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Examiners' Report
June 2025

GCSE Physics 1PH0 1H

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June 2025

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Introduction

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 radioactive decay, focussed on alpha decay and gamma decay.

In the other six-mark question, candidates had to discuss the evidence supporting the Big Bang Theory.

Candidates coped well with most questions and did particularly well in the questions asking for calculations using equations. Candidates' knowledge of practical work shows improvement on last year. This was shown particularly in Q03(a)(iii), Q05(a) and Q07(c).

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.

Question 1(b)

This question involved rearranging a simple equation and realising that the distance involved was twice the distance in the diagram.

(b) Figure 1 shows a technician standing in front of a wall.

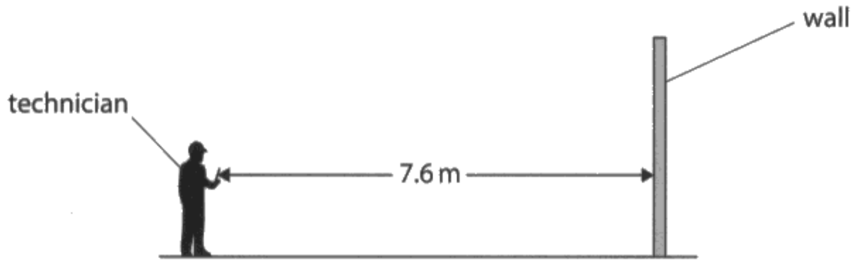

Figure 1

The technician has a device that can emit and detect **ultrasound**.

The device emits a pulse of **ultrasound** towards the wall and detects the echo of the pulse a short time later.

The wall is 7.6 m from the device.

The speed of **ultrasound** in air is 330 m/s.

Calculate the time between the emission of the pulse and the detection of the echo.

(3)

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

7.6×2

$$\text{time} = \frac{\text{distance}}{\text{speed}} \qquad \frac{15.2}{330}$$

time = 0.046 s

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Examiner Comments

The equation is clearly rearranged and the distance doubled, giving the correct answer. 3 marks scored.

(b) Figure 1 shows a technician standing in front of a wall.

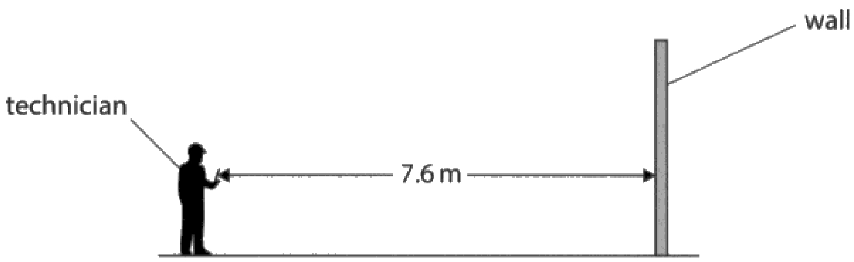

Figure 1

The technician has a device that can emit and detect **ultrasound**.

The device emits a pulse of **ultrasound** towards the wall and detects the echo of the pulse a short time later.

The wall is 7.6 m from the device.

The speed of **ultrasound** in air is 330 m / s.

Calculate the time between the emission of the pulse and the detection of the echo.

(3)

$\frac{7.6}{330} = 0.02$

time = 0.02 s

ResultsPlus Examiner Comments

In this response, the equation is clearly rearranged but the distance is not doubled so it does not gain the third mark. 2 marks scored.

Question 1(c)

Full marks could be gained in this question in one of two ways:

1. By referring to frequency (or its unit) and saying that it was too low.
2. By referring to an appropriate part of the ear and saying why it doesn't detect infrasound.

(c) Explain why humans cannot hear **infrasound**.

(2)

The frequency is too low meaning that the vibrations it causes to the ~~[illegible]~~ small bones in the ear cannot be detected by the receptors in the cochlea as they are very minor vibrations.

ResultsPlus
Examiner Comments

This response scores full marks in the first line. The rest of the response is also sufficient to score full marks using method 2. 2 marks scored.

(c) Explain why humans cannot hear **infrasound**.

(2)

Infrasound has too ~~low of a~~ high of a frequency for humans to hear, as humans can listen up to 17,~~000~~kHz, but infrasound is 22,~~000~~kHz

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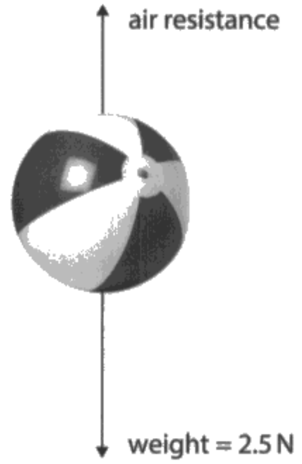
Examiner Comments

This response scores only 1 mark for referring to frequency. It is really talking about ultrasound. 1 mark scored.

Question 2(a)i

Candidates had to first of all appreciate that the accelerating force was the resultant force of 0.92 N and not the weight of the ball. Then they had to use this in the rearranged equation to calculate the acceleration.

2 (a) Figure 2 shows the two forces acting on a beach ball as it falls through the air.



(Source: © Stepan Bormotov/Shutterstock)

Figure 2

The resultant of these two forces is 0.92 N downwards.

(i) The mass of the beach ball is 0.25 kg.

Calculate the acceleration of the beach ball as it falls.

Use the equation

$F = m \times a$

$$a = \frac{F}{m}$$

$$a = \frac{0.92}{0.25} = 3.68 \text{ m/s}^2$$

(3)

acceleration = 3.68 m/s²

This response clearly chooses the correct force and, showing all the working, calculates the correct value for the acceleration.

Question 2(b)ii

Here candidates had to extrapolate the graph to the value h = 0.08 m then read off the corresponding value of F.

The students then measure values of the force, F, for several different values of h, the height of the runway.

Figure 4 is a graph of F against h.

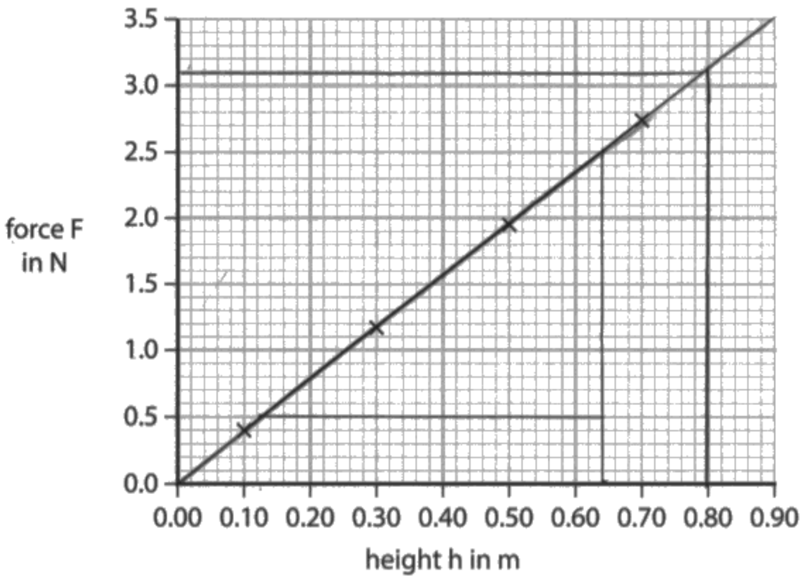


Figure 4

(ii) Use the graph in Figure 4 to determine the value of F when h = 0.80 m.

(2)

F = 3.1 N

ResultsPlus
Examiner Comments

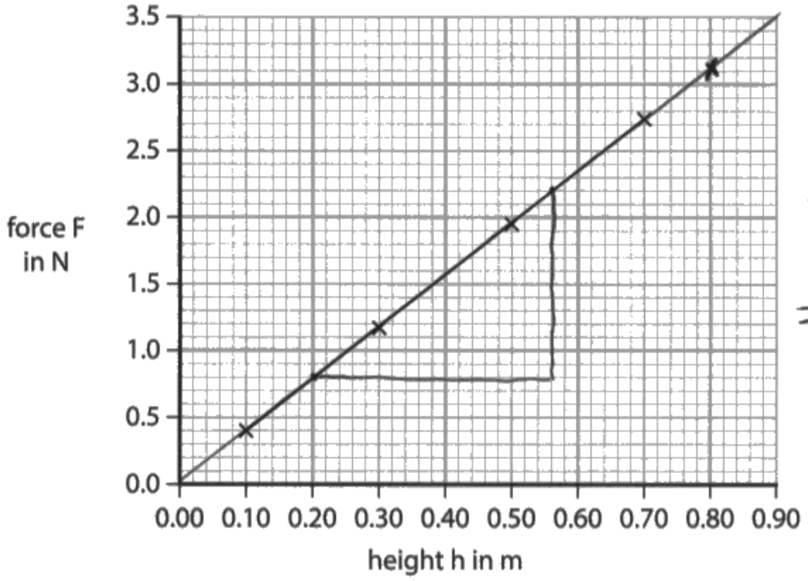
Clear working shown on the graph would have enabled this response to score 1 mark if the force axis had been read incorrectly. In the event, the scale was read correctly so full marks scored. 2 marks scored.

Question 2(b)iii

Candidates were required to determine the gradient of the straight-line graph.

The students then measure values of the force, F, for several different values of h, the height of the runway.

Figure 4 is a graph of F against h.



$\frac{\Delta Y}{\Delta x} = \frac{2.2-0.8}{0.56-0.2}$

$= \frac{1.4}{0.36} = 3.8$

Figure 4

(ii) Use the graph in Figure 4 to determine the value of F when h = 0.80 m.

(2)

F = 3.15 N

(iii) Determine the gradient of the graph in Figure 4.

(2)

gradient = 3.8 N/m

ResultsPlus
Examiner Comments

Once again, clear working shown on the graph would have meant that examiners could award an intermediate mark if the final answer had not been correct. This answer, though, was within the acceptable range (3.80 to 4.00) to score full marks. 2 marks scored.

Question 3(a)iii

Here, candidates were asked to describe a method of determining the wave speed of a wave in a tank. The previous item had asked them to determine the wavelength of the wave.

There were two acceptable methods:

1. Time a wave crest over a known distance then use speed = distance ÷ time.
2. Count the number of waves in a specified time (to calculate frequency) the use $v = f \times \lambda$

(iii) The water wave shown in Figure 5 is generated in a large tank.

d ultra distance ÷ time it takes

A student observes the wave.

Describe how the student could determine the wave speed of the wave.

(2)

Use a stopwatch to time how many waves pass a point in a certain time to calculate the frequency.
Use $v = f\lambda$ to calculate the wave speed by substituting the frequency and the wavelength.

ResultsPlus
Examiner Comments

This response describes the second method. 2 marks.

(iii) The water wave shown in Figure 5 is generated in a large tank.

A student observes the wave.

Describe how the student could determine the wave speed of the wave.

(2)

By using a metre rule, focus on one wave in the tank and use a stopwatch to measure how long it takes to reach one point ~~&~~ from the other. Then use the equation wavespeed = distance ÷ time

ResultsPlus
Examiner Comments

This response is just sufficient to score 2 marks for the first method. 2 marks scored.

Question 3(b)i

The most common correct response here was a named electromagnetic wave.

The most common error was a sound wave.

(b) When an earthquake happens, waves are transmitted through the Earth.
Figure 6 is a diagram of a part of the Earth's crust.

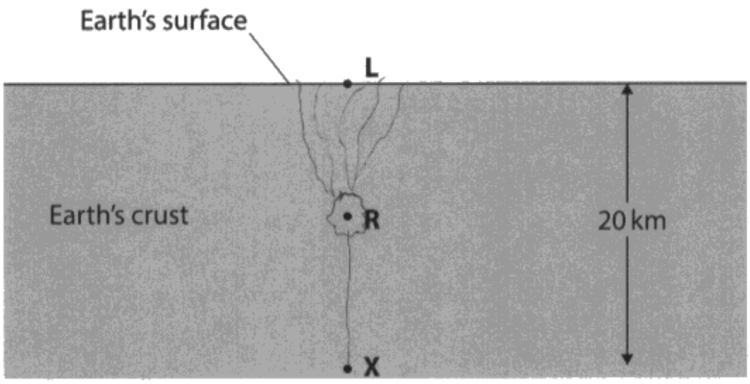


Figure 6

An earthquake happens at point **X**, 20 km below the Earth's surface.

An earthquake wave from **X** is detected at point **L**.

This earthquake wave is a transverse wave.

(i) State **one** other example of a transverse wave.

(1)

radiowave

ResultsPlus
Examiner Comments

Radio wave is a named electromagnetic wave. 1 mark scored.

Question 3(b)ii

This required the application, knowledge and understanding about transverse waves to the behaviour of some rock in the path of the earthquake wave.

Candidates had to refer to oscillations or vibrations perpendicular to the direction of travel of the wave.

(b) When an earthquake happens, waves are transmitted through the Earth.
Figure 6 is a diagram of a part of the Earth's crust.

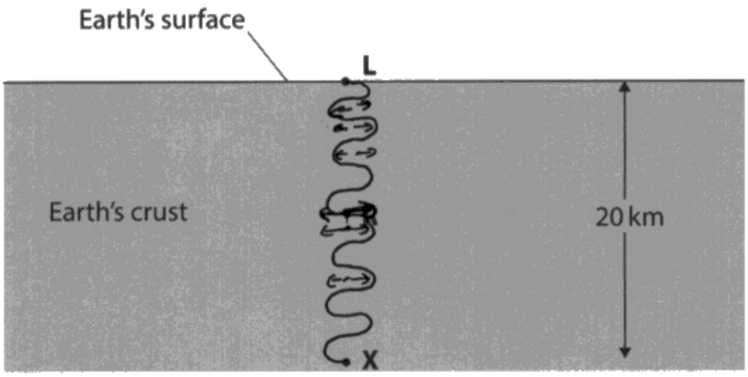


Figure 6

An earthquake happens at point **X**, 20 km below the Earth's surface.

An earthquake wave from **X** is detected at point **L**.

This earthquake wave is a transverse wave. → S wave.

(i) State **one** other example of a transverse wave.

(1)

light waves.

(ii) A point in the crust is labelled **R** in Figure 6.
There is a rock at point **R**.

Describe the effect that this earthquake wave has on the rock at **R** as the wave passes through the rock.

You may add to Figure 6 to help your answer.

(2)

Energy is transferred particles which oscillate ~~parallel~~ perpendicular to the direction of wave travel so as the wave comes up towards the surface, Rock R is shaken from side to side, causing the rock to potentially break or incur some damage.

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Examiner Comments

This is an excellent example. 2 marks scored.

Question 3(b)iii

This involved using data from a diagram to do a two-step calculation of a distance, taking care with the units involved.

This meant first calculating the distance RL then subtracting this from 20 km to find the distance XR.

(iii) The wave from **X** reaches **L** 3.8 seconds after it passes through **R**.

The speed of the wave is 4500 m / s.

Calculate the distance between **X** and **R**.

(2)

R → L = 3.8 s

s = d/t

d = s × t

d = 4500

R → L

3.8 × 4500 = 17100 m

= 17.1 km

20 − 17.1 km = 2.9 km

2900 m

distance = 2900 m

(Total for Question 3 = 9 marks)

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Examiner Comments

This response shows the calculation of RL to be 17 100 m and the subsequent calculation of XR to be 2900 m. 2 marks scored.

(iii) The wave from **X** reaches **L** 3.8 seconds after it passes through **R**.

The speed of the wave is 4500 m / s.

Calculate the distance between **X** and **R**.

(2)

wave speed = $\frac{\text{distance}}{\text{time}}$ ~~÷ time~~

$4500 = \frac{D}{3.8}$

$4500 \times 3.8 = 17100$ m

$\frac{17\,100}{3.8} = 4500$

distance = 17100 m

ResultsPlus
Examiner Comments

This response only gets as far as the first step so gets just the first mark. 1 mark scored.

Question 4(b)i

This involved using data from a radioactive decay curve for fluorine-18 to calculate the percentage of the sample remaining after 150 minutes.

A common error was to use 60.0 mg as the mass of the original sample.

(b) The isotope fluorine-18 is used in PET scans, which help to detect cancers.

Figure 7 shows a radioactive decay curve for a sample of fluorine-18.

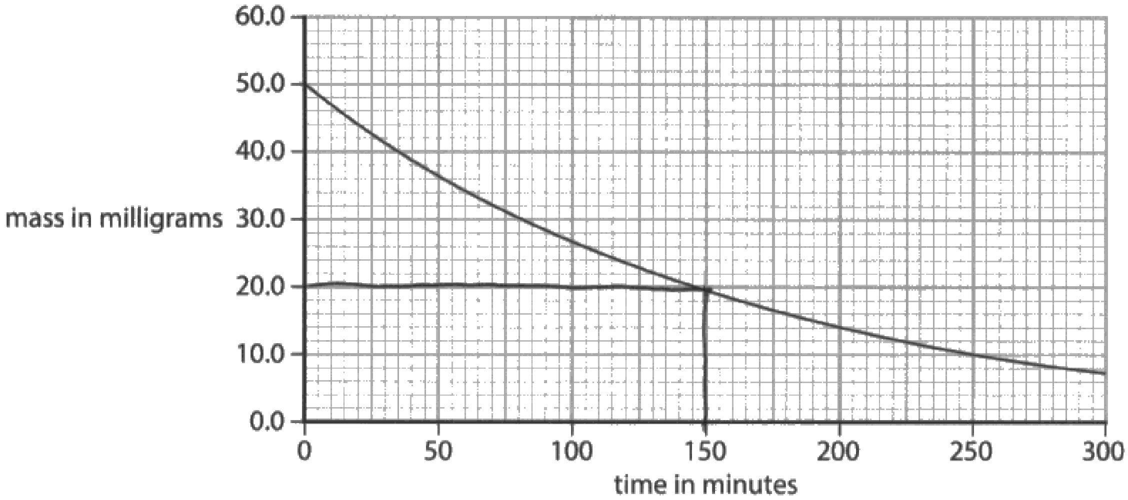


Figure 7

(i) Use the graph to calculate the percentage of fluorine-18 remaining after 150 minutes.

(2)

20/50 × 100
= 40

percentage of fluorine-18 remaining after 150 minutes = 40 %

ResultsPlus
Examiner Comments

The correct data was selected and the final answer was within the accepted range (38% to 40%). 2 marks scored.

Question 4(b)ii

Candidates were asked to describe what happens when positrons meet electrons.

Examiners were looking for two points from:

- They collide.
- Annihilate.
- Release (a pair of) gamma rays.

(ii) Fluorine-18 releases positrons.

Describe what happens when positrons meet electrons.

(2)

When positrons meet electrons they annihilate each other and emitt gamma ~~wav~~ rays in opposite direction

ResultsPlus
Examiner Comments

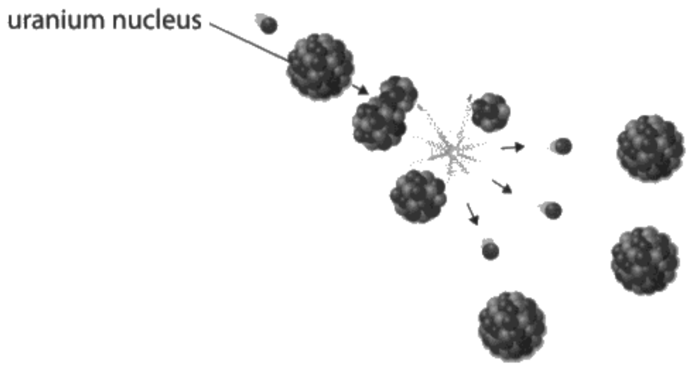
This has the annihilation and the production of gamma rays. 2 marks scored.

Question 4(c)

This question was about nuclear fission.

Candidates were asked to explain what happens when one neutron interacts with one uranium nucleus.

(c) Figure 8 shows what happens during a fission chain reaction.



(Source: © Designua/Shutterstock)

Figure 8

Explain what happens when **one** neutron interacts with **one** uranium nucleus.

(3)

- nuclear fission
- uranium nucleus absorbs the neutron
- causes uranium nucleus to split into two lighter nuclei and emits 2/3 neutrons
- this releases energy

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Examiner Comments

This response is a good, well-structured explanation. 3 marks scored.

Question 4(d)

In calculating this ratio, candidates were asked to give their answer to 2 significant figures.

(d) In 2023, Finland produced 4.4 GW of power from nuclear power plants.

The UK produced 8.9 GW of power from nuclear power plants.

Calculate the ratio of nuclear power produced in Finland compared with the UK as

$$\frac{\text{power production in Finland}}{\text{power production in the UK}}$$

Give your answer to 2 significant figures (2 s.f.).

(2)

$$\frac{4.4\ \text{GW}}{8.9\ \text{GW}} = 0.4943820225$$

$$\approx 0.49$$

ratio = 0.49

(Total for Question 4 = 11 marks)

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Examiner Comments

Correct answer to 2 sf. Full marks. 2 marks scored.

Question 5(a)

This required a description of a practical procedure.

The most common error was to describe refraction, rather than the procedure used to produce the refracted ray and mark its position.

5 (a) When light travels from air into glass, it is refracted.

To investigate this, a student has a rectangular glass block and a ray box.

The ray box produces a ray of light.

Describe how the student should use the glass block and ray box to produce a refracted ray and mark its position.

You may draw a diagram to help your answer.

(4)

Point the ray box at the glass block and shine a ray of light. Using a pencil trace around the edge of the glass block and use a pencil and ruler to draw on the ray of light entering and leaving the ~~box~~ block. Remove the glass and join the points where the light enters the block and leaves the block with a pencil and ruler. This is the refracted ray.

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Examiner Comments

A well-structured procedure that, if followed, would result in the correct ray being drawn. Drawing a diagram first here would help the candidate to structure their answer. 4 marks scored.

Question 5(b)iii

This was a complex calculation involving selecting data from a table, using v = f × λ then subtracting numbers in standard form.

(iii) The speed of blue light in air is 3.0×10^8 m/s.

Calculate the change in the speed of blue light when it travels from air into glass.

Use the equation $1nm = 10^{-9} m$

$$v = f \times \lambda$$

wavespeed = frequency × wavelength **(3)**

$3.0 \times 10^8 m/s = 6.4 \times 10^{14} \times 470nm$

$= 4.7 \times 10^{-7} m$

v in glass $= 6.4 \times 10^{14} \times 3.5 \times 10^{-7} m$

$= 224000000$

$= 2.24 \times 10^8$

$3.0 \times 10^8 - 2.24 \times 10^8 = 7.6 \times 10^7$

change in speed = 7.6×10^7 m/s

(Total for Question 5 = 9 marks)

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Examiner Comments

This is a well-structured calculation, with clear working, keeping control of the standard form and mixed units.

Question 6(a)i

This was a straightforward calculation involving rearranging a given equation.

6 (a) Figure 10 shows a skier sliding down a slope.

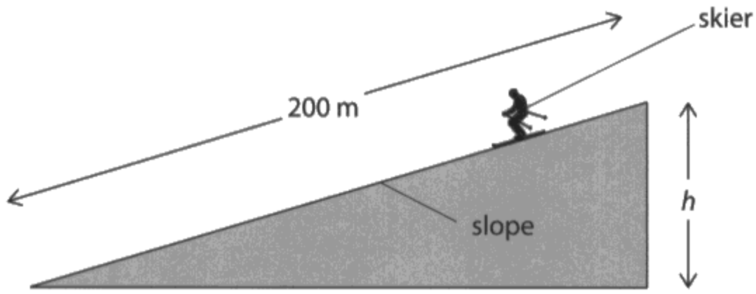

Figure 10

(i) The gravitational potential energy of the skier decreases by 39 000 J between the top and the bottom of the slope.

The mass of the skier is 70 kg.

Calculate the height, h of the slope.

The value of g is 10 N/kg.

Use the equation

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

$70 \times 10 = 700$

$\frac{39000}{700}$

(2)

$h = \cancel{\frac{m \times g}{GPE}}$ $\frac{GPE}{m \times g}$

$h =$ 55.7 m

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Correct answer, full marks. 2 marks scored.

Question 6(a)ii

This was a more complex calculation where the equation was not given in the question and it was possible to use more than one of the equations in the equation book.

6 (a) Figure 10 shows a skier sliding down a slope.

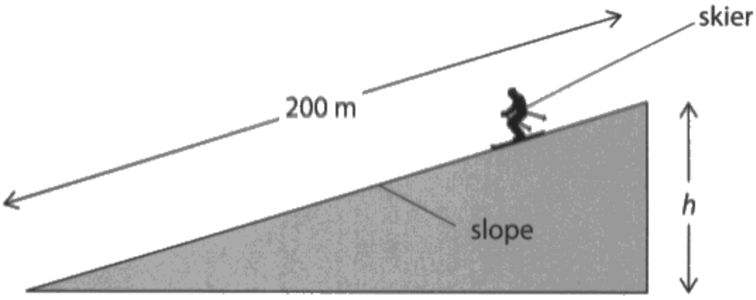

Figure 10

GPE

(i) The gravitational potential energy of the skier decreases by 39 000 J between the top and the bottom of the slope.

The mass of the skier is 70 kg.

Calculate the height, h of the slope.

The value of g is 10 N/kg.

Use the equation

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

(2)

$39000 = 70 \times 10 \times h$

$\frac{39000}{700} = 55.71$ (2dp)

$h =$ 55.71 m

(ii) The skier starts from rest at the top of the slope.

The velocity of the skier at the bottom of the slope is 27 m/s.

Using information from Figure 10, calculate the acceleration of the skier along the slope.

(3)

~~v-u / t~~

$v^2 - u^2 = 2ax$

$27^2 = 2a(200)$

$\frac{27^2}{400} = 1.8225$

acceleration = 1.8 (2sf) m/s^2

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Examiner Comments

This response picks the most suitable equation, rearranges it and gets the correct answer. 3 marks scored.

Question 6(a)iii

Examiners were looking for an explanation involving GPE at the top and KE at the bottom of the slope, the amount of energy dissipated being the difference between the two.

(iii) When the skier slides from the top to the bottom of the slope, some energy is dissipated.

Explain how to determine the amount of energy dissipated.

(2)

work out the difference between his GPE at the start and his KE at the end, and the number left over will be the dissipated energy.

An excellent explanation.

Question 6(b)i

Even though the athletes were running at a constant speed, their velocity was changing because velocity is a vector and their direction was changing.

(b) Figure 11 shows athletes running at a constant speed on a curved section of a track.

(Source: © Photo and Co/Getty Images)

Figure 11

(i) Even though they are running at a constant speed, the velocity of each athlete is changing.

State why the velocity of each athlete is changing.

(1)

· Velocity is a vector so has magnitude and direction

· The direction is changing

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A concise response that shows good understanding.

Question 6(b)ii

Here candidates were required to find the gradient of a curve at a particular point.

They had to realise that they had to draw a tangent to the curve at that point and determine its gradient.

(ii) The athletes start the race on a straight section of track.

Figure 12 shows a distance/time graph for one of the athletes.

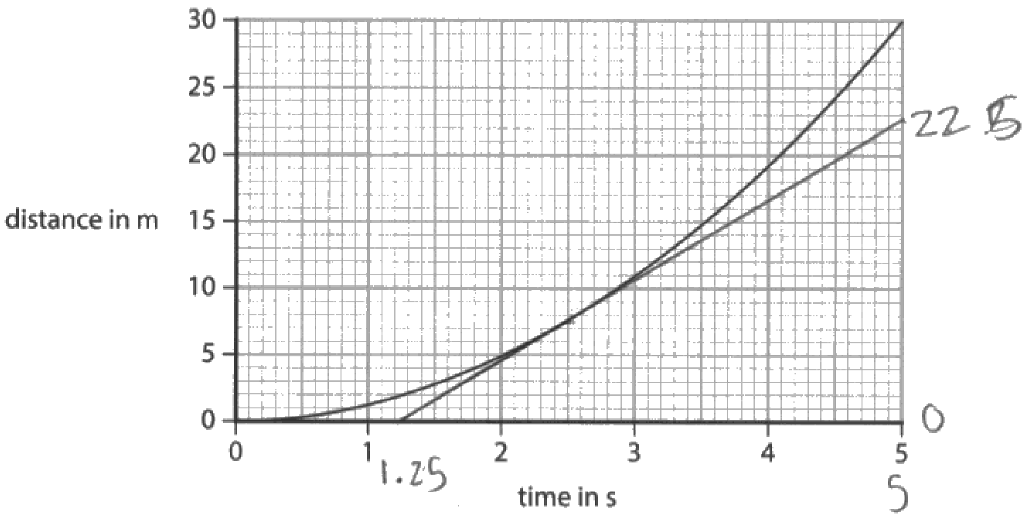

Figure 12

Determine the gradient of this graph at a time of 2.5 s.

(2)

$\frac{22.5-0}{5-1.25} = 6$ m/s

gradient = 6 m/s

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Examiner Comments

The tangent is clearly visible and accurately drawn. The answer is in the allowed range (5.0 to 7.0). 2 marks scored.

Question 7(a)

Here candidates were asked to describe how the power of a lens is related to its focal length and shape.

Examiners were looking for shorter focal length and smaller radius of curvature for a higher power. 'More curved', 'thicker' or 'fatter' were acceptable alternatives to smaller radius of curvature.

7 (a) **Describe how the power of a lens is related to its focal length and the shape of the lens.**

(2)

High power, is a thicker lense () and has a shorter focal length, a lower power lense has a thinner lense (), and has a longer focal length.

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This response describes this completely and adds sketches to reinforce the description. Scores 2 marks.

Question 7(b)

This question was not answered well. Candidates were asked to provide one example each of a virtual image and a real image that a lens could produce.

(b) (i) Give **one** example of a virtual image that a lens could produce.

(1)

[illegible]

~~Cameras~~ Magnifying glasses

(ii) Give **one** example of a real image that a lens could produce.

(1)

~~Eyes~~ Photographs.

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There were several acceptable answers. These are two of them. 2 marks scored.

Question 7(c)

This question tested knowledge and understanding of the concept of critical angle using a standard illustration.

There were 3 marks available and most candidates were able to score at least 1. There was some uncertainty about what happened when the angle was 380.

(c) A student investigates what happens when a ray of light shines into a semicircular block made of transparent plastic.

The ray meets the straight edge at an angle of 20°, as shown in Figure 13.

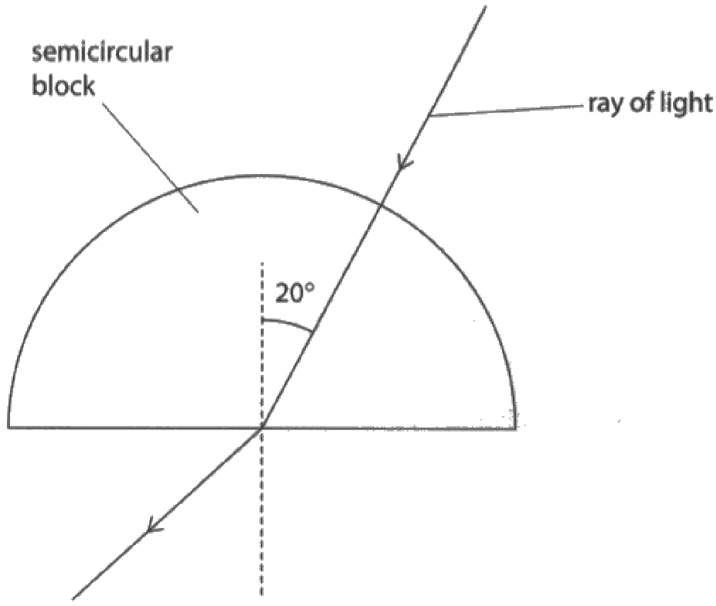

Figure 13

The student gradually increases the angle at the straight edge from 20° to 50° and observes what happens to the ray of light.

The critical angle for the transparent plastic is 38°.

Describe what you would expect to happen to the ray of light as the angle at the straight edge increases from 20° to 50°.

You may add to the diagram in Figure 13 to help your answer.

(3)

- As the angle at the straight edge increases, the refracted angle bends further away from the normal.
- when angle at straight edge is equal to 38°, the refracted ray will be at 90°.
- when the angle at straight edge is greater than 38° total internal reflection occurs.

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Examiner Comments

This is a well-constructed methodical approach, showing a clear understanding of what happens at the critical angle and after the critical angle has been exceeded. 3 marks scored.

Question 7(d)

Candidates had to appreciate that an object such as Ceres was absorbing and emitting radiation and that when the rate of emission was the same as the rate of absorption the temperature would be constant.

(d) The asteroid Ceres orbits the Sun between Mars and Jupiter.

During its orbit, Ceres receives electromagnetic radiation from the Sun.

The average temperature of Ceres is constant.

Explain why the average temperature of Ceres remains constant.

(4)

Ceres is absorbing ~~and emitting~~ and radiating the same amount of heat from the Sun at the same rate, so the temperature will not increase or decrease but will remain constant.

ResultsPlus
Examiner Comments

In this context, 'heat' being radiated or absorbed was acceptable so this response scores full marks. 4 marks scored.

Question 8(a)i-ii

This question required candidates to us the equations for momentum and for force involving rate of change of momentum.

Knowledge of the unit for momentum was also required.

Part (ii) involved an unfamiliar rearrangement.

8 (a) Figure 14 shows a footballer and a ball.

(Source: © GelgelNasution/Shutterstock)

Figure 14

The ball is stationary before it is kicked.

The mass of the ball is 0.43 kg.

The kick exerts a force of 2700 N on the ball.

The velocity of the ball just after it has been kicked is 36 m / s.

(i) Calculate the momentum of the ball just after it has been kicked.

State the unit for momentum.

(3)

$p = m \times v$

$p = 0.43 \times 36$

$p = 15.48$

momentum = 15.48

unit kg.m/s ~~Kg/m/s~~ ~~kg/m/s~~

(ii) Calculate the amount of time that the footballer's kicking foot is in contact with the ball.

(2)

~~$t = F$~~

$t = \frac{(mv - mu)}{F} = \frac{15.48 - 0}{2700} \approx 0.00573$

time = 0.00573 s

ResultsPlus
Examiner Comments

This response scored full marks for the correct value of momentum with the correct units and the successful rearrangement of the force equation.

(i) – 3 marks scored.

(ii) – 2 marks scored.

Question 8(a)iii

Candidates were required to apply their knowledge and understanding of Newton's third law to the situation of a ball being kicked.

For full marks, a response would refer to the force exerted by the foot on the ball and the force exerted by the ball on the foot and to explain that these forces are equal and opposite.

This is a deceptively difficult concept but many good answers were seen.

(iii) Explain how Newton's third law applies to the interaction between the kicking foot and the football.

(3)

The kicking foot ~~on~~ and the ball exert equal and opposite forces on eachother so while the foot exerts a force of 2700 N on the ball, the ball exerts the same force on the person and towards them. as every force exerted has an equal opposite/reaction.

ResultsPlus
Examiner Comments

This clearly identifies the two forces and the fact that they are equal in magnitude but opposite in direction. 3 marks scored.

Question 8(b)

A three-mark response to this question would link the equation for momentum with the conservation of momentum and the observation that there is more mass moving after the collision.

(b) Figure 15 shows a system consisting of two toy trolleys, **S** and **T**, on a straight, horizontal track.

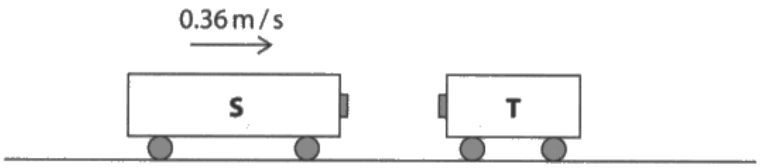

Figure 15

T is not moving.

S is moving with a velocity of 0.36 m / s towards **T**.

S collides with **T**.

The trolleys stick together and move off together. ~~m = m x v~~ $p = m \times v$

With reference to the momentum of the system, explain why the velocity of the trolleys after the collision is less than the velocity of **S** before the collision.

(3)

The mass of trolley S seems to bigger than trolley T as it is larger. When trolley S collides with trolley T it transfers some of its kinetic energy to trolley T causing it to also move off with trolley S. ~~Since the~~ By using p = m x v, and the rule of conservation of momentum where the total momentum before and after a collision is equal always equal, we know that trolley T has also got a mass, so when trolley T and trolley S mass is added, there is ~~g~~ a greater mass than there was before when it was just trolley S. Therefore less velocity is needed ~~to~~ to conserve momentum.

(Total for Question 8 = 11 marks)

ResultsPlus
Examiner Comments

From line 3 onwards, this explanation links those three things clearly and succinctly. 3 marks scored.

Question 9(a)iii

This calculation did not involve a rearrangement but did involve standard form and a squaring of a number in standard form.

Many candidates did well with this item. Those who did not do well had difficulty squaring a number in standard form.

(iii) The mass of a beta minus particle is 9.1×10^{-31} kg.

Calculate the kinetic energy of a beta minus particle moving with a speed of 3.8×10^{6} m/s.

(2)

$$KE = \frac{1}{2} \times 9.1 \times 10^{-31} \times (3.8 \times 10^{6})^2$$

kinetic energy = 6.5702×10^{-18} J

ResultsPlus
Examiner Comments

Uncomplicated working producing the correct answer here. 2 marks scored.

Question 9(b)

Acceptable answers here could refer either to the particles involved or the effect of beta plus emission on the mass number and atomic number of the nucleus.

A common error was to describe beta minus emission.

(b) Describe what happens in the nucleus of an atom when a beta plus particle is emitted.

(2)

proton turns to a neutron, so mass number stays the same and atomic number ~~it~~ decreases by 1.

ResultsPlus
Examiner Comments

This response covers both forms of description. 2 marks scored.

Question 9(c)

In this extended open response question, candidates had to demonstrate their knowledge and understanding of alpha and gamma radiation by comparing the two radiations and the effects of each type of decay on the original nucleus.

A Level 3 response would include a description of at least one type of radiation and the effect that type of decay has on the original nucleus. The response would also include, for comparison, either the effect or description of the other type of decay.

A Level 2 response would involve a more limited comparison, such as comparing the two types of radiation in terms of their nature but not including the effects on the nucleus.

A Level 1 response would contain some isolated facts relating to alpha or gamma radiation.

Descriptions of the ionisation and/or penetrating properties of the radiations were not required by the question but could gain some limited credit.

*(c) Radioactive decay can produce gamma radiation and alpha radiation.

Compare the processes of gamma decay and alpha decay.

Your answer should include

- a description of both gamma radiation and alpha radiation
- the effect of each type of decay on the original nucleus.

$^{4}_{2}He$

(6)

Gamma radiation is the most penetrating but the least ionising. Alpha radiation is the least pentrating but highly ionising. With gamma decay the nucleus doesn't gain or lose anything and stays the same. For Alpha decay the mass number decreases by 4 and the atomic number decreases by 2. Gamma radiation ~~doesn't~~ doesn't decay as it is made up of EM waves and not particles like the rest.

Examiner Comments

This response gives the nature of gamma radiation (EM wave) and says that, with the decay, the nucleus doesn't gain or lose anything. By comparison, it describes the effect that alpha decay has on the atomic and mass numbers of the nucleus. This scores Level 3, 6 marks. The discussion about ionisation/penetration properties does not add or take away from this response.

Question 10(a)

Candidates were required to apply their knowledge about the evolution of stars with a mass larger than the Sun to identify mass as the key variable in a table of data.

Most were able to do this successfully. The most common misconception was to suggest that the older a star was, the more likely it was to turn into a black hole. Also, errors in dealing with powers of ten led to selection of the wrong star.

10 (a) The table in Figure 16 shows some data about four stars.

star	mass in kg	age in years
Antares	2.6×10^{31}	1.5×10^{7}
Arcturus	2.2×10^{30}	7.1×10^{9}
Proxima Centauri	2.4×10^{29}	4.8×10^{9}
The Sun	2.0×10^{30}	4.6×10^{9}

Figure 16

(i) State which star in the table in Figure 16 is **most likely** to become a Black Hole.

(1)

~~The Sun~~ Atares

(ii) Using data from the table in Figure 16, give a reason for your answer to part (i).

(1)

It has the largest mass

ResultsPlus
Examiner Comments

This response makes the correct selection for the correct reason.

Question 10(b)i

In a question about stars, candidates were asked to describe what is meant by nuclear fusion.

Examiners were looking for the idea that small nuclei join to become larger nuclei.

This was well answered by many. The most common errors were to use the words 'atoms' or 'particles' instead of 'nuclei'.

Question 10(b)ii

This was a demanding calculation of mass loss using a given equation.

It involved a rearrangement and standard from and the final evaluation had to include the unit to gain the mark.

The most common errors were missing the unit in the answer or not squaring the speed correctly.

(ii) The speed of light, c, is 3.0×10^8 m/s.

The energy radiated by the Sun in 1 second is 3.9×10^{26} J.

Calculate the decrease in the Sun's mass equivalent to this energy.

State the unit with your answer.

Use the equation

$$E = m \times c^2$$

(2)

$$3.9 \times 10^{26} = (3.0 \times 10^8)^2 \times m$$

$$m = \frac{3.9 \times 10^{26}}{(3 \times 10^8)^2} = 4\,333\,333\,333 \simeq 4.33 \times 10^9$$

decrease in mass = 4.33×10^9 kg

ResultsPlus
Examiner Comments

This response shows a clear path through the working, essential in complex calculations. It also shows that the unit was given careful thought. 2 marks scored.

(ii) The speed of light, c, is 3.0×10^8 m/s.

The energy radiated by the Sun in 1 second is 3.9×10^{26} J.

Calculate the decrease in the Sun's mass equivalent to this energy.

State the unit with your answer.

Use the equation

$$E = m \times c^2$$

(2)

$= m \times (3.0 \times 10^8)^2$

$3.9 \times 10^{26} = m \times (3.0 \times 10^8)^2$

decrease in mass = 4 333 333 333

$3.9 \times 10^{26} = m \times 9 \times 10^{16}$

ResultsPlus
Examiner Comments

This response gets the correct numerical answer but misses out the unit. 1 mark scored.

Question 10(c)

In this extended open response question, candidates had to demonstrate their knowledge and understanding of two pieces of evidence that support the Big Bang Theory about the origin and development of the Universe. These two pieces of evidence were Red Shift and Cosmic Microwave Background Radiation (CMBR).

A Level 3 response would identify and describe at least one piece of evidence and link it to the aspect of the Big Bang Theory that it supports. The response would also at least identify the other piece of evidence.

A Level 2 response would identify at least one piece of evidence and **either** describe it **or** link it to the aspect of the Big Bang theory that it supports. The response would also at least identify the other piece of evidence.

A Level 1 response would contain isolated statements about the Big Bang Theory, Red Shift or CMBR.

*(c) There have been a number of theories about the origin and development of the Universe.

One theory about the origin and development of the Universe is The Big Bang Theory.

Discuss **two** pieces of evidence that support The Big Bang Theory.

(6)

The Big bang theory states that the universe started from a single point and has been expanding since and is supported by red shift and cosmic microwave backgrand radiation.

CMB radiation

microwaves found across the sky because as the universe was young and not it let out radiation as it cooled which was stretched out over time to produce longer wavelength waves, microwaves. These waves are found across the sky which suggests that the universe originated from a single point

Red-Shift

distant galaxies are moving away faster from each other which shows that the universe is expanding because they are more red-shifted. The longer wavelength shows that they are moving away from our galaxy and the ~~~~ rate of change suggests moving away faster. This provides evidence that ~~~~ the universe is expanding but also that it started from a single point because they are moving away from each other

(Total for Question 10 = 12 marks)

TOTAL FOR PAPER = 100 MARKS

ResultsPlus
Examiner Comments

This response identifies CMBR, describes it as microwave radiation found 'across the sky' and links it to the idea of the Universe having a definite beginning. It also identifies Red Shift as being the other piece of evidence, making this Level 3, 6 marks. The response goes further by describing Red Shift and linking it to the expansion of the Universe.

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.
- When suggesting improvements or extensions to a practical procedure, make sure they are relevant to the context of the question.
- Where a question involves a calculation, make sure they write down the equation they are using 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.

Grade boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link: https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

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