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Examiners' Report
November 2012

GCSE Physics 5PH1H 01

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November 2012

Publications Code UG034063

Introduction

A wide range of skills was tested on this paper. Candidates had to demonstrate their ability to recall, show understanding of and apply their knowledge in a variety of contexts.

Many candidates were able successfully to work through calculations using only their calculator and then just write the correct answer in the space provided. Even for the best, though, this is a risky strategy since even the most minor error will mean no marks are scored. If there is an error and working is shown, some marks can still be awarded.

Candidates performance on 6-mark questions continues to improve. Many candidates benefitted from planning before beginning the writing process. They then crossed through this work to show it was not to be marked. Where this was seen, the results were generally very good.

Question 1 (b)

This item requires simple recall of an important fact stated in the specification.

(b) X-rays from a star travel to a space telescope in orbit around the Earth.

Explain why visible light from the same star takes the same time to reach the telescope.

(2)

All waves are the same speed X-rays however have higher frequency than visible light

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Examiner Comments

The important adjective 'electromagnetic' is missing from the given statement. There is just sufficient mention of both types of radiation to gain the first mark. There is no mention of space/vacuum. The idea of frequency is correct but irrelevant here and so is not markworthy.

This response was awarded 1 mark of the two available.

(b) X-rays from a star travel to a space telescope in orbit around the Earth.

Explain why visible light from the same star takes the same time to reach the telescope.

(2)

All parts of the EM spectrum travel at the same speed in a vacuum and space is a vacuum.

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Examiner Comments

Adding 'Both visible light and X-rays are electromagnetic radiations.' would fully complete this response. However, there is easily sufficient content to earn full marks.

This response was awarded 2 marks.

Question 1 (d)

Many students struggled with powers of 10. This is part of the mathematical requirements listed in the GCSE specifications of all Awarding Bodies.

(d) An X-ray of wavelength 2.0 nm has a frequency of 1.5×10^{17} Hz.

$1.0 \text{ nm} = 1.0 \times 10^{-9}$ m

Calculate the speed of the wave.

(2)

Wave speed = frequency × wavelength

Wave speed = 1.5×10^{17} Hz × 2.0 nm

Wave speed = 150000000000000000 Hz × 2.0 nm = 3×10^{17} m

= 300000000000000000 m

speed = 3×10^{17} m/s

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Examiner Comments

Candidates did not lose all of the marks for an inability to use powers of 10. They were able to gain the 'physics' mark for substituting frequency and wavelength values into the equation.

This response scored 1 mark out of 2.

(d) An X-ray of wavelength 2.0 nm has a frequency of 1.5×10^{17} Hz.

1.0 nm = 1.0×10^{-9} m

Calculate the speed of the wave.

(2)

$v = f \times \lambda$

$v = \frac{1.5 \times 10^{17} \text{ Hz}}{2.0 \times 10^{-18} \text{ m}} = 0.75 \times 10^{-1}$ m/s.

$= 10 \times -10 = -100 \times 0.75$

$= -75$ m/s

speed = -75 m/s

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Examiner Comments

Here the equation is correctly copied from the reference page but the candidate did not know how to substitute values into it.

Question 2 (a) (ii)

This item was an excellent discriminator. Candidates responded to the stimulus at very different levels.

Some discussed a mysterious 'controller' who/which kept the temperature constant in an unspecified way.

(ii) On one sunny day no hot water is used in the house.

The water in the panels reaches a constant temperature even though the water is still absorbing energy from the Sun.

Explain why the temperature of the water in the panels becomes constant.

(3)

Because the water is still travelling along the water system and the controller controls where the water goes and the temperature of the water.

ResultsPlus
Examiner Comments

This response scored 0 since it did not even mention the {emission / loss} of any {thermal / heat} energy.

Candidates began to score by noting that heat energy was given out by the warm water.

(ii) On one sunny day no hot water is used in the house.

The water in the panels reaches a constant temperature even though the water is still absorbing energy from the Sun.

Explain why the temperature of the water in the panels becomes constant.

(3)

As the water heats up instead of the water keeping building up heat it realases heat aswell as taking it in wich then allows the water to remain at a constant tempreture.

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Examiner Comments

Here though there was no mention of the quantities involved.

This response scored 1 mark out of three.

(ii) On one sunny day no hot water is used in the house.

The water in the panels reaches a constant temperature even though the water is still absorbing energy from the Sun.

Explain why the temperature of the water in the panels becomes constant.

(3)

The temperature of the water stays constant because although black is a good absorber of heat, it radiates a little bit too. Therefore once it's at it's highest temperature, it's radiation becomes equal to it's absorption.

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Examiner Comments

Equating quantities of thermal (heat) energy was a firm step in the right direction and many students got this far.

This response scored 2 of the 3 marks.

(ii) On one sunny day no hot water is used in the house.

The water in the panels reaches a constant temperature even though the water is still absorbing energy from the Sun.

Explain why the temperature of the water in the panels becomes constant.

(3)

The temperature of the water in the panels becomes constant because the rate of heat absorbsion equals the the rate of heat radiation this is called ~~Equ~~ Thermal equilibrium.

ResultsPlus
Examiner Comments

Comparatively few were able to equate the rates at which energy was absorbed and radiated and so gain full marks.

This response scored 3/3.

Question 2 (b) (ii)

This question mentioned the word power. Some candidates wrote down both equations from the data page which contained the word power.

(ii) A large solar farm has 21 700 solar panels and generates 5.0 MW of power.

1.0 MW = 1.0 × 10^6 W

Calculate the average power each panel produces.

(2)

electrical power = current × potential difference.

Total 21700

Power 5mw

$\frac{21700}{50,000,000 \text{ W}}$

1.0 × 10^6 W (×5)

1.0

1.0

5 × 10^{36}

average power produced by each panel = 0.000434 W

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Examiner Comments

On this occasion, neither of these were needed. Candidates needed to find the average value if a given amount of power was to be produced by a known number of panels. Various combinations of the two main numbers were attempted. The change of unit caused a problem for a few.

This response scored 0.

Some candidates develop their own mathematical notations but are not always correct.

(ii) A large solar farm has 21 700 solar panels and generates 5.0 MW of power.

1.0 MW = 1.0×10^6 W

Calculate the average power each panel produces.

(2)

$10^6 \times 5 = 50^6$

50,000,000 ÷ 21,700 = 2304.1474 W

average power produced by each panel = 2304.1474 W

ResultsPlus
Examiner Comments

This response contained sufficient physics to score 1 from the two allotted to the item.

Many good candidates sensibly show their working.

(ii) A large solar farm has 21 700 solar panels and generates 5.0 MW of power.

1.0 MW = 1.0 × 10^6 W

Calculate the average power each panel produces.

(2)

$1.0 \times 10^6 = 1000000$

$1000000 \times 5.0 = 5000000$

$5000000 \div 21700 = 230.41$

average power produced by each panel = 230 W

ResultsPlus

Examiner Comments

Some even correct, like this, to a sensible number of significant figures. This response scored 2/2.

Question 2 (b) (iii)

This calculation was quite well done with 0.2, 1/5 and 20% being allowed for efficiency.

(iii) The solar farm receives 25 MW of power from the Sun to generate 5 MW of electrical power.

Calculate the efficiency of the solar farm.

(2)

$$\frac{(5)}{(25)} \times 100$$

efficiency = 20

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Examiner Comments

Many candidates made the usual mistake and divided the larger number by the smaller number to obtain a value well in excess of 100%.

ResultsPlus

Examiner Tip

Performance on this type of item will improve with practice if they are told repeatedly that values greater than (or even equal to) 100% are impossible (even though in common parlance efforts of 110% etc are often noted in speech). Those who simply wrote 5 or 500 scored 0.

This response scored 2/2.

Question 3 (b)

It was not necessary to include the procedure for finding the focussed image since this was given in the stem.

(b) A student uses a lens to form a clear image of a house.
The image is formed on a piece of paper.
The house is a long way away.

Describe how the student should find the focal length of the lens.

(2)

move the [illegible] lens so that it is facing the paper and at the back is the house move the [illegible] lens backward and forward between the paper and the house eventualy you will find the image of the house reflected on the paper.

ResultsPlus
Examiner Comments

This response scored 0 as it is restricted to how the clear image is formed.

A large number of students noted the need to measure a distance.

(b) A student uses a lens to form a clear image of a house.
The image is formed on a piece of paper.
The house is a long way away.

Describe how the student should find the focal length of the lens.

(2)

The student should mesure the distance from the lense to the paper. They should do this when thie image is clearly formed.

ResultsPlus
Examiner Comments

The important aspect was that the 'distance /space /length' was measured (1st mark) between lens and image / screen (2nd mark).

This response gained the full two marks.

(b) A student uses a lens to form a clear image of a house.
The image is formed on a piece of paper.
The house is a long way away.

Describe how the student should find the focal length of the lens.

(2)

Measure the length to the house. She could also find the focal point by using a Objective lens.

ResultsPlus
Examiner Comments

A variety of 'distances' were suggested and objective/ eyepiece lenses were frequently mentioned.

This response included 'measure the distance' and so scored 1 from 2.

Question 3 (c)

A large percentage of candidates correctly discussed moons orbiting Jupiter and therefore disproving the geocentric theory. An interesting response gave a convincing answer about moons orbiting Jupiter, crossed this out and then replaced it with an equally convincing description of how Galileo's observation of the phases of Venus (December 1610) also showed the geocentric model was incorrect. This, of course, qualified for full marks.

Although "He showed geocentric theory was wrong" was acceptable in a response it is an exaggeration to say that it proved the 'heliocentric theory correct' [and at least one candidate stated that it proved a joviocentric model!]. There was some confusion between stars, planets and moons but this was sometimes because candidates only partially remembered that Galileo reputedly thought they were stars to start with.

A couple of students referred to another of Galileo's observations - phases of Venus.

(c) Galileo used a telescope to observe Jupiter.

His observations provided evidence to support the idea that the Earth is not the centre of the Universe.

Explain how Galileo's observations supported this idea.

(2)

~~He observed Jupiter and saw 4 moons orbiting Jupiter. It proved than not everything orbitted the Earth and so the Earth was not in the centre.~~

He saw Venus showing phases. This was only possible when Venus's orbit was between the Sun and the ~~[illegible]~~ Earth, ~~and~~ so that the planet will reflect sunlight and we can see from the Earth it's phases. This proved that Earth was not in the ~~middle~~ centre of the ~~[illegible]~~ Universe.

ResultsPlus
Examiner Comments

It is hoped that this student did not waste too much time by replacing one good answer with another.

Such answers were capable of scoring full marks. This scored both marks.

Question 3 (d)

It is a pleasure to see that some students are encouraged to show their working. It is then very easy to ensure that they obtain full credit for what they have written.

(d) A student looked for information about telescopes on the Internet.
He found this equation for the magnification of a simple telescope.

$$\text{magnification} = \frac{\text{focal length of lens furthest from the eye (the objective)}}{\text{focal length of lens nearest the eye (the eyepiece)}}$$

The information sheet given with a simple telescope states:

- the magnification is 40 times (×40)
- the focal length of the objective is 110 cm.

Calculate the focal length of the eyepiece.

(3)

$$40 = \frac{110\text{cm}}{\text{eyepiece}}$$

$e \times 40 = 110$

$e = \frac{110}{40}$

$e = 2.75$

focal length of eyepiece = 2.75 cm

ResultsPlus
Examiner Comments

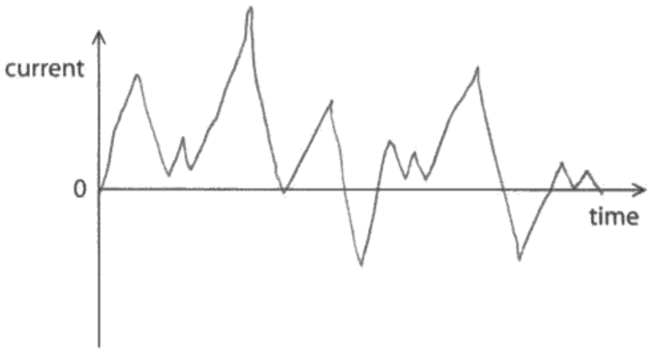
This candidate deserved the score of 3/3.

Question 4 (a) (ii)

Any student aspiring to the higher paper should ensure that such basics as the difference between direct and alternating currents (itemised in the specification) are clear.

(ii) Sketch an alternating current on the axes shown.

(1)



ResultsPlus

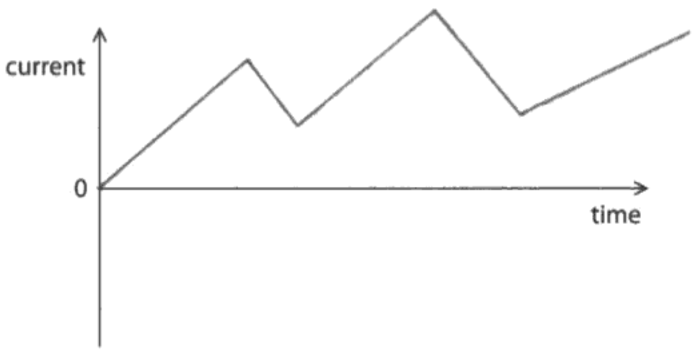
Examiner Comments

Any shape of alternating current was acceptable here as long as it crossed the time axis.

This scored the mark.

(ii) Sketch an alternating current on the axes shown.

(1)



ResultsPlus

Examiner Comments

A triangular wave could score the mark. Unfortunately, this line, although fluctuating, is all on the same side of the zero line.

This scored 0 marks.

Question 4 (b)

(b) The step-down transformer has:

- 2400 turns on the primary coil
- 200 turns on the secondary coil
- a primary voltage of 230 V.

Calculate the voltage output of the secondary coil.

(3)

$$\frac{V_p}{V_s} = \frac{N_p}{N_s} \qquad \frac{230V}{V_s} = \frac{2400}{200}$$

secondary voltage = ... V

ResultsPlus
Examiner Comments

This clearly shows the substitution and scores the first mark. This was as far as many candidates managed to proceed.

(b) The step-down transformer has:

- 2400 turns on the primary coil
- 200 turns on the secondary coil
- a primary voltage of 230 V.

Calculate the voltage output of the secondary coil.

(3)

$$\text{secondary voltage} = \frac{\text{primary voltage} \times \text{number of turns on sc}}{\text{number of turns on pc}}$$

$$\text{secondary voltage} = \frac{230 \times 200}{2400} \approx 19.2$$

secondary voltage = 19.2 V

ResultsPlus
Examiner Comments

This candidate has done the transposition before the substitution. A confident candidate can do this.

Answers such as this were awarded 3/3.

ResultsPlus
Examiner Tip

A less confident candidate might score higher marks by copying the equation from the reference page (no marks so far) and then substituting the given values into this (first mark) then attempting the transposition.

Question 4 (c) (i)

This item provided opportunities to score full marks by a variety of routes. Many complete answers were seen with 'step-up transformers' 'increase the voltage' being the most common supplemented by either/both of 'current decreases' or 'so less thermal energy was wasted'. The use of step-down transformers after the transmission was ignored.

(c) (i) Explain how transformers are used to improve the efficiency of power transmission in the National Grid.

(3)

transformers are used because they have step ups. The step up transformers increases the voltage but decreases the current so its more efficient and power doesn't get lost. ~~SP~~ Step down decreases voltage and increases current so houses/business get powerful safe, current.

ResultsPlus
Examiner Comments

The first line of this response is insufficient to score. The first mark is for the phrase 'step up transformers'. This candidate then correctly relates changes in voltage and current to this type of transformer.

Such a response scored all three marks.

(c) (i) Explain how transformers are used to improve the efficiency of power transmission in the National Grid.

(3)

They improve the efficiency as if their is more volts used the step up transpormer would decrease the current whereas if it was a step down transpormr the current would increase and voltage would increase

ResultsPlus
Examiner Comments

Many students produced somewhat confused explanations. In this case the current changes are correctly linked to the type of transformer but their effect on voltage is not clear.

This response was awarded 2 from the 3 available.

Question 4 (c) (ii)

An important aspect of an item is how much information is required to qualify for full marks. In this item, there are four ideas required for a complete description: cause, what moves, how it moves and effect.

(ii) Explain why flying a kite near power lines could be a danger to the person flying the kite.

(2)

Because if the kite touches the power lines the eectricity will pass down the String and electricute the person.

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Examiner Comments

For full marks here, any two would suffice. These could be, for example, 'touching' and 'electrocution' (most common) or ''{current/charge moving} in string' and 'through to earth/ground' or any combination of two. A worrying misconception at this level was caused by the sometimes expressed idea of an 'electric shock travelling down the string'. Many other candidates were satisfied with describing 'electricity flowing' rather than 'charge moving' or a 'current in' the string or through the person flying the kite to earth.

This response included sufficient correct material to score full marks (but would not have gained credit for the insufficient 'electricity will pass down'). It scored 2/2.

(ii) Explain why flying a kite near power lines could be a danger to the person flying the kite.

(2)

Flying a kite near power lines means the kite could get caught on the power lines and very high amouts of electricity could run down the kite, and the person flying the kite could be electrocuted.

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Examiner Comments

This response just managed to score the marks because it related completing the circuit with the person being electrocuted. The idea that 'electricity runs down the kite' is insufficient to stand for a current.

It scored 2/2.

Question 5 (a) (ii)

Some students discussed the visibility of pictures rather than the danger involved in the use of X-rays. Others spent time talking about the penetrating powers of X-rays and ultrasound. Still others described a variety of uses to which ultrasound is put.

(ii) Explain why ultrasound rather than X-rays are used for foetal scanning.

(2)

Because ultrasound is to hear sound where as x-rays are used for seeing.

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Examiner Comments

This student displays little more than a confused, non-scientific idea of X-rays. Many responses referred to using ultrasounds to listen to the baby's heartbeat. X-rays of course are well-known to produce pictures to see (although many students will have seen a photographic representation of an ultrasound scan). It scored 0.

(ii) Explain why ultrasound rather than X-rays are used for foetal scanning.

(2)

Because they are less harmful to the woman and baby. Also you can hear the baby with a ultrasound.

ResultsPlus

Examiner Comments

This response, despite using the ambiguous 'they', could have scored if there was a definite reference to danger. X-rays are known to be positively dangerous while as far as we know, normal ultrasound scans pose no risk. General references to 'the woman' or 'baby' etc are insufficient. Some reference to damage to cells / mutation / cancer is required for the second mark.

This response was not deemed credit worthy and scored 0.

(ii) Explain why ultrasound rather than X-rays are used for foetal scanning.

(2)

Ultrasound has a lower frequency than X-rays therefore it will not damage the person or baby in any way.

ResultsPlus

Examiner Comments

In theory, the upper frequency of ultrasound is undefined. This candidate may be assuming ultrasound is part of the electromagnetic spectrum and so have learnt that X-rays are more potentially damaging. Once again, the damage reference is not specific enough.

This scored 0.

Question 5 (b) (i)

Surprisingly few candidates transferred the given number and correctly associated it with the correct unit - 30 000 Hz.

Question 5 (b) (ii)

(ii) Describe the motion of particles in a material when this ultrasound wave passes through. **(2)**

when it touches materials, they also vibrate and then if they are touching ~~[illegible]~~ other particles, they vibrate as well and keeps doing this in the direction that the wave was traveling until it reaches an end.

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Examiner Comments

Relatively few students were able to combine the idea of vibration with the direction in which the particles vibrate.

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Examiner Tip

There was sufficient Physics displayed to merit the award of 2/2 although maybe the description of the direction could have been more explicit.

(ii) Describe the motion of particles in a material when this ultrasound wave passes through. **(2)**

ultrasound has a up and down motion, when ultrasound passes through a material, some of the wave is reflected back, this is why humans can see it.

ResultsPlus
Examiner Comments

Many described things that could happen to the ultrasounds rather than referring to the particular motion. Reflections and refractions were common as was the idea of the wave pushing the particles out of the way so it could pass. Up and down / side to side / left to right etc. could all be true depending on the direction of the wave.

This scored 0.

(ii) Describe the motion of particles in a material when this ultrasound wave passes through.

(2)

they vibrate ?

ResultsPlus

Examiner Comments

The response does not need to be extensive to score some marks.

(ii) Describe the motion of particles in a material when this ultrasound wave passes through.

(2)

The particles get pushed out the way for the ultra sound to pass.

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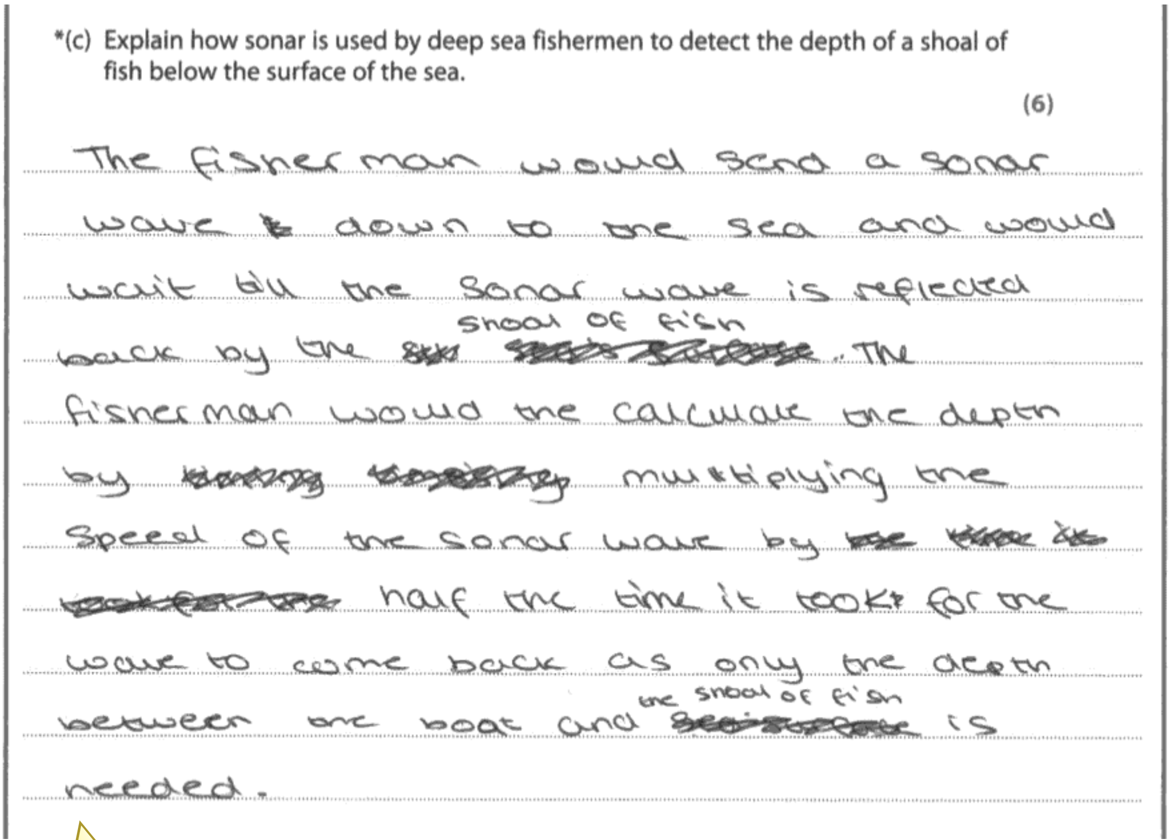
Examiner Comments

A significant number of candidates referred to 'pushing particles out of the way' for the wave to get through.

Question 5 (c)

For the 6-mark items, there are two aspects: the content to be covered and the command word which identifies how the candidate is to interact with the content. In this item, the command word is "Explain". There are many ways in which items can be explained. The second part of a command phrase tells you what is needed. 'Explain how... is used' implies a process is needed. This will involve a sequence of actions.



*(c) Explain how sonar is used by deep sea fishermen to detect the depth of a shoal of fish below the surface of the sea.

(6)

The fisherman would send a sonar wave down to the sea and would wait till the sonar wave is reflected back by the shoal of fish. The fisherman would the calculate the depth by multiplying the speed of the sonar wave by half the time it took for the wave to come back as only the depth between the boat and the shoal of fish is needed.

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Examiner Comments

The sequence in this case involves the emission and subsequent reflection of the ultrasound signal (sonar wave), the measurement of time and a suitable calculation using the speed equation. Here the measurement of time is implied by an explicit statement of the quantity in the calculation. The speed of the wave is also mentioned. A vital part of this method is the need to divide by 2. It does not matter if the time used is the total time and then the total distance is divided by 2 to give the depth or if half the total time gives the depth directly.

The response was judged to be sufficiently clear to score level 3, 6 marks.

Partial answers may receive partial reward.

*(c) Explain how sonar is used by deep sea fishermen to detect the depth of a shoal of fish below the surface of the sea.

(6)

Because they have a sonar box on the bottom of there boat that sends sound waves downwards the sound waves bounce off fish and return to the box which detects the distance there and back then halves it. It also shows an image of the fish

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Examiner Comments

The student clearly discusses reflection but then fails to include the next steps in the sequence. The final comment about halving is insufficient to raise this above level one, since the aspects of time measurement and calculation using speed are both absent.

This response was awarded level one, 2 marks.

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Examiner Tip

These 6-mark questions are designed so that all students have a good chance of starting to score. Consequently, it is important to have a go. Leaving the response space blank guarantees obtaining no marks.

Misconceptions included answers about shoals emitting ultrasounds and fish receiving sounds and then sending their own signals back.

*(c) Explain how sonar is used by deep sea fishermen to detect the depth of a shoal of fish below the surface of the sea.

(6)

It detects size and movement so as it searches it would pick up (detect) the movement of a large area (the shoal of fish) and can keep track of the fish in order to know they're still there to catch.

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Examiner Comments

This response shows sonar may detect the presence of fish but it gives no indication of their whereabouts. Even the fundamental idea of reflecting a signal/wave is absent.

This response was awarded 0 marks.

*(c) Explain how sonar is used by deep sea fishermen to detect the depth of a shoal of fish below the surface of the sea.

(6)

the fisher men send a burst of sonar below then this purse travels until it hit a object in the way the sonar is now ~~re~~ reflected and returns to the boat a computer or the fisher man now ~~calc~~ calculates the distance the sonar pulse travled using the time it took and the speed of sonar. they now send another pulse down. if the distance is still the same its probably just the ocean bed but if it isn't then somthing has moved, possibly a shoal of fish.

(Total for Question 5 = 12 marks)

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Examiner Comments

This relies on the shoal of fish moving quickly or a long time allowed between pulses. Also, it only compares depth rather than finds the depth (no idea of 'halving' is given). With this vital element missing, the response is confined to level two, 4 marks.

Question 6 (b) (i)

[Me – Mercury; V – Venus; E – Earth; Ma – Mars; A – Asteroid Belt; J – Jupiter; S – Saturn; U – Uranus; N – Neptune; P – Pluto]

(i) Read, from the chart, the predicted values for the distance from the Sun to Neptune and from the Sun to Pluto.

(2)

Sun to Neptune 40 A.U

Sun to Pluto 77 A.U

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Examiner Comments

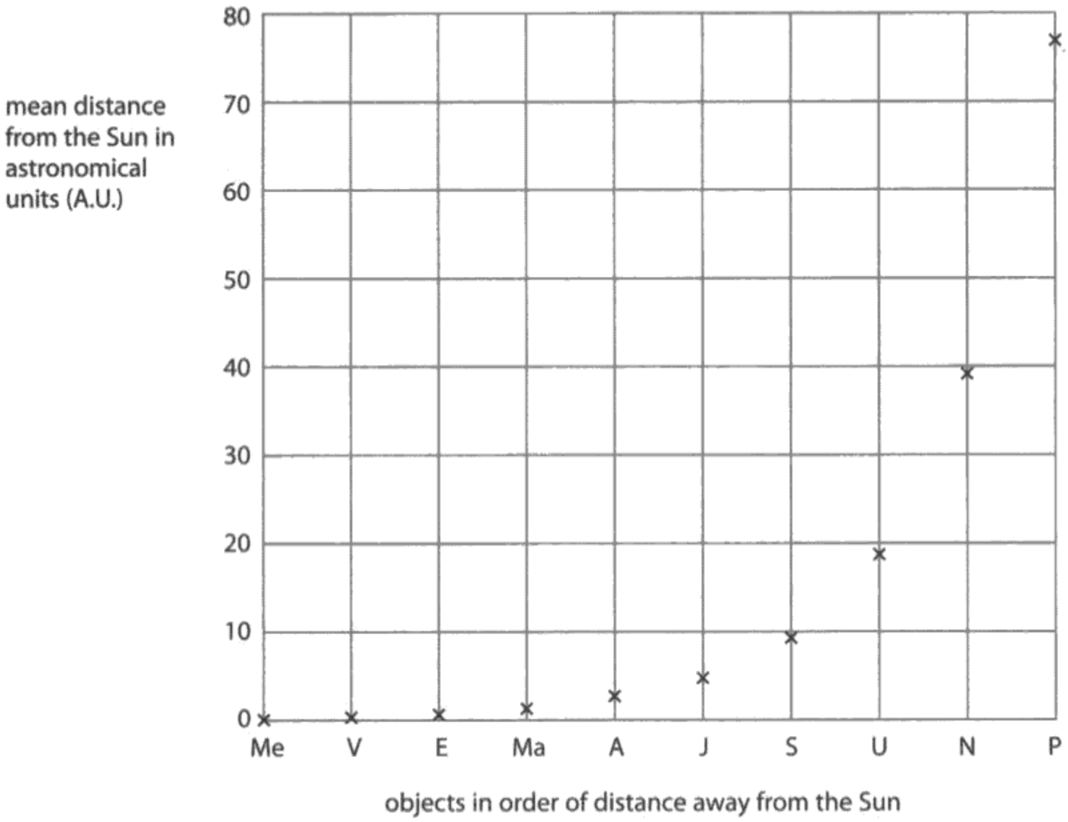
Most students did well on this item and produced a value for Pluto which was well within the acceptable range. Quite a few candidates ignored the fact that the plotted value for Neptune was clearly below 40, however.

This response scored only 1.

Question 6 (b) (ii)

(b) Bode, a scientist, found a rule predicting the distance of objects from the Sun.

The chart shows the mean distances from the Sun predicted by Bode's rule.



[Me – Mercury; V – Venus; E – Earth; Ma – Mars; A – Asteroid Belt; J – Jupiter; S – Saturn; U – Uranus; N – Neptune; P – Pluto]

(ii) Bode's rule works well for all objects between Mercury and Uranus.
From scientific measurements, however, the actual mean distance from the Sun to Neptune is 30 A.U.
Some scientists think that Neptune was not part of the original Solar System.

Explain how the predicted value for Neptune supports the view of these scientists.

(2)

It was too far away and the scientists thought that it might have belonged to a different galaxy.

ResultsPlus

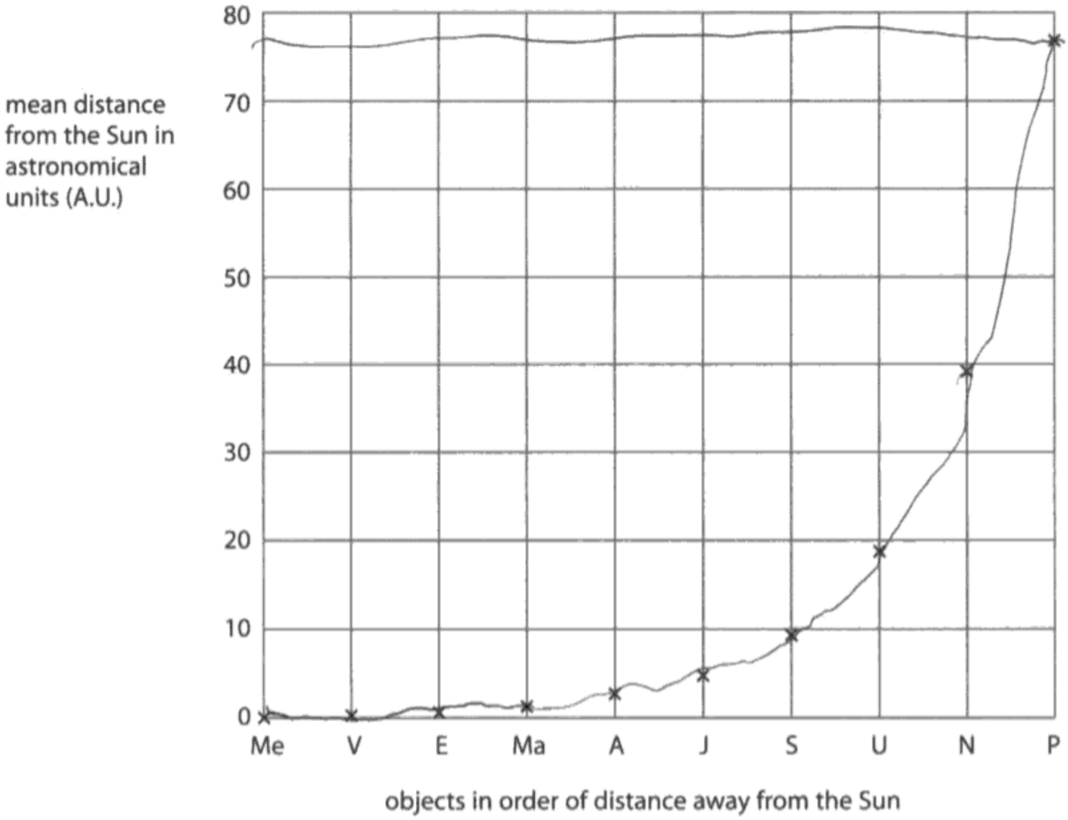
Examiner Comments

Many candidates thought that the distance from Neptune to the Sun was the critical factor. 'It' is an ambiguous word and is used in this response with two different meanings. Also what is 'it' too far away from? The important point here is that the value predicted by Bode's rule is bigger than the measured value.

This response scored 0 marks.

(b) Bode, a scientist, found a rule predicting the distance of objects from the Sun.

The chart shows the mean distances from the Sun predicted by Bode's rule.



[Me – Mercury; V – Venus; E – Earth; Ma – Mars; A – Asteroid Belt; J – Jupiter; S – Saturn; U – Uranus; N – Neptune; P – Pluto]

(ii) Bode's rule works well for all objects between Mercury and Uranus.
From scientific measurements, however, the actual mean distance from the Sun to Neptune is 30 A.U.
Some scientists think that Neptune was not part of the original Solar System.

Explain how the predicted value for Neptune supports the view of these scientists.

(2)

Because bode Said that Neptune was 40 A.u when really it was only 30 A.u and with that big of a dissesance it is hard for Scientists to decide wather it is or isn't.

ResultsPlus

Examiner Comments

Others realised that the critical factor was the discrepancy between the predicted and the actual value which initiated the dispute. But then they failed to relate it to the scientists' view.

This scored 1 mark only.

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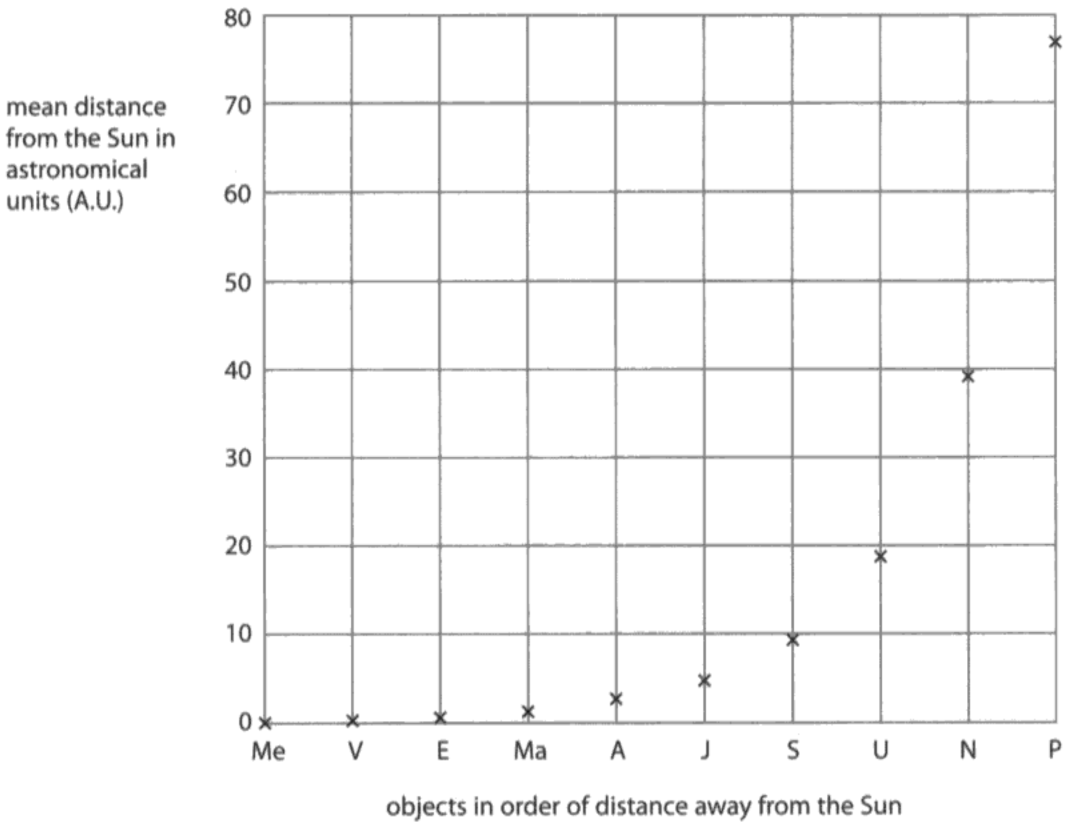
The chart shows the mean distances from the Sun predicted by Bode's rule.



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Explain how the predicted value for Neptune supports the view of these scientists.

(2)

The predicted value for the distance between the sun and neptune was 39 ~~A.A~~ A.U. However, the real value is 30 AU, which is different. Other objects follow Bode's rule, so neptune is anomolous, which supports the scientist's idea.

ResultsPlus
Examiner Comments

Few however were able to go the further stage and state that it was the anomaly that supported the scientists.

This response scored both available marks.

Question 6 (c)

As in 5c, the essence of this item is the command word - "Discuss". To score at the higher levels there must be some linkage between methods and problems or the effect(s) of the problems must be enlarged upon.

*(c) Scientists are using a variety of methods to search for life beyond Earth.

Discuss the problems involved in using these methods.

(6)

There are many problems involved with using these methods, such as:

- they could recieve interference
- false signals
- could be very long to find life beyond earth
- the methods may not be efficient
- There may not be much activity in space.
- Other life forms may not know how to communicate (if there are other life forms).

ResultsPlus

Examiner Comments

Use of bullet points does not prevent students from scoring marks. Many of the bullets in fact are written in sentence form which could be joined to produce a continuous paragraph. This script includes little of any substance. No method is specified or implied sufficiently clearly that a problem could be related to it. Even cost is not mentioned which applies to all methods. The first two could apply equally to a search on Earth. The third and fourth bullets have proved to be the case as so far we have not found life by any of the methods we have used. Number 5 is irrelevant and the last is also insufficient to gain credit.

This scored zero marks.

It is expensive to create and send probes, robots and telescopes into space, therefore cost may be an issue encountered. Also, it could take billions of years to receive signals in returns and there are several unknown galaxies beyond Earth which are so far away - it will be impossible to travel there. You cannot send humans to investigate other planets because we do not know enough about life and resources beyond Earth to risk this. Results and signals can also be mistaken or interrupted therefore they will not always be accurate.

ResultsPlus

Examiner Comments

A variety of methods is included from landers to orbiting telescopes, human exploration and possibly the wave collecting of SETI is implied. Problems associated with these methods are discussed such as expense, length of time and distances involved and danger.

There is sufficient here to score level 3, 6 marks.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

For short response items

- try to avoid the use of 'it' and 'they' which are often ambiguous.

For calculations

- Copy equation from reference list, substitute values then transpose.
- Think about units - are they consistent?
- Practise powers of 10 (H-tier) / or using large and small numbers (F-tier).
- Show working - maybe by doing the substitution first before attempting to transpose.

For six mark items:

- Highlight the command word - then think what it means in relation to what you know of the topic
- Read the question carefully at least twice - write the first sentence - read the question again. Are you obeying the command word?
- Do not be afraid to cross out work with a single neat line to show that you do not want it to be marked.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

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