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Examiners' Report
June 2015

GCSE Physics 5PH1F 01

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June 2015

Publications Code UG042621

Introduction

This unit is divided into six topics and all six topics were tested in the examination.

1. Visible light and the Solar System - tested mainly in Q 5

2. The electromagnetic spectrum - tested mainly in Q 4

3. Waves and the Universe - tested mainly in Q 2

4. Waves and the Earth - tested mainly in Q 6

5. Generation and transmission of electricity - tested mainly in Q 3

6. Energy and the future - tested mainly in Q 1

Each examination paper allows every candidate to show what they know, understand and can do.

The paper contains a mixture of question styles, including objective questions, short answer questions and extended writing questions. The two 6 mark items (in Q5 and Q6) test both Physics and candidates' quality of written communication.

This report will provide exemplification of candidates' work, together with tips and/or comments, for a selection of questions. The exemplification comes mainly from items which require more complex responses from candidates. It does not demonstrate all of the acceptable answers to each question. These can be found in the published mark scheme. Further, it only mentions some of the more common incorrect suggestions offered by candidates, to help teachers tackle these misconceptions in the classroom.

Question 1 (b) (i)

(b) This photograph shows a fan.

The blades of the fan are turned by an electric motor.

In one second, the motor gets 200 J of electrical energy from the mains supply. Only 180 J of this energy is used to turn the blades of the fan.

The rest of the energy is wasted.

(i) Calculate how much of the 200 J of energy is wasted.

(1)

36 000

wasted energy = ... J

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Examiner Comments

Unfortunately, more candidates than expected did not understand the question or the meaning of their answer. Any value greater than 200 **must** be wrong. 0 marks.

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Examiner Tip

Read through the task line of the question and check that the answer agrees with this.

Question 1 (b) (ii)

This question was challenging for some candidates.

(ii) State what happens to the wasted energy.

(1)

the wasted energy runs down, back to the electrical sorce to be re-Charged

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Examiner Comments

Other suggestions also not creditworthy include: 'It isn't used' and 'it remains there, runs the electric motor'

Question 1 (b) (iii)

Calculations are usually good indicators of overall performance. This one involved substitution into a standard, and provided equation.

Most candidates who scored well overall arrived at the correct answer often with working correctly shown.

(iii) Calculate the efficiency of the motor.

(2)

$\frac{180J}{200J} = 0.9 \times 200J = 180J$

efficiency = 180

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Examiner Comments

Sometimes candidates performed the correct substitution but then thought this insufficient and proceeded elsewhere.

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Examiner Tip

If working is shown, some allowance can be made for partially correct work. Thus, this response scored 1 mark.

Question 2 (b) (i)

This question tested the idea of orbits and how they differ from each other.

(b) Both the Hubble telescope and the Moon orbit the Earth.
The table gives data about these

	average radius of orbit / km	time of orbit
Moon	385 000	27 days
Hubble	560	96 minutes

(i) What is the closest distance between the Moon and the Hubble telescope?

(1)

384,440 km

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Examiner Comments

They will be closest when they are on the same side of the Earth. So, subtract one from the other.

(b) Both the Hubble telescope and the Moon orbit the Earth.
The table gives data about these

	average radius of orbit / km	time of orbit
Moon	385 000	27 days
Hubble	560	96 minutes

(i) What is the closest distance between the Moon and the Hubble telescope?

(1)

385000 ÷ 560 = 687.5

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Examiner Comments

Some candidates seem to think that division is the only operation to use in calculations.

Question 2 (b) (ii)

An explanation, for the varying separations of Moon and Hubble, proved difficult for some of the weaker candidates.

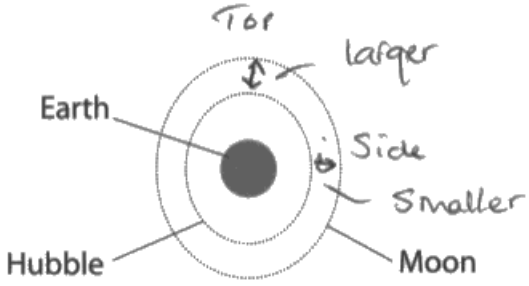
Some candidates were able to provide a limited explanation in terms of elliptical orbits.

Some candidates had problems with technical terms.

(ii) Explain why the distance between the Moon and the Hubble telescope changes.

You may add to this diagram to help your answer.

(2)



The movement of both the moon and hubble goes in a oval shape so there is a bigger distance at the top compared to the sides of the orbit

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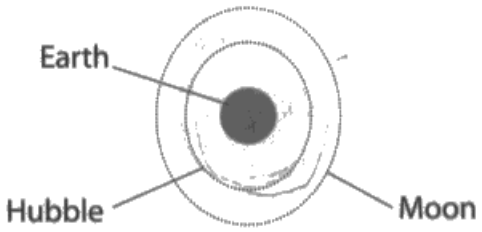
Examiner Comments
This showed different separations on the diagram. 1 mark.



The universe is expanding the moon and hubble telescope could be moving away.

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Examiner Comments
There is evidently confusion here with the Big Bang and red shift. 0 marks.

Here is an example of a good response.

because they both take different lengths of time to orbit the Earth completely. So the Hubble could be almost finished orbit whilst the moon is half way.

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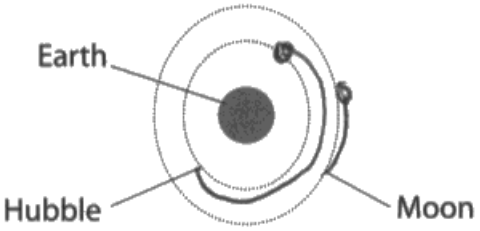
Examiner Comments

This response states that orbital times are different and clearly implies that they can be at different (relative) places in their orbits. 2 marks.



The hubble telescopes moves around faster than the moon does which means it gets further away from the moon and eventually closer.

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Examiner Comments

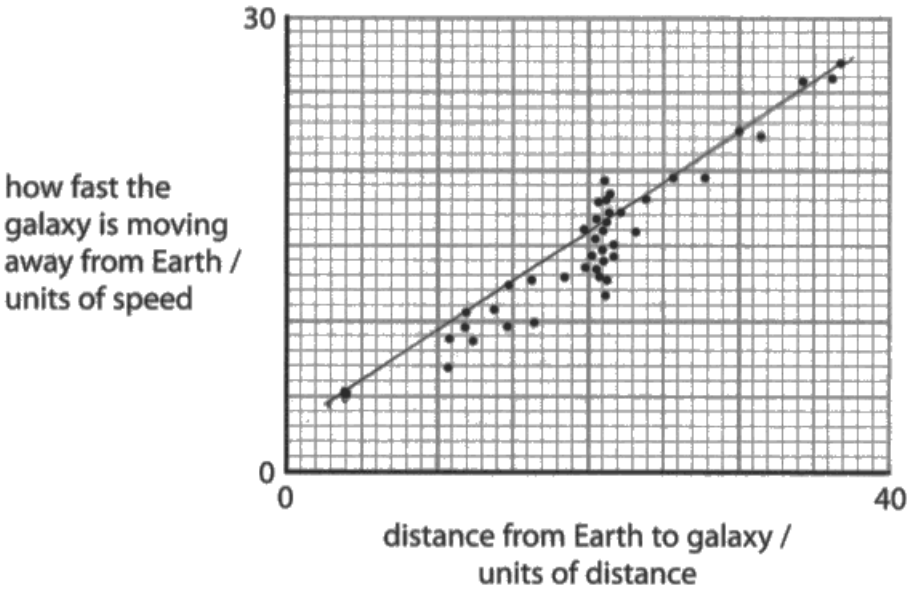
This response was sufficient for the two marks available.

Question 2 (c) (i)

Most candidates were able to plot the required point correctly

(c) Hubble measured the distance of many galaxies from Earth.
He also measured the speed at which each galaxy moved away from Earth.

Hubble plotted his data on a graph like this.



(i) Plot the point: distance = 5 units, speed = 4 units

(1)

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Examiner Comments

Some candidates mixed up the axes. This candidate plotted distance 4 units and speed 5 units. 0 marks.

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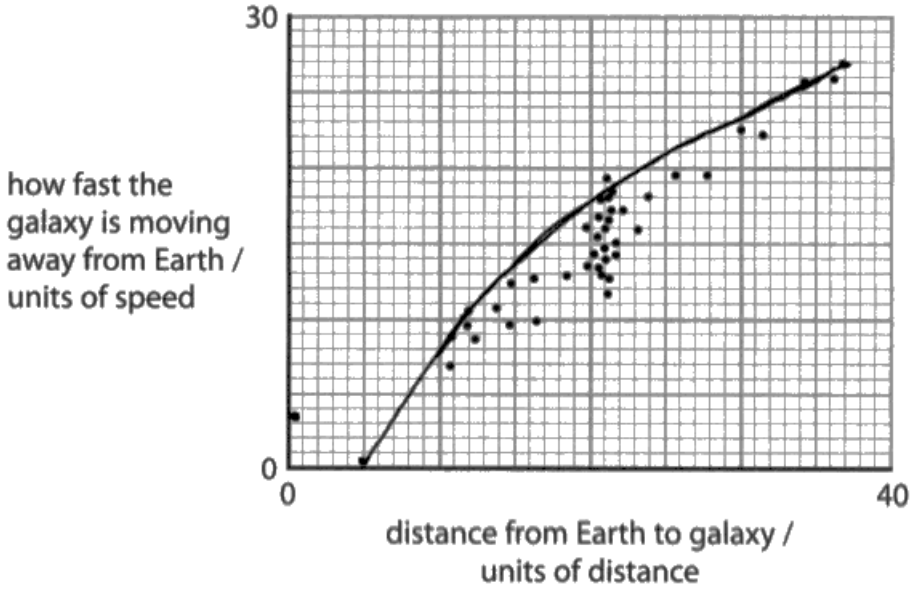
Examiner Tip

Candidates should frequently practice both producing and interpreting graphs.

Question 2 (c) (ii)

This question required candidates to draw a *straight* line of best fit.



(i) Plot the point: distance = 5 units, speed = 4 units

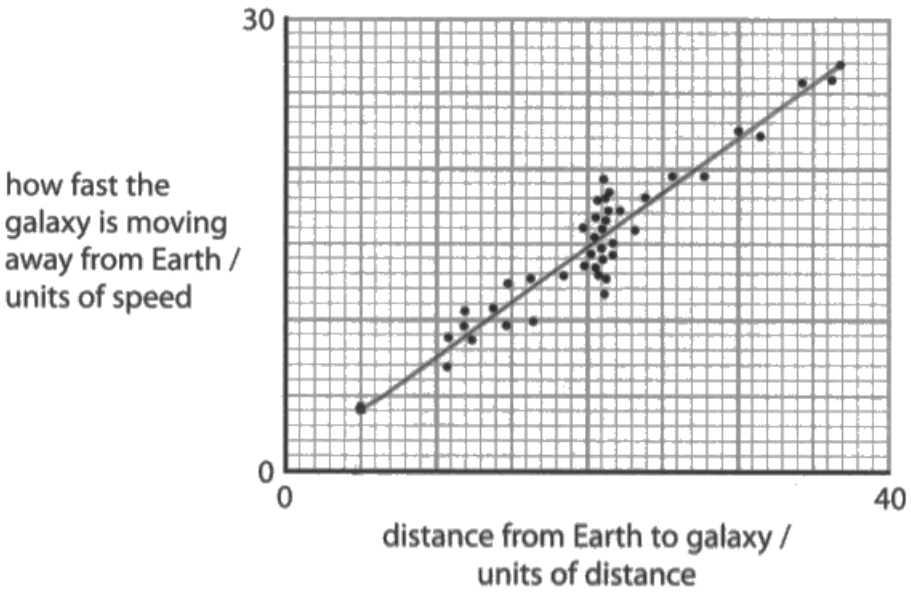
(1)

(ii) Draw the straight line of best fit.

(1)

ResultsPlus
Examiner Comments

An example of a response that scored 0.



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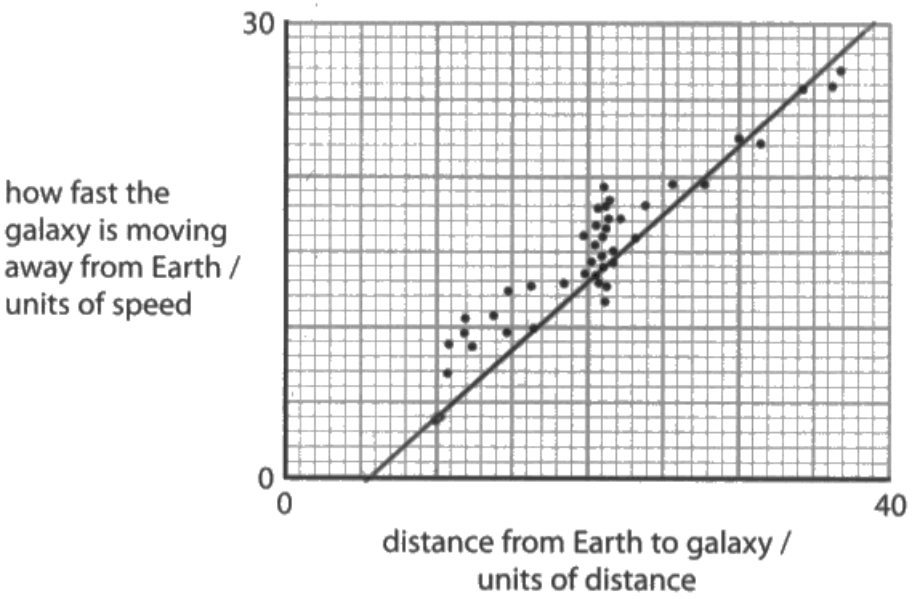
Examiner Comments

This was judged creditworthy since there were points above and below the line at the top and the lower ends. It was an excellent attempt.



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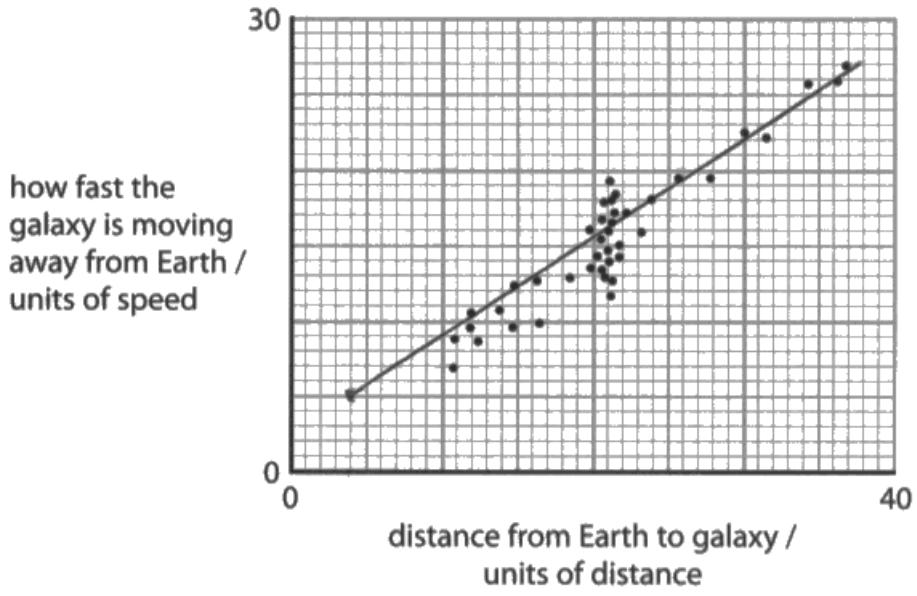
Examiner Comments

By comparison, this had few points below it so scored 0.



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Examiner Comments

The line here is above nearly all the lower points and again scored zero.

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Examiner Tip

This graph may be good for discussion either during the normal lesson time or after candidates have attempted it in a test/examination.

Question 2 (d)

This question tested the Big Bang theory. There were many and varied ideas as to the meaning.

(d) Hubble's work led to the theory of the Big Bang.

Describe what is meant by the Big Bang theory.

(2)

The big bang theory is that there was a big explosion with lots in it and the universe has been expanding ever since.

ResultsPlus
Examiner Comments

This was awarded two marks based on the final six words.

(d) Hubble's work led to the theory of the Big Bang.

Describe what is meant by the Big Bang theory.

(2)

It all started with a particle which exploded and expanded (still expanding) to our universe and made all the planets, the stars and moons. Big bang theory = how the universe was formed.

ResultsPlus
Examiner Comments

This was given 1 mark as the idea of origin of Universe was clear. It was not awarded two marks since it mentions that a particle exploded. This is incorrect since it implies that there was something present before the Big Bang.

(d) Hubble's work led to the theory of the Big Bang.

Describe what is meant by the Big Bang theory.

(2)

The Big Bang theory is where the planets travel and at some point in time will offenciallly crash into eachoth causing The Big Bang.

ResultsPlus
Examiner Comments

Crashes between various astronomical objects were frequent wrong answers. 0 marks.

(d) Hubble's work led to the theory of the Big Bang.

Describe what is meant by the Big Bang theory.

(2)

The Big Bang theory is where particles in the air colided and formed the Earth.

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Examiner Comments

0 marks.

Question 3 (a) (ii)

This question asked candidates to provide an explanation.

(ii) Explain why the voltage produced by this wind-powered generator is not always the same.

(2)

because one day there could be hardly any wind and the next day could be a lot of wind.

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Examiner Comments

This response correctly introduces the idea that wind speed varies and is worth 1 mark. But it does not relate the voltage / 'electricity' to it.

(ii) Explain why the voltage produced by this wind-powered generator is not always the same.

(2)

It is not always the same because the weather could vary and some days you would gain lots of electricity when it is windy and others you wouldn't because it may not be windy.

ResultsPlus
Examiner Comments

In contrast, this response scored full marks for clearly showing the relation between electricity production with wind / no wind. Note that a reference to the vague term 'weather' without wind would be insufficient.

Question 3 (a) (iii)

Working out the cost of using electricity regularly appears on examination papers.

(iii) It would cost the homeowner 15 p to buy 1.0 kW h of electrical energy from the National Grid.

His generator has a maximum power of 2.0 kW.
The generator produces energy at this maximum power for 3 hours.

Calculate how much it would cost to buy the same amount of energy from the National Grid.

(2)

2.0 x 1.0 x 3

15 + 15 = 30

30 x 3 = 90

cost = 6 90

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Examiner Comments

Candidates change their mind and do not always cross out working they do not actually use. The value they put in the answer space is the important one. This scored both marks.

Others are able to score partial marks even though the electricity seems excessively expensive!

2 kw x 15p x 3hours =

(2)

x60
3
180

cost = 5400

ResultsPlus
Examiner Comments

The working shown is sufficient for 1 of the 2 marks.

Question 3 (b)

It was very pleasing to note that many candidates scored all of the three marks available for this question.

(b) An electric kettle is plugged into a 230 V mains supply.
It has a power of 2.5 kW.

Use this equation to calculate the current in the kettle.

$$\text{current (in amps)} = \frac{\text{power (in watts)}}{\text{voltage (in volts)}}$$

(3)

$\frac{2.5}{230} = 92$

current = 92 A

ResultsPlus
Examiner Comments

This response has used the values given in the stem and so scores the first mark only as both the units and the arithmetic are incorrect.

(b) An electric kettle is plugged into a 230 V mains supply.
It has a power of 2.5 kW.

Use this equation to calculate the current in the kettle.

$$\text{current (in amps)} = \frac{\text{power (in watts)}}{\text{voltage (in volts)}}$$

(3)

Current = $\frac{2500}{230}$

current = 10.86 A

ResultsPlus
Examiner Comments

The change from kW to W is shown in the substitution.

Question 3 (c)

For this question there were many ways of suggesting why the generator would be insufficient

(c) Suggest why a 2 kW wind-powered generator may not supply all the electrical energy needed in a house.

(1)

it may not be able to supply enough energy for the house

ResultsPlus
Examiner Comments

This response scored 0 as it simply rephrases the information in the stem of the question.

Because if you got kids, you need to wash for them, watch tv, charge, and more, 2kw might not be enough to run a home

ResultsPlus
Examiner Comments

Here, the idea of insufficiency is expressed in terms of the use of more than one appliance. This scored 1 mark.

Because a keftle can take up to 2.5 kw itself and many people have multiple electrial appliances

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Examiner Comments

In this case, the candidate refers back to the kettle and shows that this already needs more than 2 kW.

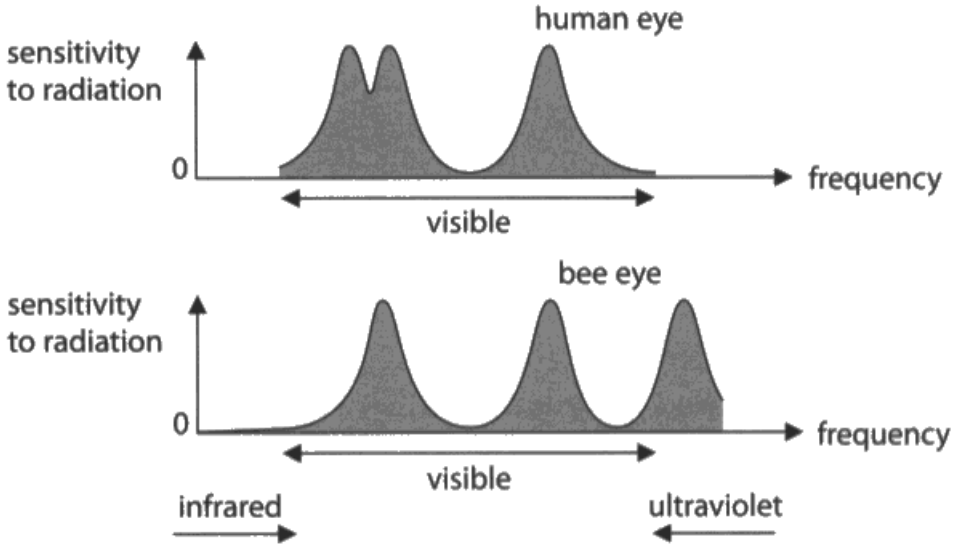
This scored 1 mark.

Question 4 (c)

This question asked for a comparative description of two graphs.

There were three possible marking points. One was for the limitations of the human eye, another for the extension outside the (human) range and a third for the relative spacing of the three peaks.

(c) The diagrams show the radiations to which the human eye and the bee eye are sensitive.



Describe differences in the sensitivity to radiation of a human eye and a bee eye.

(2)

A human is only able to see visible light but the bee can also see infrared and ultraviolet as there eyes are more sensitive.

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Examiner Comments

For this part, 'seeing' light was accepted even though we do not actually see the light. This response scored on the first two marking points.

Bees can detect invisible light such as ultraviolet ~~wh~~ and infrared where as humans can't.

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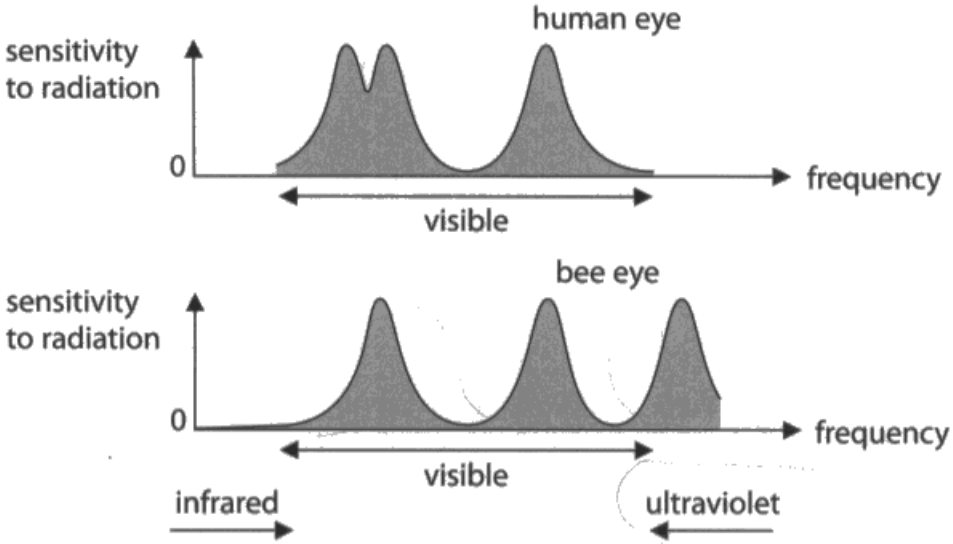
Examiner Comments

Bees 'can' but humans 'cannot' is only one point so only scores one mark.

(c) The diagrams show the radiations to which the human eye and the bee eye are sensitive.



Describe differences in the sensitivity to radiation of a human eye and a bee eye.

(2)

The human eye has a shorter wavelength than the bee eye. The bee high has a bigger/smaller frequency.

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Examiner Comments

This response tried to cover the third marking point but unsuccessfully.

Question 4 (e)

In this 'cultural' question, a change of unit was required to finish with the unit given.

The most common erroneous response involved just the numbers as stated i.e. 4 minutes.

(e) There is a piece of music called "The Flight of the Bumble Bee."
This takes 4 minutes to play.
During this time, a bee flies 1608 m.

Calculate the average speed of the bee.

(3)

$\frac{1608}{260}$

speed 6.7 m/s

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Examiner Comments

Many candidates built the change into their substitution. This scored all three marks.

(e) There is a piece of music called "The Flight of the Bumble Bee."
This takes 4 minutes to play.
During this time, a bee flies 1608 m.

Calculate the average speed of the bee.

(3)

$\frac{1608}{4}$

speed 402 m/s

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This scored 2 marks, as it missed the change of unit.

(3)

60 sec - 1 minute
120 sec - 2 minutes
180 sec - 3 minutes
240 sec - 4 minutes

speed ..... m/s

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Examiner Comments

Some candidates found it hard work gaining the one mark for change of unit.

Question 4 (f)

A variety of responses were allowable for this 'suggest' question.

(f) A scientist wrote this sentence:

"Ultraviolet radiation is harmful to humans but useful to honey bees."

Suggest what the scientist means by this sentence. You may wish to look back at the graphs in part (c).

(2)

too much ultraviolet radiation to humans naked eye can cause cataracts whereas ~~to~~ bees can use uv for many things eleme ant to them eg food searching. this sente nce is saying that uv has more dangers to humans therefore needs caution whereas uv can be useful to bees.

(Total for Question 4 = 10 marks)

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Examiner Comments

This response mentions the most common response, i.e. causing cancer, and the idea that bees use UV to search for food.

For the food mark, it was acceptable for 'see pollen' but 'see/ make honey/food was insufficient.'

Ultraviolet is harmful to humans as it can cause skin cancer but ultraviolet radiation is useful to honey bees they dont have a high sensitivity towards ultraviolet- radiation.

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Examiner Comments

Here the comment about the bees is not a use, just 'not as dangerous'. So only the cancer mark was scored.

This example scores only two marks.

(f) A scientist wrote this sentence:

"Ultraviolet radiation is harmful to humans but useful to honey bees."

Suggest what the scientist means by this sentence. You may wish to look back at the graphs in part (c).

(2)

Humans cannot see Ultraviolet light whereas honey bees can, human eyes are more sensitive to different lights. Honeybees may use it to see the pollen in flowers but it can damage humans cells & and skin, if used too much.

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Examiner Comments

The first mark scored was for 'see the pollen' and the second for 'damage ... skin' which was just sufficient even without the bonus use of 'cells'.

Question 5 (a) (i)

Nearly all candidates managed to correctly label at least one of the two. Wavelength was the most popular correct answer although sometimes this was incorrectly labelled frequency.

Question 5 (b) (i)

Unfortunately, candidates struggled with this question so it appears that the working of a reflecting telescope was not well known.

A strong hint was given in the stem for a refracting telescope but this seems not to have been a help to many.

(i) The two types of telescope form their images of a distant object in different ways.
A refracting telescope uses a converging lens to form an image of a distant object.

Describe how a reflecting telescope forms an image of a distant object.

(2)

a reflecting telescope use mirror to form an image. it works by the light going in then reflecting of a curved mirror onto a straight mirror then to the eyepiece where you can see the formed image

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Examiner Comments

This response scored both marks because it referred not just to a mirror (1 mark) but also to the fact that it was curved (sufficient).

It reflech the image on different mirror inside the telescope.

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Examiner Comments

A disappointingly small number even mentioned a mirror for 1 mark.

(i) The two types of telescope form their images of a distant object in different ways.
A refracting telescope uses a converging lens to form an image of a distant object.

Describe how a reflecting telescope forms an image of a distant object.

(2)

Because it reflects the light from the distant object and then magnified it.

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Examiner Comments

Often the word 'reflect' was used without saying what caused the reflection. Even the use of the word 'reflector' would have been sufficient in place of mirror.

This response scored 0.

Question 5 (b) (ii)

This tested a direct statement from the specification.

Most candidates who answered correctly used the technical term 'magnify.' Other ideas which did not score involved focusing, being a place to put your eye, inverting the image or making the image clear. While some of these may be correct things that the eyepiece does, they are not what it is *intended* to do to the image.

(ii) Both telescopes use a converging lens as an eyepiece.

State what the eyepiece of a telescope is intended to do to the image.

(1)

make the image bigger then it is

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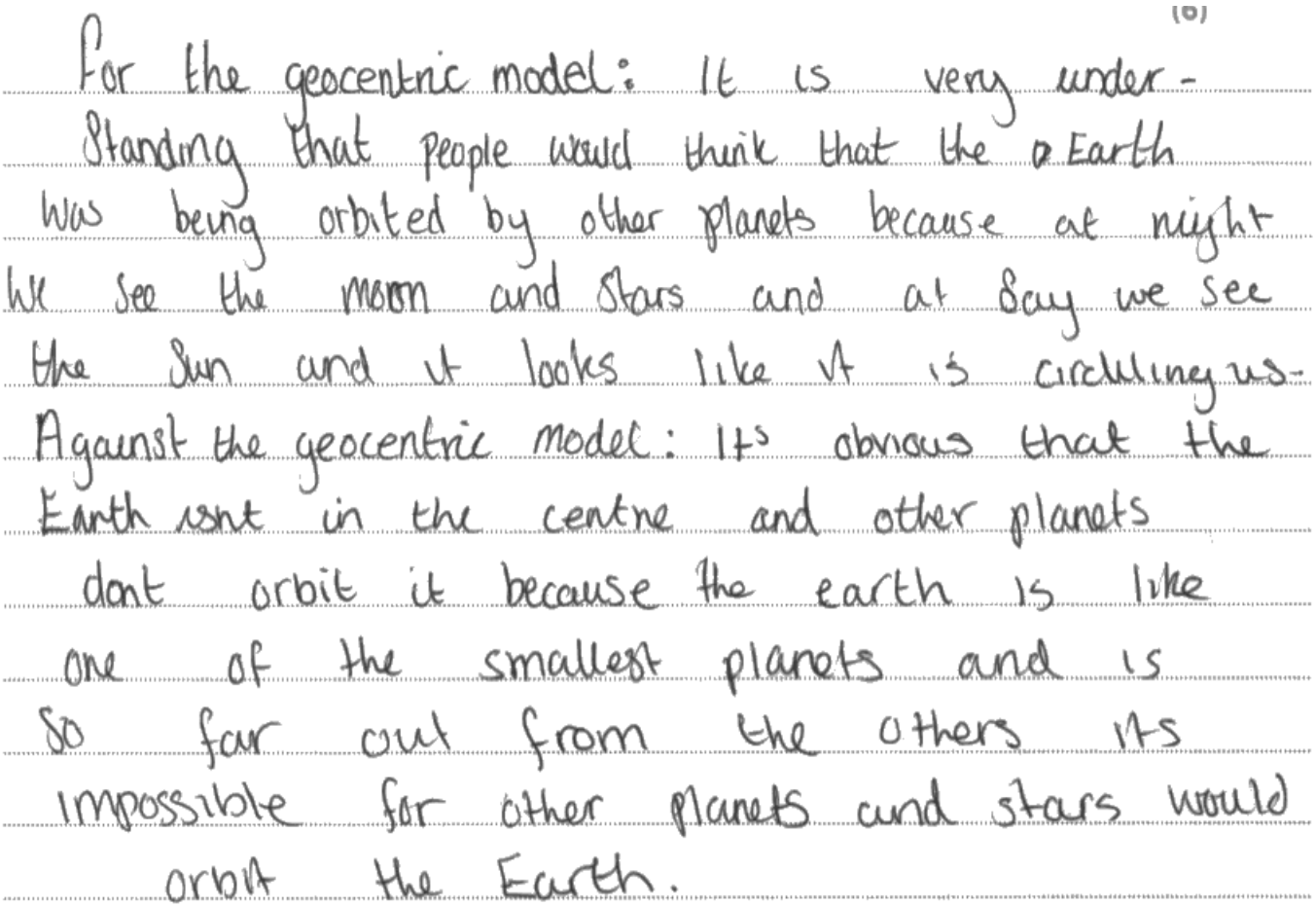
Examiner Comments

This candidate did not use the term magnify but still does enough to score the mark.

Question 5 (c)

The important part of this question was 'evidence'. Thus, there were no marks at level 2 or above for describing one or other model. Similarly, a simple mention of Jupiter's moons was insufficient evidence.

Some responses gained credit for evidence which agreed with the geocentric model but there were also responses seen that gave evidence against.



(c)

For the geocentric model: It is very understanding that people would think that the Earth was being orbited by other planets because at night we see the moon and stars and at day we see the Sun and it looks like it is circling us. Against the geocentric model: It's obvious that the Earth isnt in the centre and other planets dont orbit it because the earth is like one of the smallest planets and is so far out from the others its impossible for other planets and stars would orbit the Earth.

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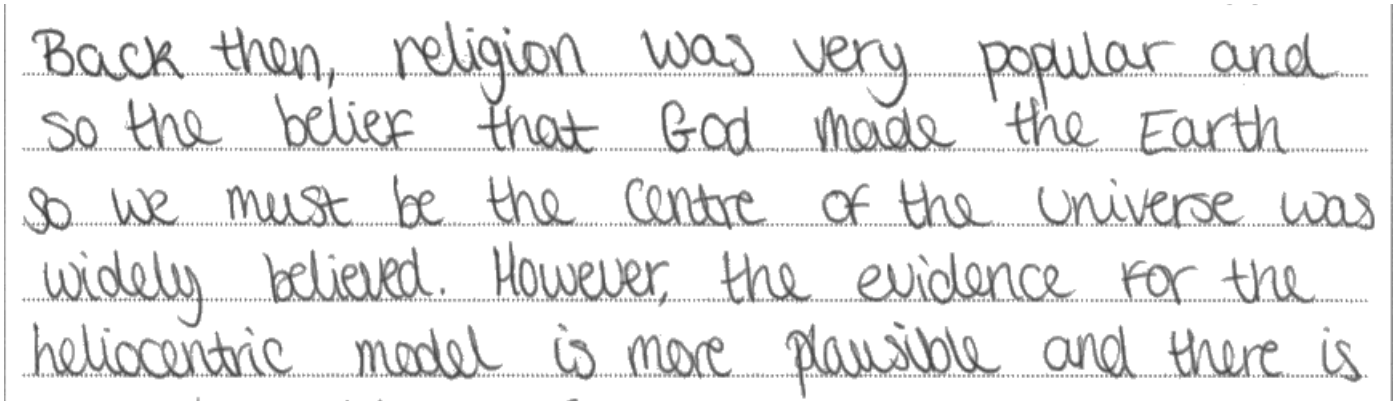
Examiner Comments

Evidence such as movement of Sun, Moon and stars across the sky, everyday, in the same direction etc. was acceptable. The 'Moon orbits Earth' is not *evidence.*

This response scored 2 marks for the first five lines, but nothing for 'against'.



Back then, religion was very popular and so the belief that God made the Earth so we must be the centre of the Universe was widely believed. However, the evidence for the heliocentric model is more plausible and there is

physical evidence, (such as Galileo's observations of Jupiter's moons) rather than just based on faith.

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The evidence was that the moons were seen to be moving round/orbiting Jupiter. This response was thus limited to level 1 since there is no evidence either of the geocentric model.

The geocenteric model was proved wrong by Galileo as he found that there were 4 moons orbiting jupiter. This meant that the Earth could not be geocentric as there was something that was in orbit ~~within~~ with something other the Earth. However it could not then be proved that the universe was heliocentric because at that time people were not able to view the whole solar system and could only provide evidence such as drawings which were inconclusive. Therefore speculation remained of which model was correct until more modern technology was available

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The candidate shows that they are clear what the geocentric model is and how Galileo's observations disprove it. However, there is no evidence in favour of the geocentric and so the response scores 4 marks.

A large amount of writing is unnecessary to gain full marks.

Evidedence for the geocentric model is we see the sun and the moon rising and setting everyday so they could be orbiting around us. Evidence against is other planets have moons that orbit around them and not the Earth. Also

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Examiner Comments

These six lines contain sufficient argument to score all six marks. It contains some evidence for and against the geocentric model and explains how they fit in with or refute this model.

Question 6 (b)

To predict earthquakes it is necessary to know their cause(s).

(b) Explain why it is difficult to predict when an earthquake will happen.

(2)

Because of the waves when the Plates rub agansrt eachother.

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Examiner Comments

This candidate has brought out the rubbing nature of the plates' movement and has not just said that the 'plates move' and so scores one mark.

There are other aspects of earthquakes which contribute to the difficulty.

(b) Explain why it is difficult to predict when an earthquake will happen.

(2)

Because it only happens when a sudden movement takes place. And you cant see under around as the Plates are to deep.

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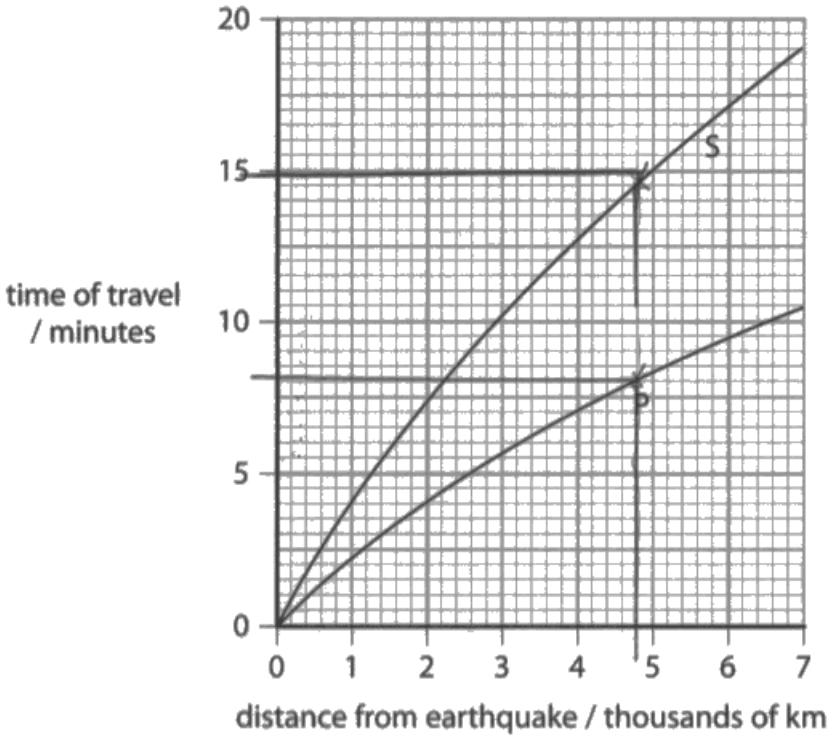
Examiner Comments

Here the candidate has alluded to the random/ sudden nature of the shift and also mentions that, since they happen deep underground, direct observation is impossible. This scores 2 marks.

Question 6 (c)

Two of the three marks for this part were for working out the scale and then reading the values from the graph. The third mark was for knowing how to use them to find the time of travel.

(c) The graph shows how long it takes the P-waves and the S-waves from an earthquake to travel different distances.



The time difference between these waves arriving at a place allows scientists to find out how far away the earthquake was.

Use the graph to find the time difference between the P- and S-waves when the distance is 4800 km.

(3)

time for P-wave = 6 minutes

time for S-wave = 15 minutes

time difference = 9 minutes

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Examiner Comments

This candidate misread the value for the P-wave but was successful with the S-wave. They then correctly subtracted the two to gain two marks.

The time difference between these waves arriving at a place allows scientists to find out how far away the earthquake was.

Use the graph to find the time difference between the P- and S-waves when the distance is 4800 km.

(3)

time for P-wave = 7 minutes

time for S-wave = 16 minutes

time difference = 9 minutes

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Examiner Comments

This candidate was unsuccessful at reading the values but knew what to do with them so scored 1 mark.

The time difference between these waves arriving at a place allows scientists to find out how far away the earthquake was.

Use the graph to find the time difference between the P- and S-waves when the distance is 4800 km.

(3)

time for P-wave = 8 minutes

time for S-wave = 14.30 minutes

time difference = 6.30 minutes

ResultsPlus
Examiner Comments

Many carried out the task correctly, after allowing for the decimal place. This response was clearly worth all 3 marks.

Question 6 (d)

Marks for this question varied. Many candidates scored reasonably well but some struggled to gain even the odd mark.

A piece of writing like this, accompanied by annotation on the diagram has some merit.

Scientists know where a earth quake has happend ~~because~~ using Seismic Stations because the closer an earthquake is to a Seismic Station the time will be quicker if the earthquake happened at x. The waves will be at Seismic Station Y quicker than Seismic Station Z.

ResultsPlus
Examiner Comments

It refers to the difference in arrival times somewhat. It would allow some idea to be gained of the earthquake's position. It scored 2 because the language was considered just sufficient to communicate the idea at level 1.

Answers such as this were not uncommon.

Seismic waves travel at the same speed in a vacumm and they are transverse. The Seismic waves are a peice of technology that sends ultra sound down to the earthquake core and then it reflects causing an echo, which would show the co-ordinates of where it had happened. Seismic P waves are for transverse waves which happen on the surface of water and seismic S waves are for longitude waves where the seismic waves move across. Also the seismic P waves move back and forth.

ResultsPlus
Examiner Comments

Several technical terms are introduced but are irrelevant, in the wrong context or just wrong. Unfortunately this response was not creditworthy.

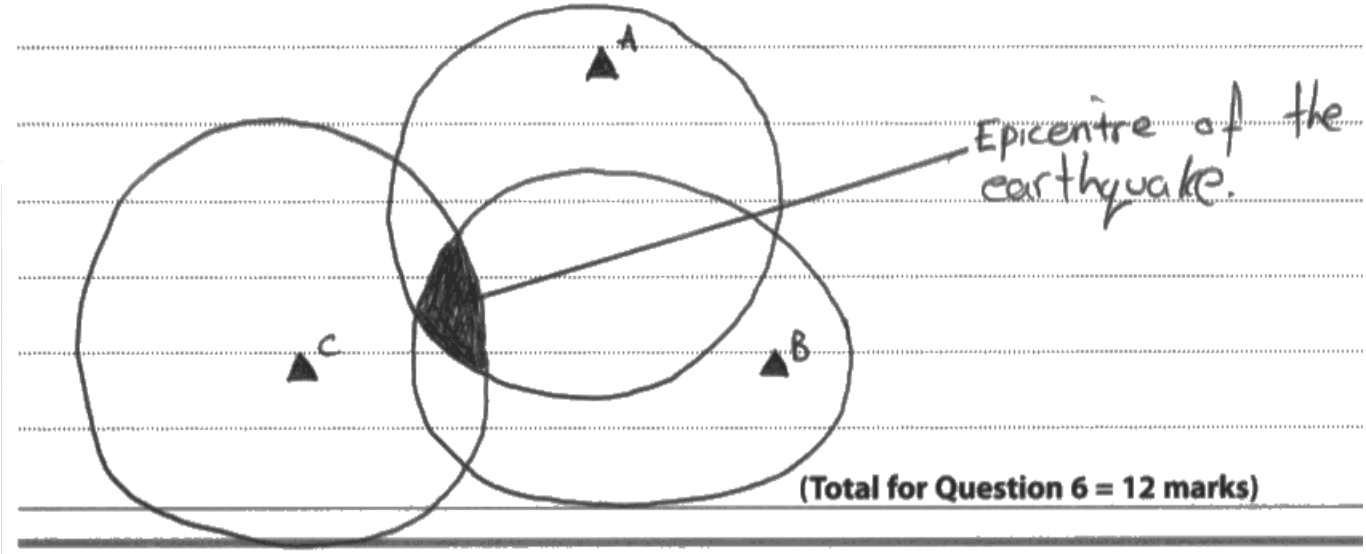
The scientist look at the time difference between the p-waves and the s-waves arriving at a place to calculate how far away the earthquake was and where it happened.

ResultsPlus
Examiner Comments

This candidate got part way through the process and scored 4 marks. It could have scored full marks by mentioning doing the same process at several stations.

(6)

The process of finding out where the earthquake came from is called Triangulation. This is basically have seismometers positioned in a triangle. When an earthquake arrives it will be in the middle of triangle. They will then find out the difference in time between the P and the S waves, at each seismometer stations, to find at exactly where it came from.



(Total for Question 6 = 12 marks)

ResultsPlus
Examiner Comments

This response has several good ideas but unfortunately earthquakes do not always occur 'in the middle of triangle'. Also, the diagram does not clarify how the circles are drawn as the triangles are nowhere near the centres of the circles. The ideas here are not clearly communicated but this is otherwise a very good response that was awarded level 3, 5 marks.

Paper Summary

Based on their performance on this paper, candidates would have benefited from:

- practicing memory games /quizzes to ensure that they have a sound knowledge of the fundamental ideas in all six topics
- being regularly challenged to recognise SI prefixes such as m and k and how to handle these in standard calculations
- practicing the showing of working (and inclusion of units) on a regular (habit-forming) basis
- regularly analysing and interpreting between a variety of data types
- making notes of the science to include in a written answer each time they start to construct a response
- using the marks at the side of a question as a guide to the form and content of their answer
- getting used to the idea of applying their knowledge to new situations by attempting questions in support materials or previous examination papers during normal classroom lessons

Grade Boundaries

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

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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