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Examiners' Report June 2022

GCSE Physics 1PH0 1F

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Introduction

This was the first examination of paper 1, 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 2 – Motion and forces.

Topic 3 – Conservation of energy.

Topic 4 – Waves.

Topic 5 – Light and the electromagnetic spectrum.

Topic 6 – Radioactivity.

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.

One of the six-mark questions tested knowledge and understanding of the Solar System. The other six-mark question was analysing a velocity-time graph.

Candidates coped well with most questions and did particularly well in the questions asking for calculations using equations. Candidates' knowledge of practical work was pleasing, given the current circumstances, particularly in Q8(b)(i) and Q8(b)(ii).

Successful candidates:

- were well-acquainted with the content of the specification.
- had been engaged with practical work at some stage during their course.
- were competent in quantitative work, especially in using equations.
- were 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.
- were 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 (b)(i)

In Q1(b) parts (i) to (iv), candidates were asked to identify parts of the electromagnetic spectrum from the given descriptions. A diagram, giving the names of the parts of the spectrum was also provided.

Most candidates were able to score 2 of the 4 marks available. The most common error was in recognising relative wavelengths.

Question 2 (a)(iii)

This was a practical based question, requiring a description of a method to measure wave speed.

Most candidates scored at least 1 of the 3 marks available with only a few scoring all 3.

(iii) Describe how a student could determine the wave speed of the water wave in Figure 3.

(3)

A student could determine wave speed of a water wave by recording the time a wave takes to get from P to Q, then divide 42cm (the distance) by the time.

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The wave is timed over a known distance, PQ, given in the diagram.

The wave speed is calculated using speed = distance ÷ time.

3 marks awarded.

Question 2 (b)(ii)

A straightforward calculation, involving selecting and substituting into the correct equation from the equation sheet.

The vast majority of candidates scored both marks for this.

Question 3 (a)(i)

Candidates had to complete a diagram showing a ray of light reflected from a plane mirror.

The first mark was for reflection, the second for showing the angle of incidence being equal to the angle of reflection.

Most candidates scored both marks.

3 This question is about reflection and refraction of light.

(a) (i) Figure 4 shows a ray of light travelling to a plane mirror.

On Figure 4, draw the ray of light after it **reflects** off the mirror surface.

(2)

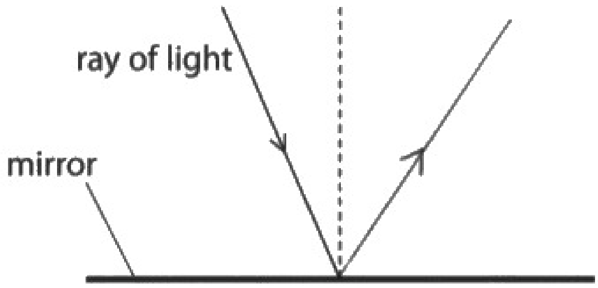

Figure 4

ResultsPlus Examiner Comments

There was a tolerance in judging the angles. This was only just acceptable for 2 marks.

3 This question is about reflection and refraction of light.

(a) (i) Figure 4 shows a ray of light travelling to a plane mirror.

On Figure 4, draw the ray of light after it **reflects** off the mirror surface.

(2)

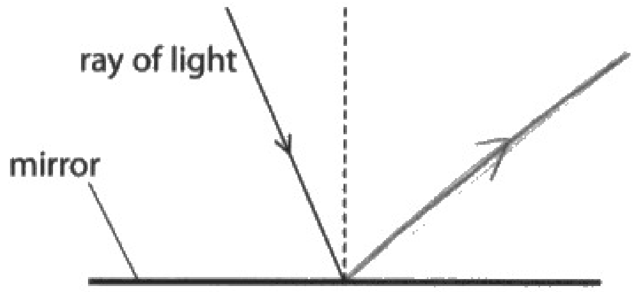

Figure 4

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Examiner Comments

This angle of reflection was judged to be outside tolerance so only the first mark was scored.

Question 3 (a)(ii)

In this part, refraction was being examined and, pleasingly, a majority of candidates scored both marks.

(ii) Figure 5 shows a ray of light in air travelling to a glass block.

On Figure 5, draw the ray of light after it **refracts** at the surface of the glass block.

(2)

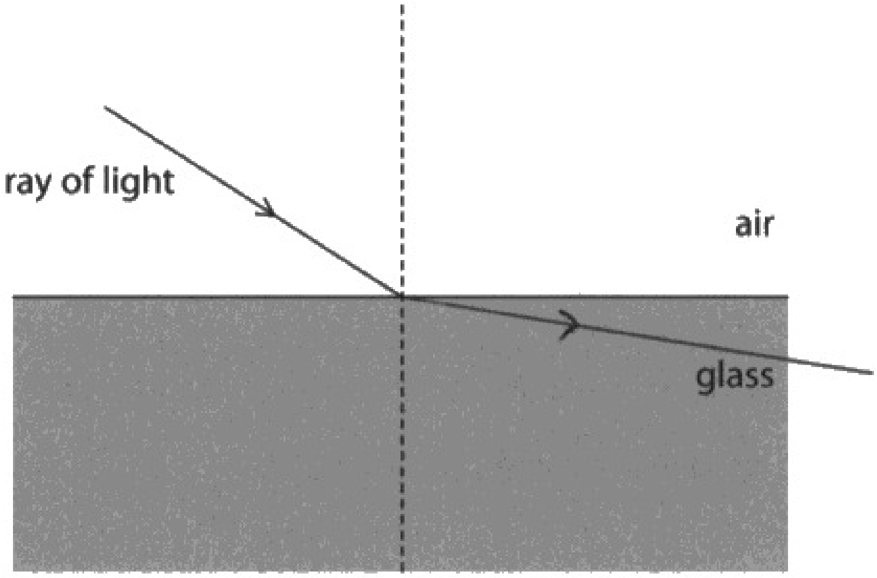

Figure 5

ResultsPlus Examiner Comments

This scored the first mark for showing a change in direction but not the second mark as the change in direction should be towards the normal.

(ii) Figure 5 shows a ray of light in air travelling to a glass block.

On Figure 5, draw the ray of light after it **refracts** at the surface of the glass block.

(2)

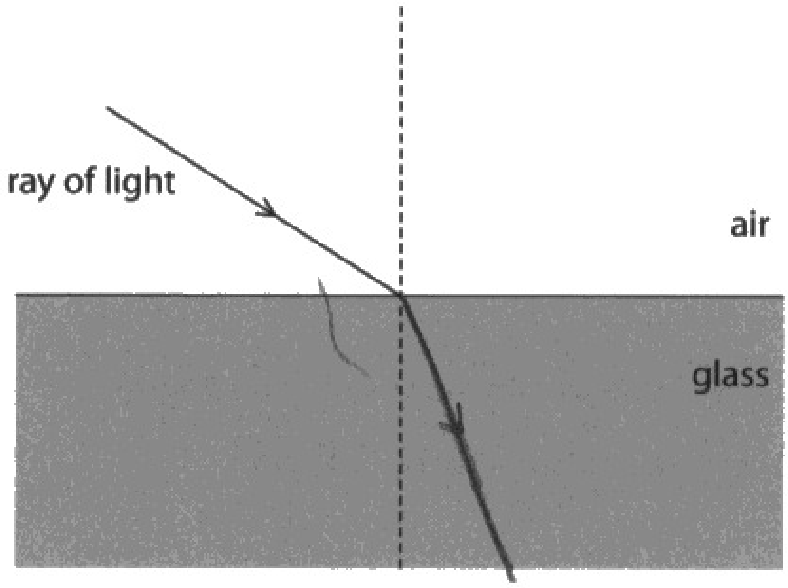

Figure 5

ResultsPlus
Examiner Comments

This shows the correct change in direction, so scores both marks.

Question 3 (a)(iii)

Total internal reflection was required here. This was not well known and very few candidates scored even 1 mark.

(iii) Figure 6 shows a ray of light in water, travelling to the surface of the water.

The angle marked **X** is greater than the critical angle.

On Figure 6, draw the ray of light after it reaches the surface of the water.

(2)

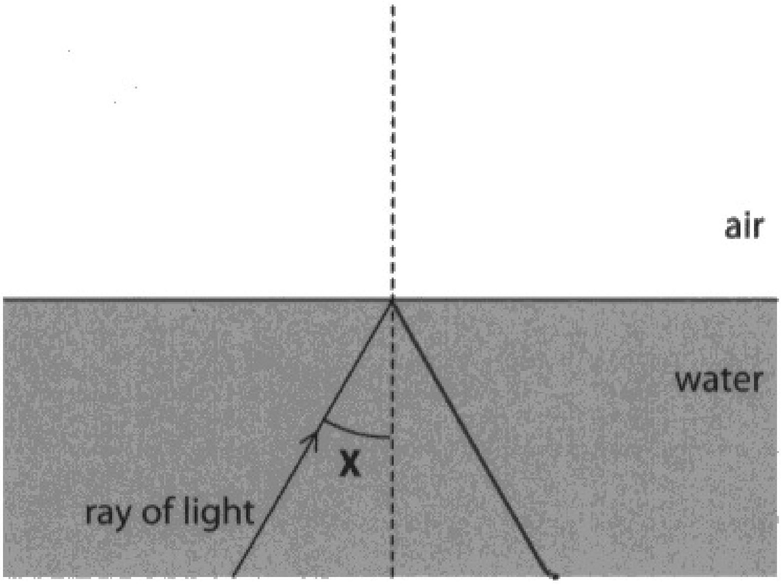

Figure 6

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Examiner Comments

This example shows the correct response.

Question 3 (b)

This was a calculation using a given equation, involving a change in the unit for focal length.

The majority of candidates scored all 3 marks and those that scored 2 did so usually for not changing the unit successfully.

Question 4 (a)

A calculation of gravitational potential energy for which the vast majority of candidates were able to score full marks.

Question 4 (b)

This was a calculation of kinetic energy where the equation had to be selected from the equation sheet. It involved squaring just one of the values and this is where errors are likely to occur.

Pleasingly, most candidates were able to score all 3 marks.

(b) A cyclist of mass 70 kg travels at a constant velocity of 8 m/s.

Calculate the kinetic energy of the cyclist.

(3)

kinetic energy = 1/2 x mass x (speed)^2

$\frac{1}{2} \times 70 \times 8^2 = 2240$

kinetic energy of the cyclist = 2240 J

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Examiner Comments

This response, scoring all 3 marks, illustrates the value of showing each step in the working.

Question 4 (c)(i)

Q4(c)(i) and Q4(c)(ii) required candidates to read values from a graph and extend the graph to predict a value.

Only a few candidates failed to score at least 1 of the 3 marks available here.

Question 4 (c)(iii)

This analysis of a graph required candidates to recognise that the error was to do with the student's reaction time and that this was similar to the time intervals shown on the graph.

Most candidates did not score here and those that did scored only 1 of the 2 marks available.

Question 5 (c)(ii)

Most candidates were not able to score a mark for the limited description of a nuclear fusion reaction.

(ii) Describe what happens in this nuclear fusion reaction.

(2)

Two nuclei come together ~~to~~ and fuse to make an atom.

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Examiner Comments

This was all that was required for 2 marks.

Question 5 (c)(iii)

An encouraging number of candidates scored both marks for this challenging calculation of a ratio involving numbers in standard form.

(iii) The intensity of the Sun's radiation in W/m² on the surface of Earth is 1.32×10^3.

The intensity of the Sun's radiation in W/m² on the surface of Mars is 4.92×10^2.

Calculate the ratio

$$\frac{\text{intensity of the Sun's radiation on the surface of Earth}}{\text{intensity of the Sun's radiation on the surface of Mars}}$$

(2)

$1.32 \times 10^3 = 1320$

$4.92 \times 10^2 = 492$

$$\frac{1320}{492} = \frac{110}{41}$$

ratio = 110 : 41

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Examiner Comments

Again, this illustrates the advantage of showing clear working.

2 marks.

Question 6 (a)(i)

The majority of candidates could give an example of how radioactivity can be dangerous to humans.

(i) State **one** way that radioactivity can be dangerous to humans.

(1)

it can cause cancer.

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One of a range of acceptable responses.

Question 6 (a)(iii)

Most candidates were able to give at least one other ionising radiation and many were able to quote two.

Question 6 (c)(i-ii)

Examiners were looking for a halving of the original mass in Q6(c)(i).

In Q6(c)(ii) they were looking for evidence of realising that 54 days was 3 half-lives and a subsequent calculation.

This was intended to be a challenging question and it was.

(c) A sample of a radioactive isotope has a mass of 520 g.

The half-life of the radioactive isotope is 18 days.

(i) Calculate the mass of the original radioactive isotope remaining after 18 days. **(1)**

520 ÷ 2 = 260

mass after 18 days ....260........ g

(ii) Calculate the mass of the original radioactive isotope remaining after 54 days. **(2)**

54 ÷ 18 = 3

520
260
130
65

mass after 54 days ....65........ g

ResultsPlus
Examiner Comments

This shows a clear train of thought in mathematical terms, gaining all 3 marks.

Question 7 (a)(i)

Q7(a)(i) and Q7(a)(ii) were graded calculations on the ideas of mass and weight.

Q7(a)(i) involved a substitution into a given equation and most candidates scored both marks.

Q7(a)(ii) involved a rearrangement and stretched the ideas a bit further. This produced an almost even spread of marks from 0 to 3.

Question 7 (b)

In this open ended response question, candidates were asked to describe the Solar System in terms of some of the objects in it and their patterns of movement. Candidates could refer to objects such as planets, moons, comets and asteroids. Level 3 could be achieved with a detailed description of two sets of objects.

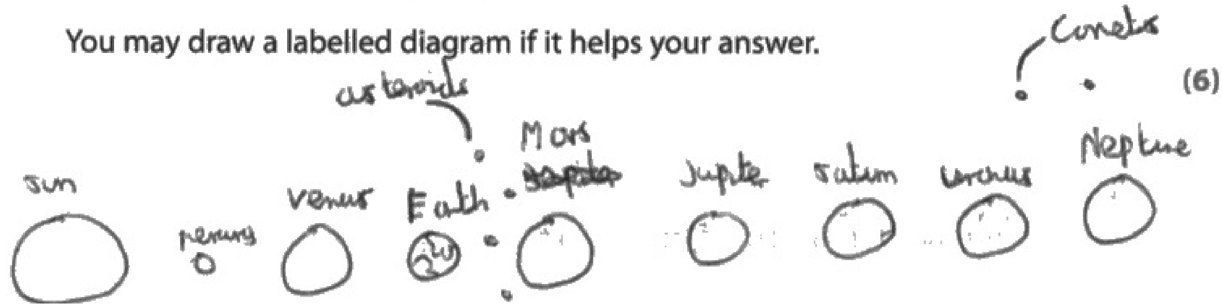
Many candidates were able to achieve at least level 2 in this question, showing sound knowledge and understanding.

*(b) Describe the Solar System in terms of the Sun, the planets, and the other objects which move in the Solar System.

Your answer should include the patterns of movement of the planets and the other objects in the Solar System.

You may draw a labelled diagram if it helps your answer.

(6)



There are 8 planets in our solar system, in order they're named: ~~Mars, Venus, Earth, Jupiter~~ Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune. These planets orbit a star called the sun in an eliptical orbit. Furthermore, there are other objects in ~~wear~~ the solar system called asteroids and Comets, asteroids are typically found in the asteroid belt between Earth and ~~Jupiter~~ Mars whilst Comets are found much further away. There is also a dwarf planet called pluto.

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Examiner Comments

This response gives clear detail about two sets of objects in the Solar System (planets and asteroids) and mentions a third set (comets). The response scores level 3, 6 marks.

ResultsPlus
Examiner Tip

It is a good idea to draw a diagram if space is provided. It will not only illustrate your answer but it may also help you to structure your answer.

*(b) Describe the Solar System in terms of the Sun, the planets, and the other objects which move in the Solar System.

Your answer should include the patterns of movement of the planets and the other objects in the Solar System.

You may draw a labelled diagram if it helps your answer.

(6)

Rocks

C

The solar system is made up of planets and Dwarf planets, these planets such as Earth, Jupiter, mars, neptune, uranus, mercury, venus, all orbit around the sun. The sun does not orbit around the planets. The are also rocks and meteroids in our solar system that float and circle the sun. The sun is the main sequence, Gaileuio believed that the sun is right in the middle of our solar system, and the sun is the only star. The Earth is made up of Rock however some planets are made up of gases such as helium.

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Examiner Comments

This candidate gives good detail about the pattern of movement of one set of objects, ie planets, but no mention is made of other objects such as moons or comets. This scores level 2, 4 marks.

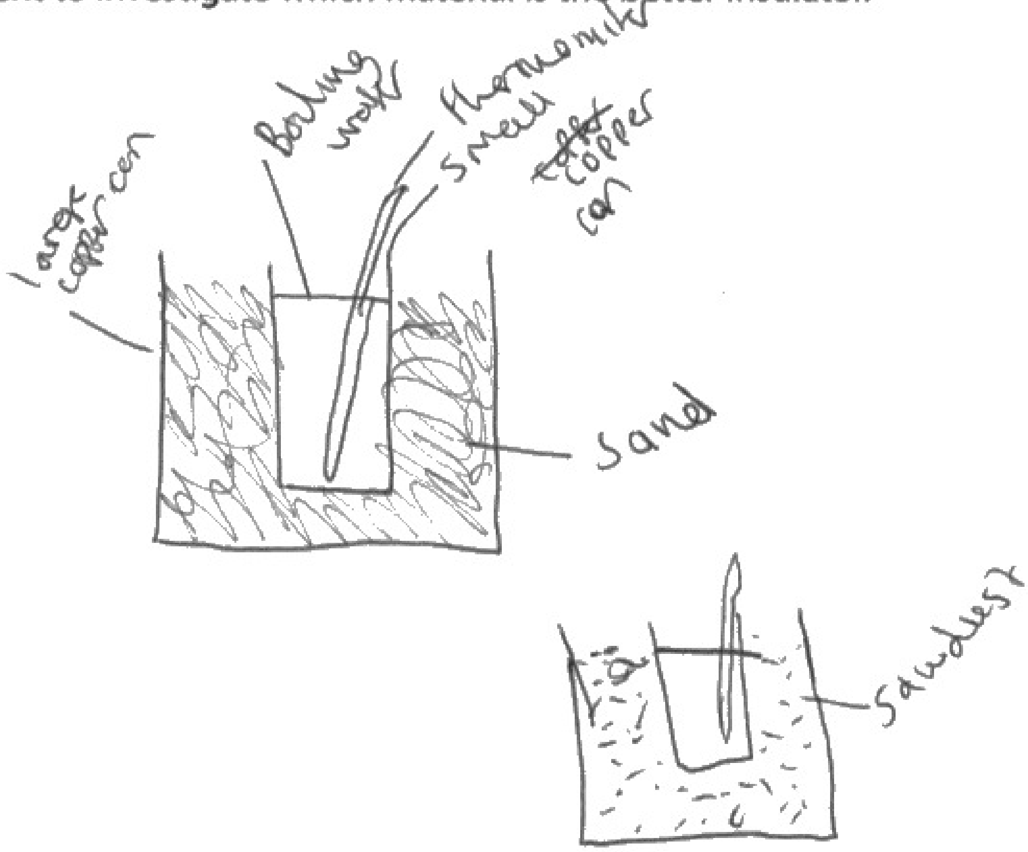
Question 8 (b)(i)

This was a practical based question where candidates were asked to draw a diagram of the set-up of apparatus in an investigation.

Even though this was an overlap question with the higher paper, most candidates were able to score at least 1 of the 3 marks available.

(i) **Draw a labelled diagram to show how the student should set up the equipment to investigate which material is the better insulator.**

(3)



ResultsPlus
Examiner Comments

This is clearly labelled, showing the correct arrangement to test which material is the better insulator.

Question 8 (b)(ii)

Here candidates were required to suggest three factors to be controlled in the investigation.

Most candidates were able to suggest at least two factors.

(ii) Give **three** factors that the student must control in this investigation.

(3)

1 The temperature of the water at the beginning of the experiment must be the same

2 how long the ~~te~~ water is left in the insulator for

3 ~~How much~~ The amount sand and sawdust must be the same

ResultsPlus
Examiner Comments

This response makes three sensible suggestions, scoring all three marks. In this context, 'amount' was accepted for 'mass' or 'volume'.

Question 8 (c)

This was a description of the relationship between two variables on an unfamiliar graph.

Most candidates scored at least 1 mark for saying that as the density increased, the thermal conductivity decreased but few went on to talk about the idea that this relationship was non-linear.

Question 8 (d)(i-ii)

Most candidates were able to score all 3 marks in this question involving an energy diagram and an efficiency calculation.

(i) Calculate the amount of energy lost to the surroundings in one second.

(1)

3000 − 2400 = 600

energy lost to the surroundings in one second = 600 J

(ii) Calculate the efficiency of the kettle.

Use the equation

$$\text{efficiency} = \frac{\text{useful energy transferred by the kettle in one second}}{\text{total energy supplied to the kettle in one second}}$$

(2)

$$\frac{2400}{3000} = 0.8$$

efficiency = 0.8

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Examiner Comments

The correct values are selected from the diagram and used in the given equation to calculate the efficiency.

Question 9 (a)(i)

Examiners were looking for an explanation linking the effect of the wet weather on the road to the safe braking of the car.

Most candidates were able to score at least 1 of the 2 marks available for this explanation.

(i) The sign tells drivers to drive at a slower speed in wet weather.

Explain why it is safer for drivers to drive at a slower speed in wet weather.

(2)

Wet weather means that there is less friction between the tire and road meaning the braking distance is increased. Its safer to drive slower because that decreases the braking distance

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Examiner Comments

This response successfully and succinctly links the reduced friction to the increase in braking distance, scoring both marks.

Question 9 (a)(ii)

A 'show that' calculation where conversions of EITHER m/s to km/h OR km/h to m/s was acceptable.

(ii) Show that a speed of 31 m/s is less than a speed of 130 km/h.

(2)

1 KM → 1000 M

130KM 130 000 M

130 0000 ÷ 60 = 2166.6 meters a minute

2166.6 ÷ 60 = 36.1 M/S

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Here the candidate converts 130 km/h in clear stages to a speed of 36.1 m/s.

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Examiner Tip

In a 'show that' calculation, it is essential that you show your working in clear stages.

Question 9 (a)(iii)

A calculation involving rearrangement of a simple equation with answer given to 2 s.f.

(iii)

> The driver's reaction time is the time between the driver seeing an emergency and starting to brake.

A car is travelling at a speed of 31 m/s.

The car travels 46 m between the driver seeing an emergency and starting to brake.

Calculate the driver's reaction time.

Give your answer to 2 significant figures.

(3)

46 ÷ 31 = 1.483

driver's reaction time = 1.5 s

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The equation for speed is rearranged and the evaluation to 4 and then 3 s.f. is correct.

Question 9 (b)

In this extended open response question, candidates had to analyse and interpret a velocity-time graph. They were asked to describe how the velocity and acceleration changed in the different sections of the graph. Level 3 could be achieved for correctly describing three of the sections and linking at least two of these to data from the graph. A pleasing number of candidates were able to achieve levels 2 and 3 in this question.

*(b) Figure 16 is a velocity/time graph for a toy train on a straight track for 7 seconds.

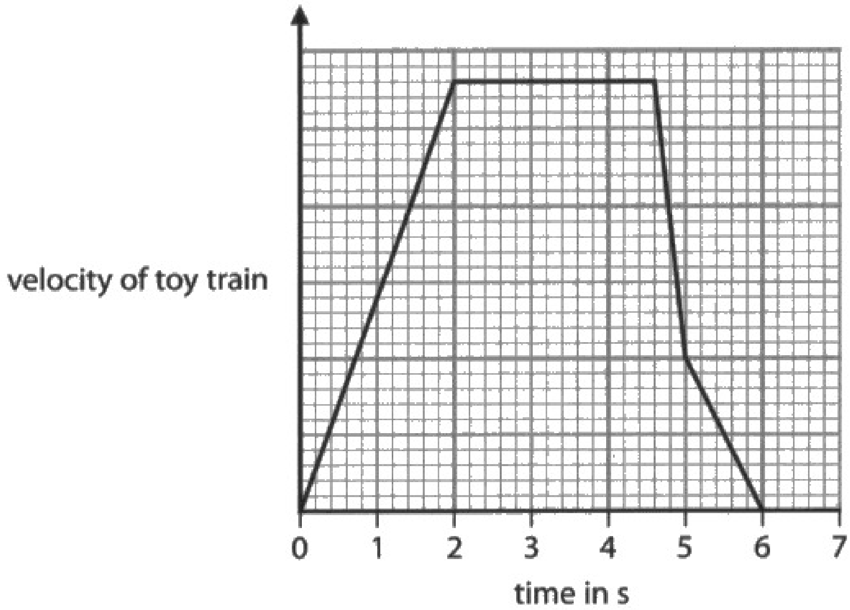

Figure 16

Using information from the graph, describe when and how the velocity and acceleration of the toy train change at different times during the 7 seconds shown on the graph.

(6)

~~Between~~ within the first 2 ~~sec~~ seconds, the toy is accelerating at its fastest rate. Between 2 and 4.6 seconds, the toy is moving at a constant speed. Then it deaccelerates from 4.6 seconds to 6 seconds.

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Examiner Comments

This response correctly describes acceleration, constant speed and deceleration, relating them all to data on the time axis. The response is clearly and logically set out and scores level 3, 6 marks.

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Examiner Tip

It is not always necessary to use all the answer space provided.

*(b) Figure 16 is a velocity/time graph for a toy train on a straight track for 7 seconds.

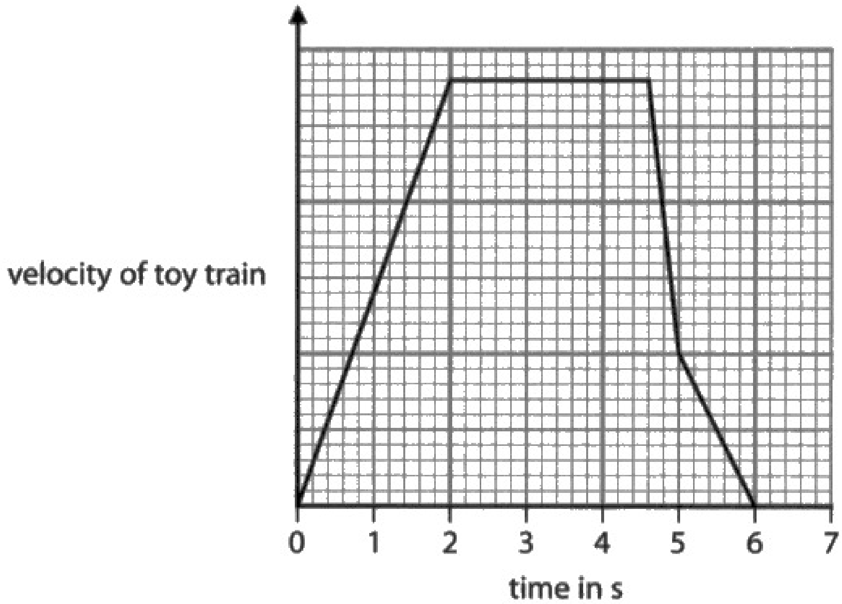

Figure 16

Using information from the graph, describe when and how the velocity and acceleration of the toy train change at different times during the 7 seconds shown on the graph.

(6)

during the first two seconds the train accelorates rapidy and the velocity increases before it then stops accelarating and the velocity levels out. Then the train de-celer-ates and the velocity falls.

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Examiner Comments

This response describes what is happening in several sections but only relates one of the sections to data from the graph, ie the first two seconds. This scores level 2, 4 marks.

Question 10 (a)(ii)

Part (a) of question 10 was about the medical uses of radioactivity. This was an overlap question with the higher paper, targeted at grades 4 and 5.

Q10(a)(ii) was about the suitability of isotopes for medical use depending on half-life.

Only a few candidates were able to score both marks for this question.

(ii) During the scan, a technician needs to take readings for about 30 minutes.

The half-life of the isotope used is about 6 hours.

1. State why an isotope with a half-life of about 6 minutes is **not** suitable.

(1)

because it would not last long enough for them to get a Clear reading

2. State why an isotope with a half-life of about 6 days is **not** suitable.

(1)

because it would be left in the body for too long after the examination

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Examiner Comments

This response shows the correct level of understanding, scoring both marks.

Question 10 (a)(iii)

Most candidates were able to suggest at least one way of reducing radiation risks to the technician, such as:

- time limiting exposure.
- radiation badges.
- protective clothing.

Question 10 (b)(i)

Part (b) of question 10 was about nuclear power.

Q10(b)(i) required knowledge and understanding of the use of control rods in nuclear reactors. The majority of candidates failed to score even 1 of the 2 available marks.

Examiners were looking for the idea that the rods absorb neutrons, making fewer neutrons available for the chain reaction.

Question 10 (b)(ii)

This was a ratio calculation involving numbers in standard form.

This was a difficult calculation but an encouraging number of candidates scored both marks.

Question 10 (b)(iii)

This was a difficult question about how energy is transferred from a nuclear reaction to the next stage in the process of generating electricity.

Only a few candidates were able to score any marks in this question.

(iii) The nuclear reaction is the first stage in the process of generating electricity.

Describe how energy is transferred from the nuclear reaction to the next stage in the process.

(2)

Energy is transferred ~~to~~ from the nuclear reaction to the next stage in the process through the heating of water. The energy is ~~tra~~ converted into heat energy and is used to boil water into steam. The steam then rises up and makes ~~a~~ fan blades move, this causes kinetic energy to be converted and generates electricity.

(Total for Question 10 = 11 marks)

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Examiner Comments

Examiners would accept a range of approaches here and this one is a good example for 2 marks.

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