the data support this conclusion.

[4 marks]

As the relative mass of star decreases, the expected lifespan increases. ~~Therefore, it's inversely proportional~~ when the ~~to~~ mass is 60 the lifespan is 3. when the mass is 1.5, the lifespan is 300. Therefore it's inversely proportional.

EXAMINER COMMENTARY

Many students do not understand the term inversely proportional. In this example, the student has looked at the decrease in mass and the increase in expected lifespan and concluded that this is inversely proportional. They have used the data to support their idea, which is good for this type of question, but do not gain credit as all they have succeeded in doing is exemplify two different pairs of measurements, not the trend within the data.

0 marks awarded.

QUESTION

06.3

0 6 . 3 Discuss the advantages and disadvantages of using a solar power station to generate electricity compared to using fossil-fuelled power stations.

[6 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
06.3	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4-6	ignore costs
	Level 1: Relevant features are identified and differences noted.	1-3	
	No relevant content	0	
	Advantages • No CO_2 emissions • (so) reduces global warming • No SO_2 emissions • (so) reduces acid rain • Renewable • Can be used to meet sudden demand • More efficient than fossil fuelled power stations		
	Disadvantages • Large area of land needed for the number of mirrors required • Energy requirement to keep the fluid at 290 °C • Energy for storage is limited if cloudy / raining		ignore unreliable unless linked to cloudy weather / fewer hours of daylight at certain times of year
	• Not suitable for use in many locations around the world • Transporting large mass of oil and salt to the location will release CO_2		

STUDENT A

0 6 . 3 Discuss the advantages and disadvantages of using a solar power station to generate electricity compared to using fossil-fuelled power stations.

[6 marks]

Solar power station is a renewable energy source, it will never run out and can also be replaced but fossil fuels are non renewable, it will run out one day. ~~However solar power stations are~~ Solar power stations are also ~~unreliable~~ reliable however sometimes it can be hard to increase supply when there's an increase in demand. Solar power station take up a lot of space and spoil the view. It can also disturb the people living nearby, it also provides less energy as compared to fossil fuels.

EXAMINER COMMENTARY

This response is a clear level 1 response. The student has identified some simple advantages and disadvantages of using a solar power station. They have not referred to any environmental effects other than the appearance of the power station so do not gain further credit.

2 marks awarded.

STUDENT B

0 6 . 3 Discuss the advantages and disadvantages of using a solar power station to generate electricity compared to using fossil-fuelled power stations.

[6 marks]

Solar power ~~sta~~ is renewable therefore it will never run out as long as the sun exists, it is also eco-friendly as it does not provide CO_2 emissions and solar power can be stored in solar ponds. However, fossil fuels are non-renewable and will eventually run out, they also release a lot of greenhouse gases which damage the environment and contribute to global warming. However, you can burn fossil fuels any time of the day but you can only extract solar energy in the morning or whenever the sun is shining. This means you can use fossil fuels anytime however you can only extract solar energy at certain conditions.

EXAMINER COMMENTARY

This response is an example of a low level 2 response. The student has given simple advantages and disadvantages. They have also gone on to discuss carbon dioxide emissions and made the link to greenhouse gases. Their disadvantages discussion is weaker with reference to energy from sunlight only being available in the mornings.

4 marks awarded.

STUDENT C

0 6 . 3 Discuss the advantages and disadvantages of using a solar power station to generate electricity compared to using fossil-fuelled power stations.

[6 marks]

Solar power stations are renewable sources of energy. They don't produce green-house gases such as CO_2 so they don't harm the environment. However they can only work in precense of sun so in countries with not much sun they wouldn't work. They can be expensive to install and they can't meet the demand of electricity by people so fossil fuels must be used. however unlike fossil fuels they don't produce sulfuric acid that would cause acid rain or CO_2 that causes climate change. Solar power stations can be unsightly and kill habitats and they need large spaces.

EXAMINER COMMENTARY

This is an example of a clear level 2 response. The student has given a good account of the environmental benefits of solar power stations, referring to both carbon dioxide and sulphur dioxide. Their discussion of the disadvantages is slightly weaker referring to 'not much sun' rather than linking to hours of daylight or typical weather conditions. Sunlight is a better way of describing 'Sun' too. They have also talked about solar power stations only work in the presence of sun without clarifying that they understand that cloudy conditions will limit, rather than stopping generation of electricity or provision of energy for storage.

5 marks awarded.

QUESTION

02.1

0 2 . 1 An electromagnet can be made by coiling an insulated wire around an iron nail.

A student makes the following hypothesis:

"Changing the number of turns of wire will change the strength of an electromagnet."

The student has a nail, a long insulated wire, a power supply, an ammeter and paper clips.

Describe how the student could use this equipment to test the hypothesis.

You should include:

- the independent variable
- the dependent variable
- measurements to record
- variables to be controlled and how to control them
- safety considerations.

You may include a labelled diagram in your answer.

[6 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
02.1	Level 3: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	
	Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3-4	
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1-2	
	No relevant content	0	

STUDENT A

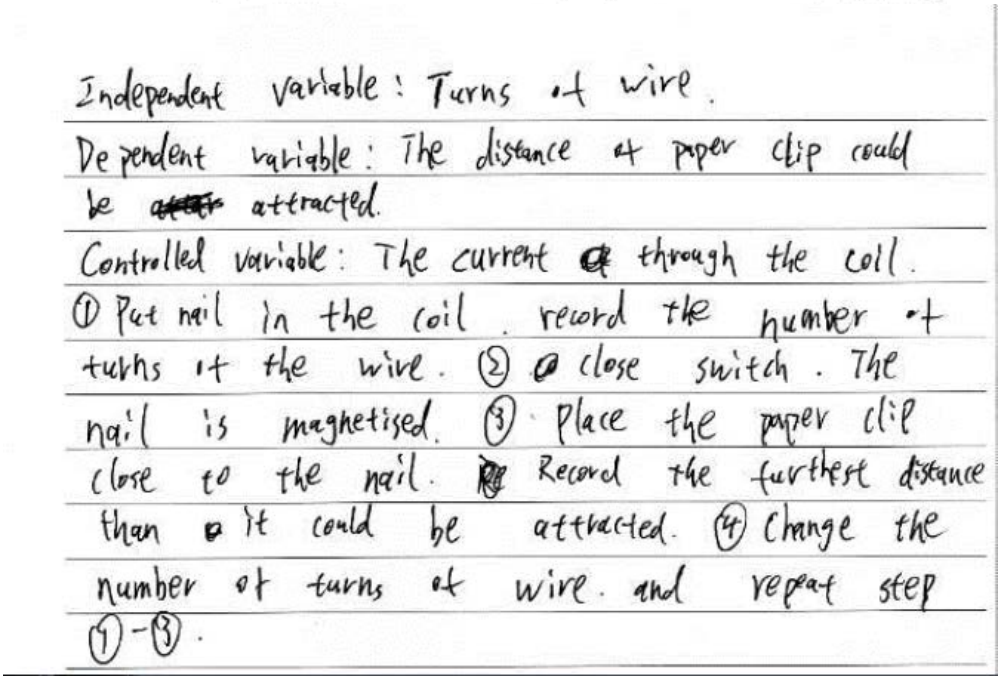
Describe how the student could use this equipment to test the hypothesis.

You should include:

- the independent variable
- the dependent variable
- measurements to record
- variables to be controlled and how to control them
- safety considerations.

You may include a labelled diagram in your answer.

[6 marks]



Independent variable: Turns of wire.

Dependent variable: The distance of paper clip could be ~~after~~ attracted.

Controlled variable: The current through the coil.

① Put nail in the coil. record the number of turns of the wire. ② close switch. The nail is maghetised. ③ Place the paper clip close to the nail. Record the furthest distance than it could be attracted. ④ Change the number of turns of wire. and repeat step ①-③.

EXAMINER COMMENTS

This is an example of an alternative method to describe this investigation. The student has correctly identified the independent variable and a suitable dependent variable that links to their method of measuring distance that a paperclip can be attracted from. There is only one control variable identified. Safety has not been considered in their response.
This response is a good level 2 response but the lack of control variables and safety considerations means that the account is not enough for level 3.

4 marks awarded.

STUDENT B

Describe how the student could use this equipment to test the hypothesis.

You should include:

- the independent variable
- the dependent variable
- measurements to record
- variables to be controlled and how to control them
- safety considerations.

You may include a labelled diagram in your answer.

[6 marks]

The student can start by placing ~~a~~ clips beneath an electromagnet which he should make by coiling the wire around the nail a set number of times. Then he should connect the wire to the power supply and see how many paper clips are picked up by the nail with specific numbers of turns of wire. The student should repeat this experiment for ~~diff~~ with electromagnets with different numbers of turns of wire.

The student should make sure his hands are not wet so that he doesnot catch electricity.

EXAMINER COMMENTARY

The student has given an account of the investigation and given correct statements about measurements to record but has not made any link to the variables. There is no consideration of control variables in the account and the safety considerations are weak.
The basic idea of how to carry out the experiment but with no suggestions as to how to achieve a valid outcome means that the response is level 1.

2 marks awarded.

STUDENT C

Describe how the student could use this equipment to test the hypothesis.

You should include:

- the independent variable
- the dependent variable
- measurements to record
- variables to be controlled and how to control them
- safety considerations.

You may include a labelled diagram in your answer.

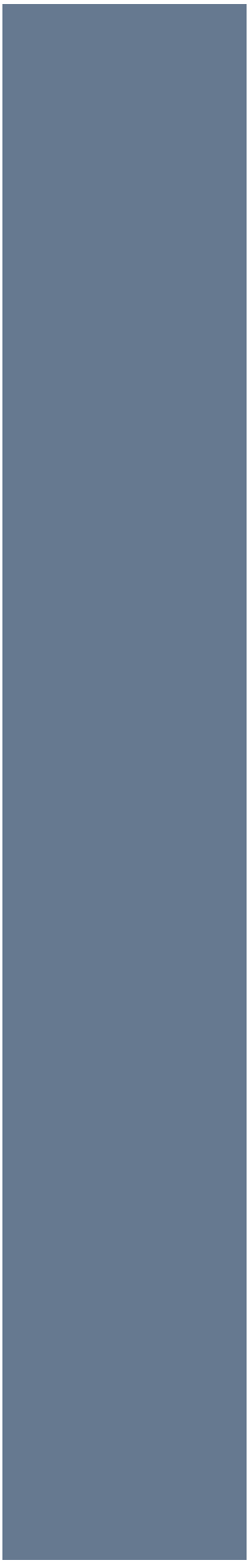
[6 marks]

Firstly the student should consider the independant variable. They should make it the number of ~~times~~ coils of wire around the nail. The more times the wire is wrapped around the ~~test~~ weaker ~~strong~~ the current will be. The student also needs to consider how tightly they are wrapping the wire around the nail.

EXAMINER COMMENTARY

This response is well structured and the student attempts to address all of the bullet points. They correctly identify the independent variable, although they should be referring to 'turns on the coil' rather than 'number of coils'.
The student then goes on to incorrectly link number of turns to current in the coil. They have the incorrect dependent variable and then go on to say that number of paper clips picked up should be recorded. In their discussion about control variables they refer to the power supply but this is a contradiction to earlier in the answer where they talked about adjusting the power source to vary the current. The account is unclear and contains a number of misconceptions about the investigation so this is a level 1 response. The correctly identified independent variable and a relevant step involving number of paperclips allow this response to gain 1 mark.

1 mark awarded.



FURTHER GUIDANCE AND CONTACTS

You can contact the subject team directly at science@oxfordaqaexams.org.uk

Please note: We aim to respond to all email enquiries within two working days.

Our UK office hours are Monday to Friday, 8am – 5pm local time.

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