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Examiners' Report
June 2015

GCSE Physics 5PH1H 01

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Introduction

The unit was divided into six topics and all six topics were tested in the examination. It was intended that the examination paper would allow every candidate to show what they knew, understood and were able to do. To achieve this, each question increased in difficulty as the questions progressed.

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 two six mark questions were used to test quality of written communication (QWC).

It was encouraging to note the positive way in which the vast majority of candidates approached the paper, particularly in the six mark questions.

Successful candidates were:

- well grounded in the fundamental knowledge required in questions such as 5d
- willing to think, use their knowledge to solve new problems and apply their knowledge to unfamiliar situations as in question 4d
- able to analyse data and draw conclusions as in question 3biii
- able to tackle calculations of increasing difficulty and show the stages in their working
- able to construct their explanations in a logical order, using the marks at the side of the questions as a guide.

Less successful candidates:

- had gaps in their knowledge
- found difficulty in applying their knowledge to new situations
- found difficulty in analysing and interpreting data
- did not do well in calculations
- did not think through their answers before writing.

This report will provide exemplification of candidates' work, together with tips and/or comments, for a selection of questions. The exemplification will come mainly from questions which required more complex responses from candidates.

Question 1 (b)

It was pleasing to see the overwhelming majority of candidates score all three marks for this efficiency calculation.

Question 1 (c)

Both marks could be scored by stating that the rate of absorption of radiation is equal to the rate of emission of radiation when the temperature is constant. One mark was awarded for statements which did not refer to rates such as 'energy in = energy out'.

Question 1 (d)

Full marks could be gained by using the diagram to see that some of the radiation is reflected off the cover and some passes through the wing completely.

Most candidates scored at least 1 mark here.

Question 2 (a) (i)

The vast majority of candidates were able to describe the process well enough to score at least 1 of the 2 marks available with a significant number scoring both marks.

Stars and the Universe

2 (a) Our Sun is a main sequence star.
It will stay as a main sequence star for millions of years, continuing to radiate energy.

(i) Our Sun was formed from a nebula.

Describe the formation of our Sun from nebula to main sequence.

(2)

in the nebula, gas and dust is pulled together by gravity and nuclear fusion occurs - this forms the main star; which maintains a constant shape when the outward force of nuclear ~~force~~ fusion is balanced with gravity

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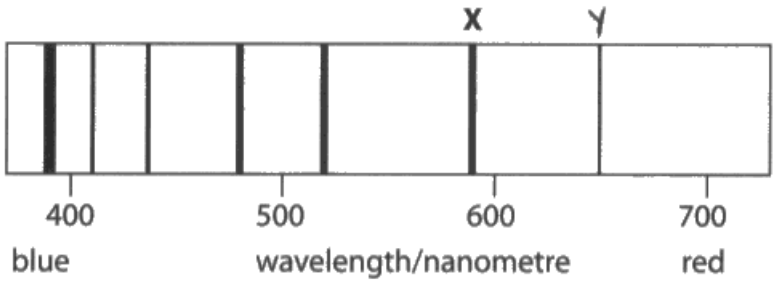
Examiner Comments

This response demonstrates a perfectly adequate description at this level, scoring both marks.

Question 2 (b) (i-ii)

The vast majority of candidates correctly placed their line Y to the right of the line X on the diagram and went on to refer to red shift or longer wavelength in their answer. About one third went on to score all 3 marks by referring to the galaxy moving away.

(b) The diagram shows some lines in the spectrum of light from a nearby galaxy. One of the lines is marked **X**.



(i) Line **X** will be in a different position in the spectrum of light from a much more distant galaxy.

Draw a line on the diagram to show a possible new position for line **X** in the spectrum of light from a much more distant galaxy.

Label this new line **Y**.

(1)

(ii) Explain why you have drawn line **Y** in this position on the diagram.

(2)

From a more distant ~~galaxy~~ galaxy, the wavelength of light is stretched, lowering the frequency. This causes a shift ~~not~~ to the red end of the spectrum for more distant / faster moving away galleries. So, the lines of the spectrum would be closer to the red, showing red shift.

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Examiner Comments

Here is a good explanation, scoring all 3 marks.

Question 2 (c) (ii)

Cosmic microwave background radiation or even CMB would get the mark here. The most common errors were to omit the word 'microwave' or to say CMB and redshift.

Question 3 (a) (ii)

The most common correct response referred to convection currents in the mantle.

Full marks could also be gained by referring to uneven heating or heat from the core causing the material under the plates to move.

Question 3 (b) (i)

Examiners were looking for responses which linked refraction or change in wave speed with change in density or material. Just over half of the candidates scored at least 1 mark with about a third going on to score both marks.

Question 3 (b) (ii)

Examiners were looking for responses that referred to the difference in arrival times of P and S waves following an earthquake.

The majority of candidates scored at least one of the two marks available by making a relevant reference to a time difference and over one third of candidates went on to score both marks with accurate descriptions.

(ii) S-waves and P-waves travel at different speeds.
The scientists use the (S–P) time to estimate how far away the earthquake is.

Suggest what is meant by (S–P) time.

(2)

This is the ~~spet~~ ~~seperation~~ time between arrival of the Pwaves and the arrival of S waves.

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Examiner Comments

This response is concise and to the point and scored both marks.

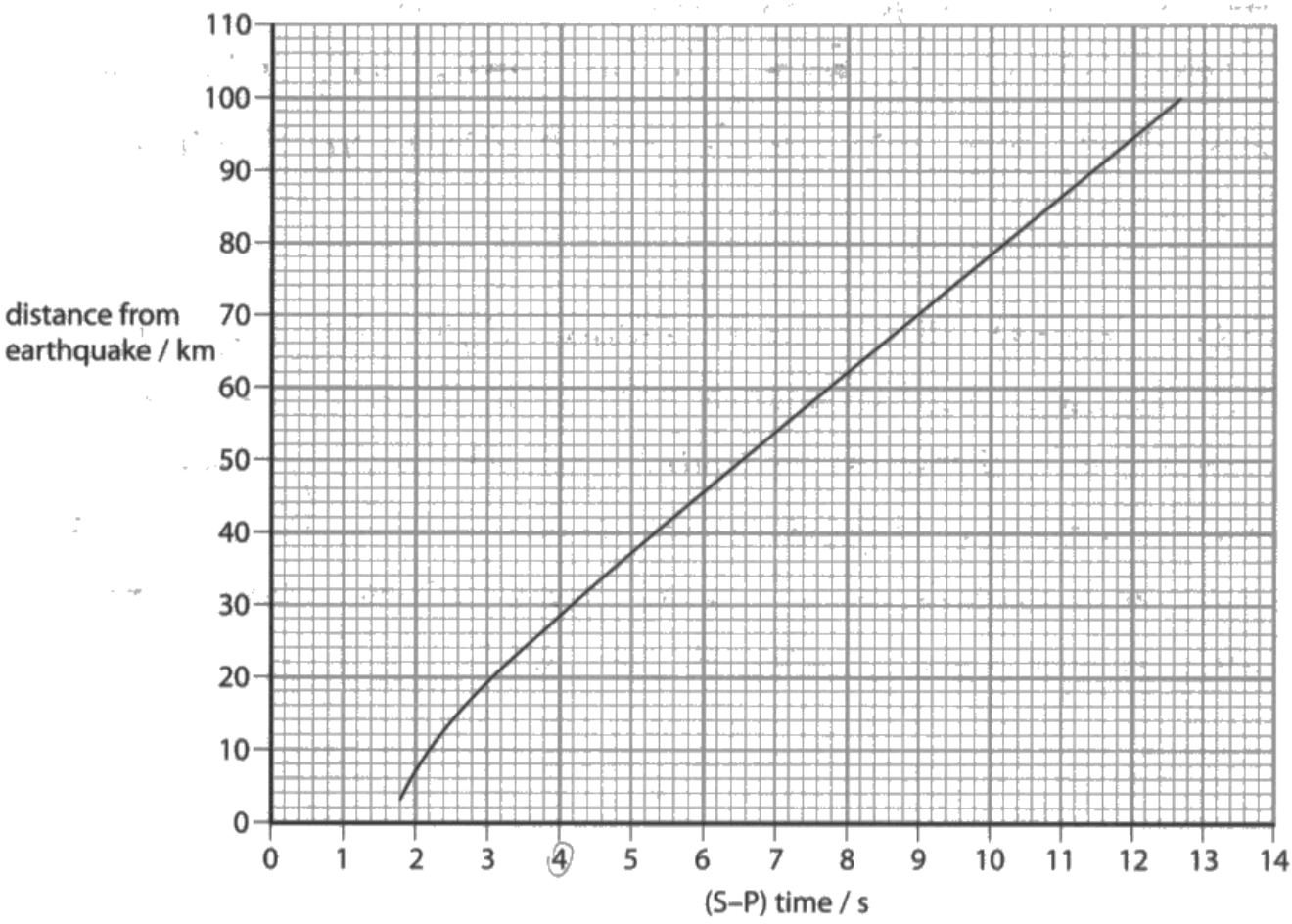
Question 3 (b) (iii)

Candidates could gain all 3 marks by selecting at least two points on the graph, using the equation to get estimates of distance using S-P times from the graph and comparing them with the real S-P times on the graph.

(iii) Some scientists use the following equation to get a quick estimate of how far away an earthquake happened.

distance from earthquake in km = 8 × (S–P) time in seconds

The graph shows the relationship between the (S–P) time and the distance from the earthquake, measured along the Earth's surface.



Use values from the graph to evaluate the range of distances for which this estimate is reasonable.

(3)

This estimate is reasonable from a distance of ~~28km~~ about 40km because this took just under over 5 seconds. (8 x 5 = 40). This estimate is reasonable for all of the distances after this point, for example as at 12 seconds the distance is 94km which is quite ~~accurate~~ accurate £ (12 x 8 = 96)

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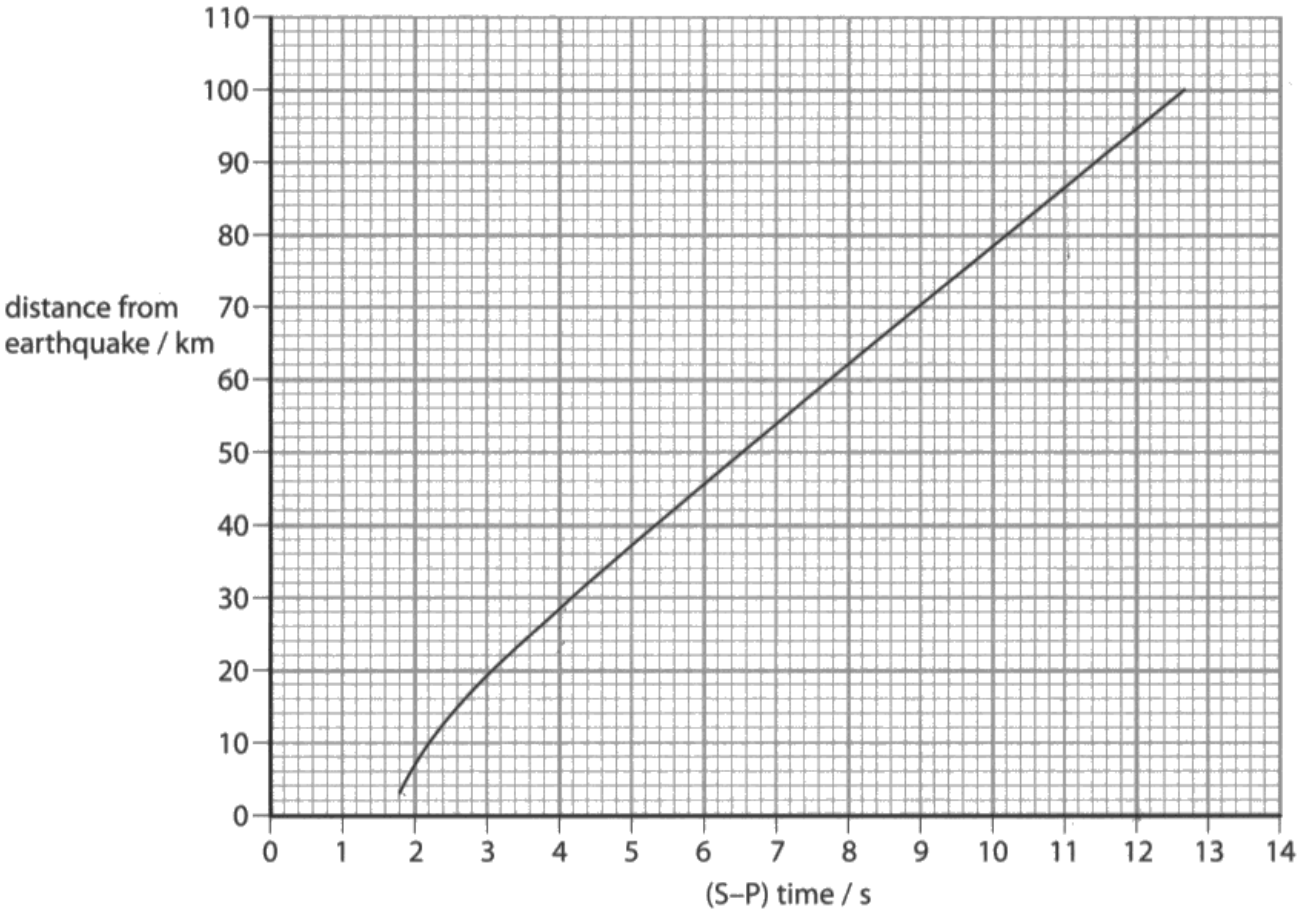
Examiner Comments

A concise and accurate answer scoring 3 marks.

(iii) Some scientists use the following equation to get a quick estimate of how far away an earthquake happened.

distance from earthquake in km = 8 × (S–P) time in seconds

The graph shows the relationship between the (S–P) time and the distance from the earthquake, measured along the Earth's surface.



Use values from the graph to evaluate the range of distances for which this estimate is reasonable.

(3)

The estimate is bad ~~good~~ for example 4 x 8 = 32km therefore it's a few kms out as the real distance was 29km. However it gets more accurate the longer the distance as 12 x 8 = 96 and it's at 94 there being more reasonable and accurate

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Examiner Comments

Even though this does not separately quote points on the graph, the examples are clearly using points from the graph.

Question 4 (a)

Acceptable responses covered a range of advantages to do with measurement, analysis, recording, detail, using other electromagnetic waves and long exposure.

The majority of candidates were able to suggest at least one advantage.

Using lenses

4 (a) State **two** advantages of using a camera, rather than the unaided eye, for studying stars.

(2)

1 Cameras create images which can be made from collecting light for a long time making the image clearer.

2 Some cameras can create images from other types of radiation ~~for~~ for example ~~heat~~ Infrared cameras.

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Examiner Comments

This example is to do with long exposure time and other electromagnetic waves, scoring both marks.

Using lenses

4 (a) State **two** advantages of using a camera, rather than the unaided eye, for studying stars.

(2)

1 A camera can 'zoom in' much further than the human eye can see, for more detailed studying.

2 Using light, a camera can take shots at different times to see how an object changes, which the eye cannot do.

Hello

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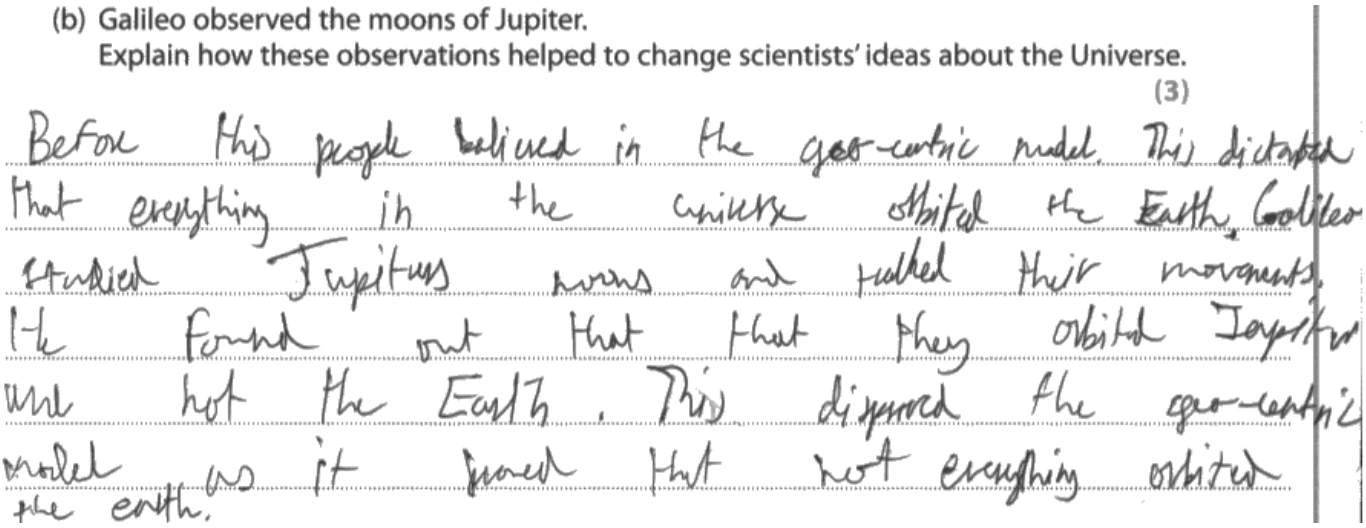
Examiner Comments

This is to do with recording and detail.

Question 4 (b)

Examiners were looking for an explanation showing the implications of the observations of moons orbiting Jupiter for the geocentric model of the Solar system. This was well answered in the main but many candidates wrote outside the answer space or even on separate sheets. Usually this extra writing was just repeating the question.

(b) Galileo observed the moons of Jupiter.
Explain how these observations helped to change scientists' ideas about the Universe.
(3)



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Examiner Comments

This response outlines the geocentric model and states that moons orbiting Jupiter means that not everything can be orbiting the Earth. Full marks.

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Examiner Tip

It is not necessary to repeat the question in your answer. It wastes time and can sometimes get in the way of your answer.

Question 4 (d) (i-ii)

Even though this only required substitution into simple given equations, the equations were unfamiliar and the question had to be read carefully to select the correct data to input. The minus sign was required to score the mark in part (ii). The vast majority of candidates were able to score at least 2 of the 3 marks available here.

(d) The linear magnification of a thin lens is given the symbol *M*.
The following equation for *M* is used for lenses in cameras.

$$M = \frac{f}{(d - f)}$$

where *f* is the focal length of the lens and *d* is the distance between the lens and an object.

A lens has a focal length of 12 cm.

(i) Use the equation to calculate *M* when the distance from an object to the lens is 14 cm

$M = \frac{12}{(14-12)} = \frac{12}{2} = 6$ (2)

M = 6

(ii) Use the equation to calculate *M* when the distance from an object to the lens is 11 cm

$\frac{12}{11-12} = \frac{12}{-1} = -12$ (1)

M = −12

ResultsPlus
Examiner Comments

Clear working and perfect answers, scoring all 3 marks.

(d) The linear magnification of a thin lens is given the symbol *M*.
The following equation for *M* is used for lenses in cameras.

$$M = \frac{f}{(d - f)}$$

where *f* is the focal length of the lens and *d* is the distance between the lens and an object.

A lens has a focal length of 12 cm.

(i) Use the equation to calculate *M* when the distance from an object to the lens is 14 cm

14 − 12 = 2 $\frac{12}{2}$ = 6

(2)

M = 6

(ii) Use the equation to calculate *M* when the distance from an object to the lens is 11 cm

14 − 11 = 3 $\frac{12}{3}$ = 4

(1)

M = 4

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Examiner Comments

This candidate scores both marks for part (i) but then uses the object distance from part (i) instead of the focal length to substitute into the equation, therefore scoring no marks in part (ii).

Question 4 (d) (iii)

This question targted the most able candidates. Successful candidates analysed the data and saw that negative magnifications were all for object distances that were shorter than the given focal length and positive magnifications were all for object distances that were longer than the given focal length. They then used their knowledge from their practical work with lenses to deduce that the sign of M indicated whether the image was real or positive or upright or inverted.

(iii) The table shows the magnifications produced by this lens for different distances between object and lens.

d / cm	*M*
3.0	–1.3
9.0	–4.0
15	4.0
21	1.3

Suggest what the sign of *M* indicates about the image produced by the lens.

(1)

Wheater its real or virtual.

ResultsPlus
Examiner Comments

One of the two possible correct responses, ignoring the poor spelling of whether.

(iii) The table shows the magnifications produced by this lens for different distances between object and lens.

d / cm	*M*
3.0	–1.3
9.0	–4.0
15	4.0
21	1.3

Suggest what the sign of *M* indicates about the image produced by the lens.

(1)

It may suggest whether the image is ~~real, upright or inverted~~ inverted,

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Examiner Comments

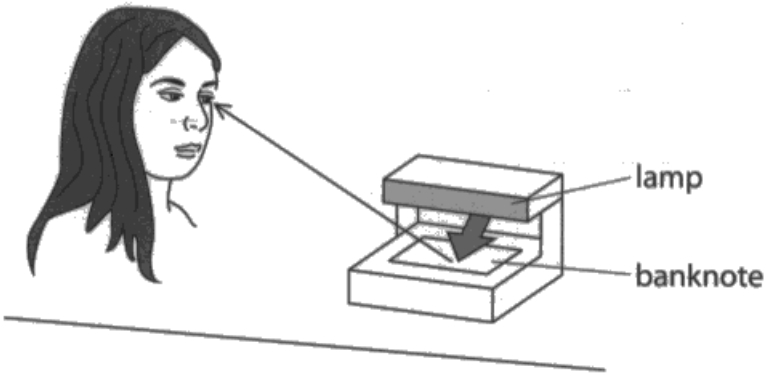
This response demonstrates the other possible response.

Question 5 (b)

The two different electromagnetic radiations had to be identified for the first mark. For the second mark, candidates had to refer to absorption of ultraviolet and emission of visible light.

(b) The picture shows a woman checking that a banknote is genuine.

She is using a lamp which emits a radiation which is part of the electromagnetic spectrum.



Explain how **two** different electromagnetic radiations enable the woman to check the banknote.

(2)

The bank note flurosceses. It absorbs the ultraviolet light at one frequency and emits visible light. This is used to check bank notes as each bank note has a speceial marking.

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Examiner Comments

Both types of electromagnetic radiation are mentioned and the correct references to absorption and emission are given. Full marks.

Question 5 (c)

This was intended to be a difficult calculation involving two equations, although one of the equations was very straightforward. It required a substitution, a transformation and numbers in standard form. A very pleasing number of candidates scored all 3 marks, showing the value of setting out working in logical steps. Many scored one mark for substituting correctly into the equation relating wave speed, frequency and wavelength.

(c) A light wave from a star has a frequency of 6.67×10^{14} Hz and a wavelength of 4.50×10^{-7} m.

The star is 4.00×10^{16} m away from Earth.

Calculate the time it takes light from the star to reach the Earth.

Wave speed = m/s.

(3)

wavespeed = frequency x wavelength.

$6.67 \times 10^{14} \times 4.5 \times 10^{-7}$

= 300150000

400000000000000000

time to reach Earth = ... s

ResultsPlus
Examiner Comments

This candidate scored the first mark for the first step then went no further.

(c) A light wave from a star has a frequency of 6.67×10^{14} Hz and a wavelength of 4.50×10^{-7} m.

The star is 4.00×10^{16} m away from Earth.

Calculate the time it takes light from the star to reach the Earth.

(3)

wave speed = freq. x wavelength.

$(6.67 \times 10^{14}) \times (4.50 \times 10^{-7}) = 300150000$

wavespeed = distance / time.

$\frac{4.00 \times 10^{16}}{300150000}$

$= 133266700$

time to reach Earth = 1.3×10^{8} s

ResultsPlus
Examiner Comments

Clear working, set out in logical steps, full marks.

Question 5 (d)

A detailed explanation for level 3 (6 marks) would clearly differentiate between the directions of vibrations for longitudinal and transverse waves relative to the direction of travel of the wave and give at least one example of each type of wave from the list given in the question. There was a good spread of responses across all 3 levels.

*(d) Explain the differences between longitudinal and transverse waves.
Your explanation should refer to ultraviolet, ultrasound and seismic waves.

(6)

Transverse waves have vibrations that are perpendicular to the path of travel of the wave. Longitudinal waves have vibrations that travel in the same direction as the wave. All electromagnetic waves are transverse waves which means that ultraviolet is a transverse waves. On the other hand, sound is a longitudinal wave which means ultrasound is a longitudinal waves. Transverse waves can travel through vacuum but longitudinal waves can't as they need a medium to travel through such as air, water, etc. P-waves are longitudinal waves and S-waves are transverse waves.

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This candidate has clearly explained the difference between transverse and longitudinal waves by referring to the directions of the vibrations in relation to the direction of wave travel. They have illustrated their explanation with correct examples. 6 marks.

Question 6 (a) (i)

This calculation involved a substitution and a transposition. It also required a unit conversion.

Electricity

6 (a) A man monitors how much money he spends on electricity.
He uses a device which calculates the cost of electrical energy used.
He connects his 2.9 kW electric kettle to the 230 V mains supply.

(i) Calculate the current in the kettle element.

$P = I \times V$

$2900\,W = I \times 230\,V$

$I = \frac{2900}{230} = 12.608695652173...$

$= 12.6$ (3 sig. fig.) (3)

current = 12.6 A

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The working is clearly shown, step by step, including converting kilowatts to watts. Full marks.

Question 6 (a) (ii)

The main difficulty with this calculation was that there were 4 variables to consider. A mark could be gained for substitution in the equation if the working was clear enough.

(ii) The device shows that in one week the total cost of the electrical energy used by the kettle is 97 p.
1kW h of electrical energy costs 17 p.

Calculate the length of time for which the kettle has been switched on during the week.

$97p = 2.9 \times \text{time} \times 17$ (3)

$97 \div 2.9 \div 17 = 1.9675 = 2h$

Cost of elec = power × time × cost of 1kWh

time = 2.0 hours

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Here the working is shown but not clearly. The calculation is correct so gains all 3 marks.

Question 6 (b)

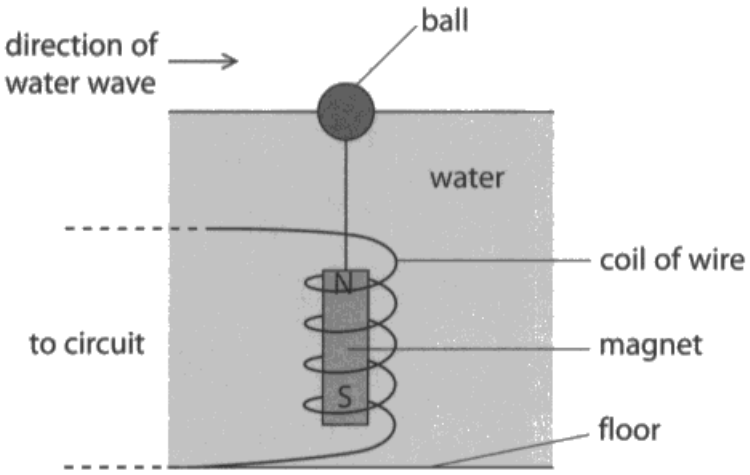
Candidates were not expected to give an explanation of this situation beyond the requirements of the specification. A detailed explanation for level 3 (6 marks) would link the motion of the magnet to the size or direction of the induced current and refer this to points on the graph.

There were many very good responses to this question, displaying a good understanding of the concept. Equally, there were many responses that did not get as far as saying that it was the magnet moving in the coil that induced the current.

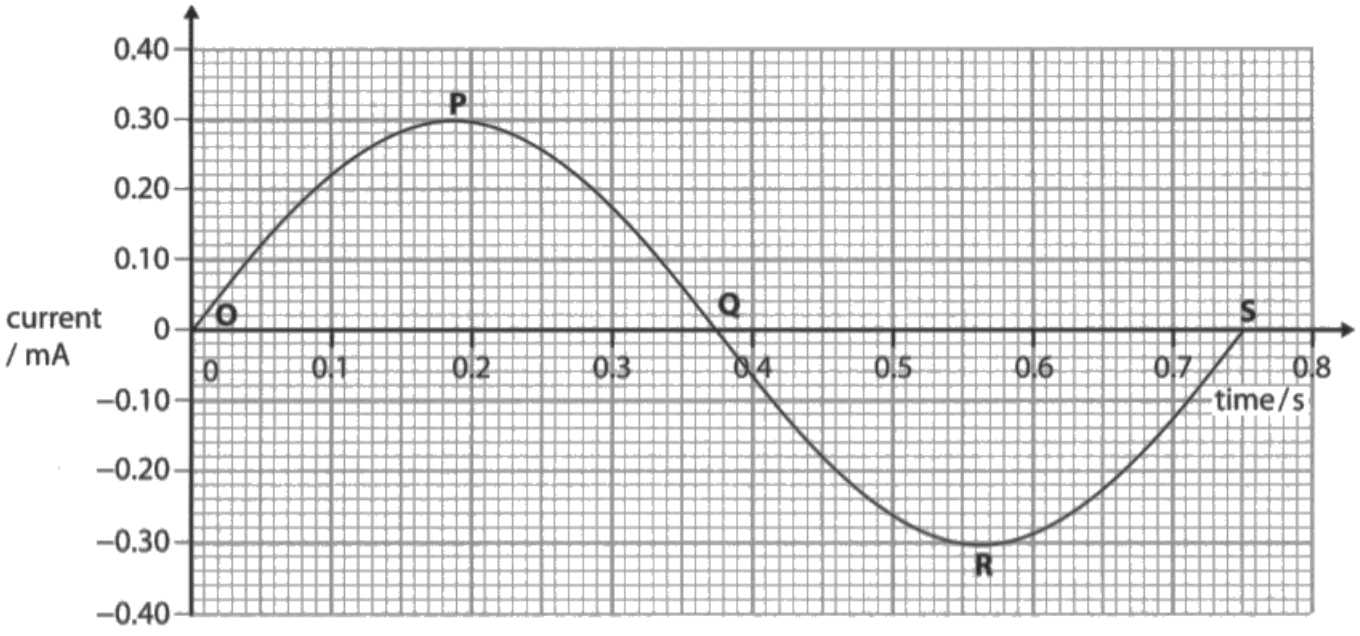
*(b) The diagram shows a model used to generate electricity from water waves in a tank.

A ball floats on the surface of the water in the tank.
A coil of wire is fixed to the floor of the tank.
A magnet is suspended from the ball inside the coil.

When a wave is sent along the surface of the water the ball moves up and down.



The graph shows the current induced in the coil.



Explain how this current is induced in the coil in the model.
You should refer to the model and to the labelled points on the graph in your answer.

(6)

As a magnet moves through a coil, it induces an alternating current in the coil of wire (electromagnetic induction). The ball suspends the magnet so that the ball is always above water. As the wave passes, ~~[illegible]~~ the ball is lifted so that it is still above water because of its ~~buoyancy~~ buoyancy. This means that the magnet is pulled up, inducing a current in the wire in one direction (P) from the resting point (Q). As the wave passes, the magnet returns to where it was (Q), but the dip behind the wave causes the magnet to be moved downwards, inducing a current in the opposite direction (R), and then it returns to S after the ~~[illegible]~~ water is flat again. We can see the peak current induced was 0.3mA and -0.3mA. It is an alternating current.

(Total for Question 6 = 12 marks)

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This response states that a current is induced when the magnet moves and that the direction of the current changes when the direction of movement changes. This is related to the graph by saying that P and R show currents in opposite directions. 6 marks.

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 six topics.
- Get used to the idea of applying their knowledge to new situations by attempting questions in support materials or previous examination papers. Question 3biii would be a good example on this paper.
- Show their working at each stage of a calculation, particularly in complex calculations or those involving transposing an equation.
- Use the marks at the side of a question as a guide to the form and content of their answer.
- Avoid repeating the question in their answer.

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