ResultsPlus

edexcel

Examiners' Report
June 2014

GCSE Physics 5PH1H 01

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk.

Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

ResultsPlus

Giving you insight to inform next steps

ResultsPlus is Pearson's free online service giving instant and detailed analysis of your students' exam results.

- See students' scores for every exam question.
- Understand how your students' performance compares with class and national averages.
- Identify potential topics, skills and types of question where students may need to develop their learning further.

For more information on ResultsPlus, or to log in, visit www.edexcel.com/resultsplus.
Your exams officer will be able to set up your ResultsPlus account in minutes via Edexcel Online.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk.

June 2014

Publications Code UG040007

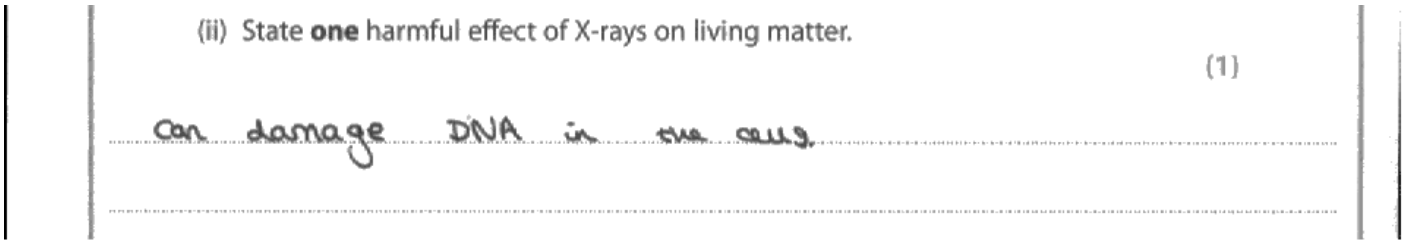
Introduction

This paper tested many of the skills specified in 'How science works' and detailed in the Assessment Objectives of the specification. There were many parts where a candidate could score from recall of knowledge given in the specification and to show understanding of this at a basic level. In addition, candidates were given the opportunity to show their ability to apply this knowledge in more unusual (but explained) situations.

Question 1 (a) (ii)

This item tested simple recall of a statement in the specification.

Most candidates scored the mark for this item.


(ii) State **one** harmful effect of X-rays on living matter.

(1)

can damage DNA in the cells.

ResultsPlus
Examiner Comments

A variety of responses are creditworthy including a simple reference to causing cancer.

ResultsPlus
Examiner Tip

There are clear statements in the specification relating to the harmful effects of radiation from various parts of the electromagnetic spectrum. These should not only be learnt but also understood in terms of differences in frequency.

Sometimes of course, candidates get confused.

(ii) State **one** harmful effect of X-rays on living matter.

(1)

x-rays can harm the body by infra red radiation

ResultsPlus
Examiner Comments

Even without the reference to infrared radiation though, this answer would be insufficient to score. It lacks specificity of what will be damaged.

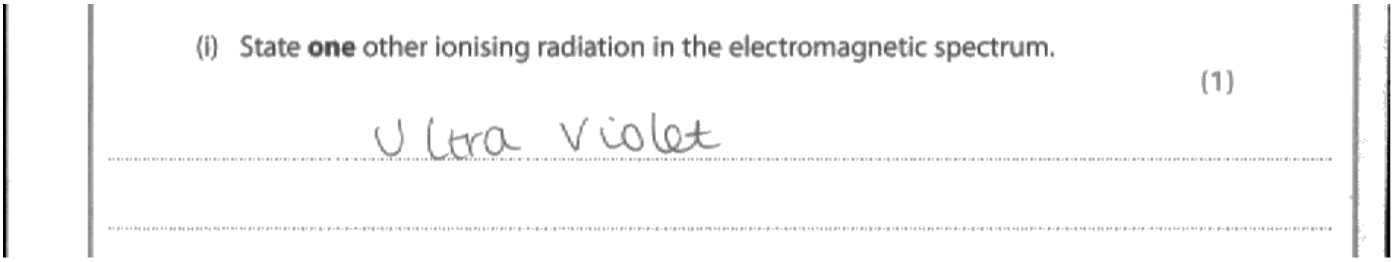
ResultsPlus
Examiner Tip

Some detail about cells, tissue etc is needed.

Question 1 (b) (i)

This item combined recall with basic understanding by restricting consideration to those parts of the spectrum which could ionise matter.

'Gamma' was by far the most common correct answer.



(i) State **one** other ionising radiation in the electromagnetic spectrum.

(1)

Ultra Violet

ResultsPlus
Examiner Comments

Another section was also accepted since some high energy frequencies will qualify.

ResultsPlus
Examiner Tip

It may be best to restrict discussion of ionisation to gamma and X-rays, at this level.

Of the non-ionising regions of the spectrum, microwaves was by far the most common.

(i) State **one** other ionising radiation in the electromagnetic spectrum.

(1)

Microwave

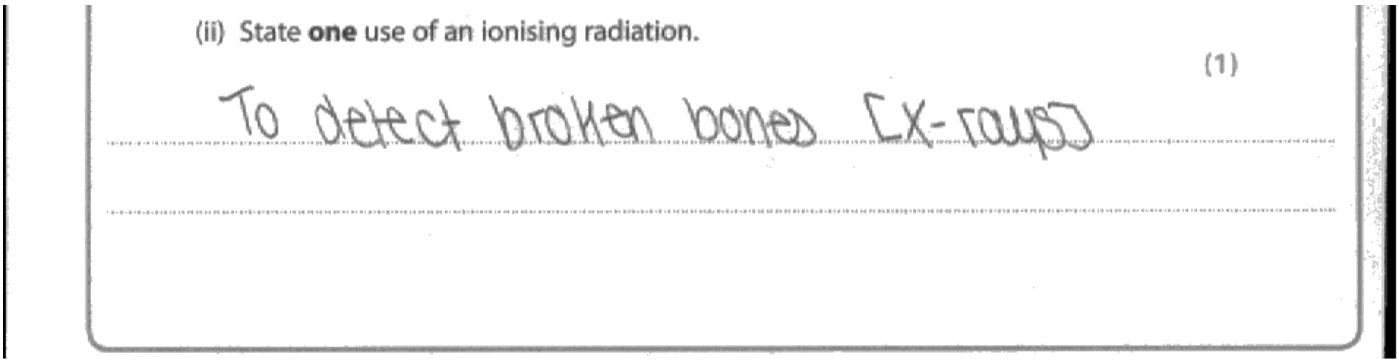
ResultsPlus
Examiner Comments

Candidates clearly knew that these waves were dangerous but often thought they caused cancer.

Question 1 (b) (ii)

For some, there was a carry-through error into this part by giving a use for an ionising radiation as 'microwaving food'.

There was no demand for a link between the use and the name of the radiation for this part.


(ii) State **one** use of an ionising radiation. (1)

To detect broken bones [X-rays]

ResultsPlus
Examiner Comments

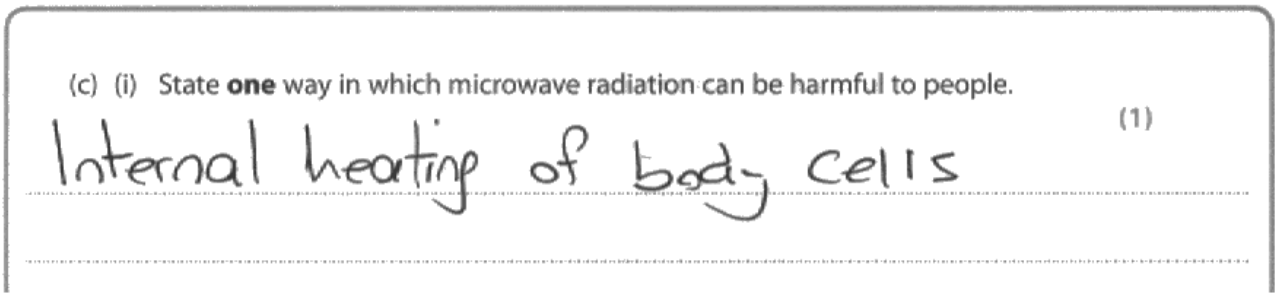
Most candidates did give a link, however.

ResultsPlus
Examiner Tip

Providing extra information such as this can be dangerous as wrong may cancel correct.

Question 1 (c) (i)

Fewer than half of candidates at this, the higher, level correctly stated how microwave radiation can be harmful to people.


(c) (i) State **one** way in which microwave radiation can be harmful to people.

(1)

Internal heating of body cells

ResultsPlus
Examiner Comments

All that was required was a repeat of the specification statement as this response shows.

Some responses were too general to qualify for a mark.

(c) (i) State **one** way in which microwave radiation can be harmful to people. **(1)**

Microwaves can ~~burn~~ overcook/heat food making it dangerous to eat

ResultsPlus
Examiner Comments

Any other type of oven or fire can produce a similar effect.

Question 1 (c) (ii)

The modal score for this item was 2 from the 3 available.

Question 2 (a)

The idea that answers, particularly to multimark items, can score even when not perfect is shown by this response.

Here the candidate has left a gap.

(a) Explain why step-down transformers are used in the transmission of electricity in the National Grid.

(2)

Step-down Transformes decreane the voltage and increane the . This is done as the voltage going at to the homes need a decreane in voltage to be Safe.

ResultsPlus

Examiner Comments

What is said about decrease in voltage, being near homes and being (relatively) safe merit the two marks. The gap could mean one of several things: eg current, energy or power. The candidate is not sure and so leaves it blank. There is no penalty for this.

In this case, the responder starts with an inappropriate statement.

(a) Explain why step-down transformers are used in the transmission of electricity in the National Grid.

(2)

A Step-down transformer is used so that the national grid doesn't explode with power. The Step-down transformer decreases the voltage and increases the current.

ResultsPlus

Examiner Comments

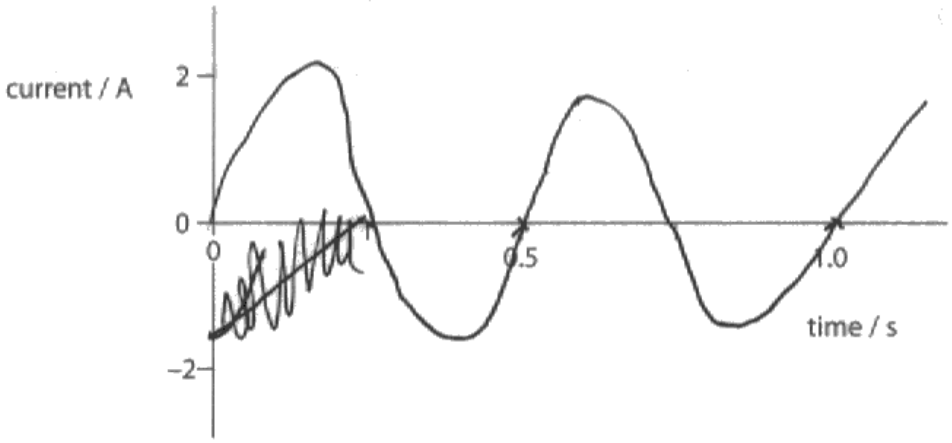
The incorrect comment is then followed by a correct and relevant statement and so can score one of the two marks available.

Question 2 (b)

There were two distinct ideas involved in this item.

(b) Transformers need alternating current to work properly.
Sketch a graph of an alternating current with a frequency of 2 Hz.

(2)

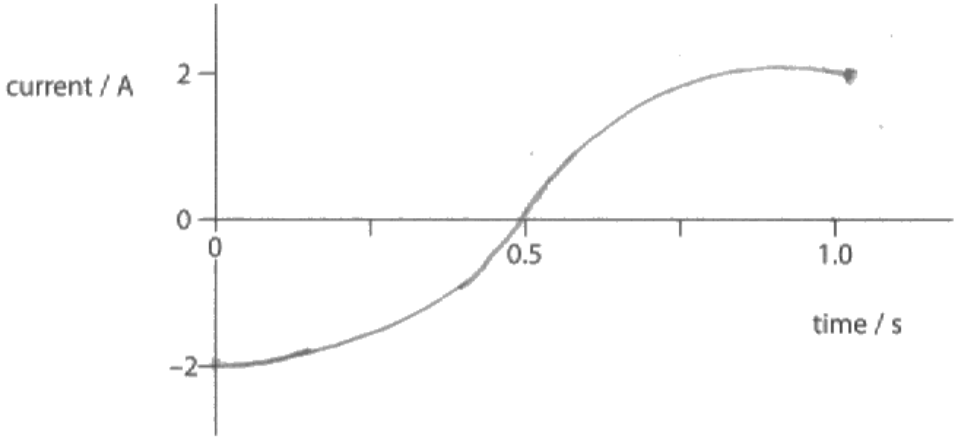


ResultsPlus
Examiner Comments

Almost all scored the first mark for producing a line indicating the flow of current in one direction and then in the other. Comparatively few then proceeded to correctly draw a current with a frequency of 2 Hz. By far the most common incorrect answer was a current with f = 1 Hz.

(b) Transformers need alternating current to work properly.
Sketch a graph of an alternating current with a frequency of 2 Hz.

(2)



ResultsPlus
Examiner Comments

Some went a stage further and used the 2, but incorrectly.

Question 2 (c)

The often repeated phrase 'show your working' benefited some candidates.

(c) A transformer has 2400 turns on the primary coil and 100 turns on the secondary coil.

Calculate the secondary voltage if the primary voltage is 12 V. (3)

$\frac{V_P}{V_S} = \frac{N_P}{N_S}$

$\frac{12}{?} = \frac{2400}{100}$

$V_S = \frac{2400}{100} \times 12$

$= 288$

secondary voltage = 288 V

ResultsPlus
Examiner Comments

Here the candidate was able to substitute values in a correct equation but could not then transpose the equation.

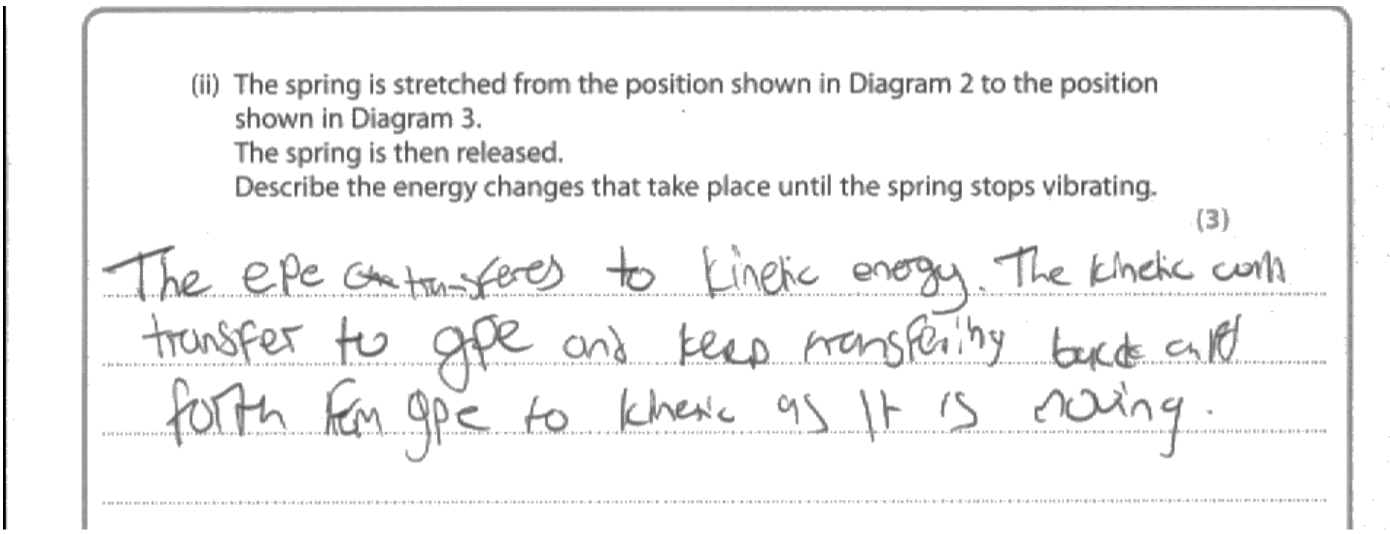
ResultsPlus
Examiner Tip

This scored 1 from the 3 available, for the left hand side of the response. Given the right circumstances, this could mean a whole grade difference. If just the number 288 is given, with no working, no marks can be awarded.

Question 3 (a) (ii)

A variety of approaches enabled candidates to score full marks for this item.

One way to score marks was to do a series of energy transfers.



(ii) The spring is stretched from the position shown in Diagram 2 to the position shown in Diagram 3.
The spring is then released.
Describe the energy changes that take place until the spring stops vibrating.

(3)

The epe is transferes to kinetic energy. The kinetic can transfer to gpe and keep transfering back and forth from gpe to kinetic as it is moving.

ResultsPlus
Examiner Comments

The first line and a half were sufficient to score the three marks available, although the description is incomplete.

(ii) The spring is stretched from the position shown in Diagram 2 to the position shown in Diagram 3.
The spring is then released.
Describe the energy changes that take place until the spring stops vibrating.

(3)

The energy goes from elastic potential to kinetic to gravitational then back to kinetic and gravitational until the spring stops. Energy is also converted to heat (thermal energy) and sound.

ResultsPlus
Examiner Comments

Here the candidate appreciates what happens right to the end and this response is well worth all three marks.

Not all responses, of course, were creditworthy.

(ii) The spring is stretched from the position shown in Diagram 2 to the position shown in Diagram 3.
The spring is then released.
Describe the energy changes that take place until the spring stops vibrating.

(3)

The spring has a longitudinal wave and after its released, its ~~gravitational~~ elastic potential energy will increase.

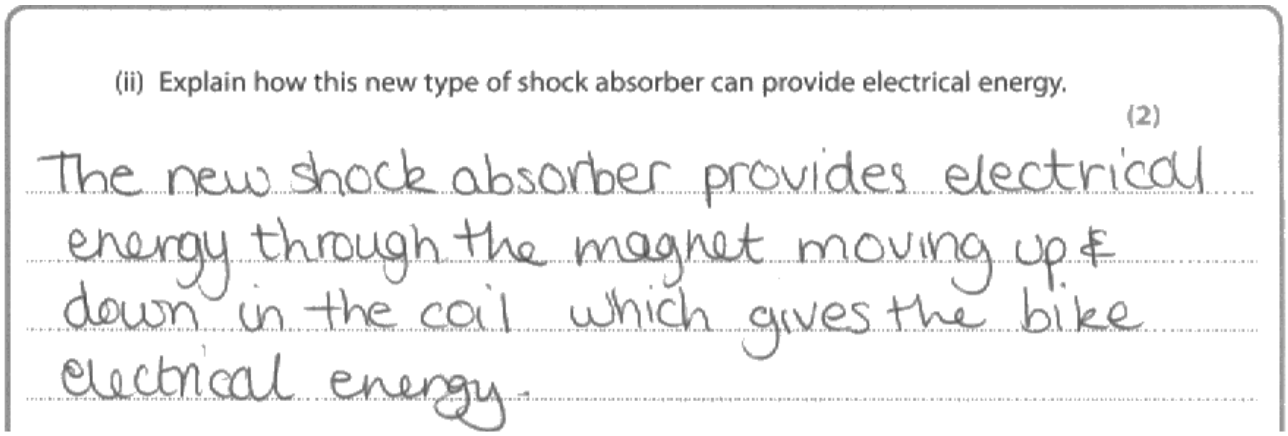
ResultsPlus
Examiner Comments

The description of when there was EPE was incorrect.

Question 3 (b) (ii)

This item tested candidates' ability to recognise a familiar situation in an unusual context.

Many candidates correctly spotted that it was 'the relative movement of a magnet and a coil' which was the source of the electrical energy, as stated in the specification.



(ii) Explain how this new type of shock absorber can provide electrical energy.

(2)

The new shock absorber provides electrical energy through the magnet moving up & down in the coil which gives the bike electrical energy.

ResultsPlus
Examiner Comments

Here, the candidate describes the relative movement as the magnet 'moving up and down'. This scores 1 mark.

ResultsPlus
Examiner Tip

Marks are not normally given for repetition of the question so references to 'provides' or 'gives' electrical energy' do not score.

The specification talks about 'induced current' and 'the generation of electric current by induction'.

(ii) Explain how this new type of shock absorber can provide electrical energy.

(2)

when the ~~a~~ magnet passes through the coil of wire, it will induce an electrical current because it is crossing ~~a~~ the magnetic field.

ResultsPlus
Examiner Comments

This candidate has scored both marks.

Question 3 (b) (iii)

The final part of this question was the most challenging, and required students to apply what they knew about the factors which affect the size of the induced current into a practical situation.

There were marks for how the induction depended on the frequency of movement and the amount of penetration of the coil by the magnet.

(iii) The diagram shows the bumps on the surface of two roads, L and M.
Explain why the device will transfer more energy on road L than on road M for a motorcycle travelling at the same speed.

(3)

road L

road M

Road L has more bumps compared to the smaller road M which has bumps that are more gradual compared to the abrupt and uneven bumps on road L. This means that at the same speed, more kinetic will be transfered into electrical energy on road L as the increased number of bumps means more electromagnetic induction can occur as the coil moves ~~more~~ more and at a higher rate.

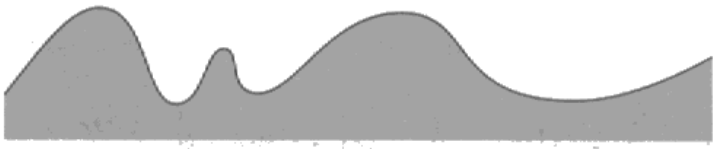
(Total for Question 3 = 10 marks)

ResultsPlus
Examiner Comments

This candidate described both factors concisely in the final seven words. Electromagnetic induction was the chosen way of expressing the energy transfer.

(iii) The diagram shows the bumps on the surface of two roads, L and M.
Explain why the device will transfer more energy on road L than on road M for a motorcycle travelling at the same speed.

(3)



road L

road M

Road M can only pound a gentle (slow) bump which wouldn't
and induce much current. It also only goes up and down (a complete wave)
once so less induction. The reverse is true for road L as it has
high enough bumps to induce and frequent enough to make through
more energy. ✓

(Total for Question 3 = 10 marks)

ResultsPlus
Examiner Comments

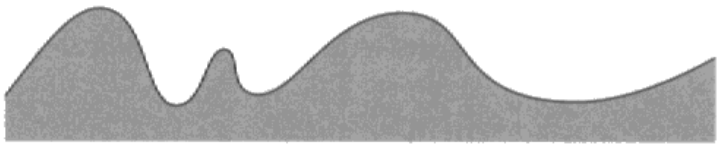
There were different ways of including the same three ideas.

ResultsPlus
Examiner Tip

Here the factors affecting the induced current were 'high enough' and 'frequent enough'.

(iii) The diagram shows the bumps on the surface of two roads, L and M.
Explain why the device will transfer more energy on road L than on road M for a motorcycle travelling at the same speed.

(3)



road L

road M

• It will transfer more energy on road L because the device works when the motorcycle goes over bumps - there are ~~tarq~~ more bumps on road L then M as road M is smoother. The bumps on L are also larger and more frequent

(Total for Question 3 = 10 marks)

ResultsPlus
Examiner Comments

Sometimes the factors were identified but not related to the energy transfer.

Question 4 (a)

Most candidates were able to express their ideas of 'frequency ranges'.

Some were expressed in terms of numbers.

(a) The noise from the explosion was described as the loudest sound ever detected on Earth.
However, human beings could not hear this sound.
State the **two** sound frequency ranges that human beings cannot hear.

(2)

Below 20 Hz and above 20 kHz.

ResultsPlus
Examiner Comments

These values are the ones stated in the specification.

Some people tried to answer by simply giving a specimen value within each range such as 19 Hz and 21 000 Hz.

ResultsPlus
Examiner Tip

To score full marks here it was necessary to include an appropriate unit somewhere eg Hz or kHz. Students must be convinced that, in most cases, numbers on their own are not enough.

(a) The noise from the explosion was described as the loudest sound ever detected on Earth.
However, human beings could not hear this sound.
State the **two** sound frequency ranges that human beings cannot hear.

(2)

Infrasound + Ultrasound

ResultsPlus
Examiner Comments

Most candidates, however, gave the ranges in words and of course scored full marks for this.

There was a degree of sympathy for this response.

(a) The noise from the explosion was described as the loudest sound ever detected on Earth.
However, human beings could not hear this sound.
State the **two** sound frequency ranges that human beings cannot hear.

(2)

ultra violet, Infared

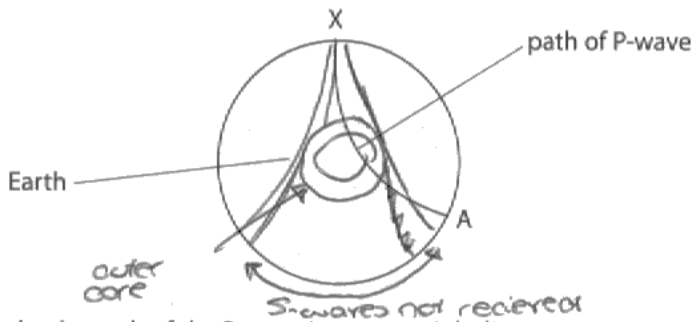
ResultsPlus
Examiner Comments

Unfortunately, no marks could be awarded for the answer.

Question 4 (b) (ii-iii)

This two-part question tested ideas of refraction and the inability of S-waves to pass through liquids.

The diagram shows the path of a P-wave.
The P-wave travels from the collision at X, through the Earth, to another point, A.



(ii) Explain why the path of the P-wave is not a straight line.

(2)

denser

The wave is refracted from the materials that it travels through and so its speed and direction changes.

(iii) Explain why there are regions on the Earth's surface where S-waves from the collision at X cannot be detected. You can add to the diagram to help your answer.

(3)

S-waves are transverse and so they can't travel through the liquid the Earth's outer core, they are lost and can't be detected from underneath the outer core, or the other side of the planet

ResultsPlus
Examiner Comments

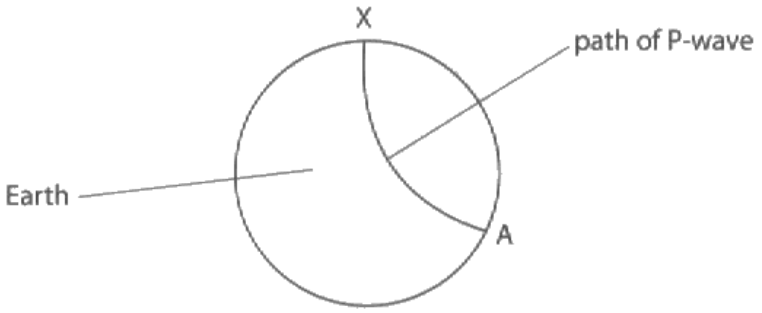
In both parts, this candidate scores the second mark for the afterthoughts.

ResultsPlus
Examiner Tip

Candidates should always try to leave time to read through the responses at the end.

Many candidates scored the first marking point by either mentioning refraction or the change in speed.

The diagram shows the path of a P-wave.
The P-wave travels from the collision at X, through the Earth, to another point, A.



(ii) Explain why the path of the P-wave is not a straight line.

(2)

Because it refracts from the centre of the earth.

(iii) Explain why there are regions on the Earth's surface where S-waves from the collision at X cannot be detected. You can add to the diagram to help your answer.

(3)

Because the S waves cannot travel through liquid and could therefore not be able to get to point X.

ResultsPlus
Examiner Comments

Few went on to mention density changes within the Earth. A variety of other reasons were given in part (i) for the curvature of the wave. These included gravitational effects.

This candidate did not say for part (ii) where the liquid was and so scored only one mark as X was also incorrectly used. Many said that the S-waves could not pass through the *water* of the oceans. They scored zero.

The same score was given to responses which related lack of detection to lack of sufficient speed.

Question 4 (b) (iv)

There were many quite good answers to this application item with most of these successfully linking previous knowledge about earthquakes to the novel situation presented in the stem.

(iv) Describe how a meteor colliding with the Earth could set off an earthquake.

(2)

The meteor could cause the ~~so~~ plates to move against eachother rapidly which causes an Earthquake.

(Total for Question 4 = 10 marks)

ResultsPlus
Examiner Comments

Many candidates were able to give sufficient idea of what an earthquake was to score one mark. The second mark could be scored in terms of the suddenness of the energy release, the names or symbols of the waves that were formed or some description of the meteor in terms of energy, force or momentum.

Far too many though thought that earthquakes were caused by P and S waves rather than the reverse.

(iv) Describe how a meteor colliding with the Earth could set off an earthquake.

(2)

It could cause the tectonic plates to collide with one another or move around - This causes an earthquake.

(Total for Question 4 = 10 marks)

ResultsPlus
Examiner Comments

This response related the collision to the tectonic plates' movement but was not specific enough to show how the plates move to produce an earthquake. It, thus, scored only 1 mark.

Question 5 (a)

This item tested recall of information given directly in a specification statement.

This response was one of the many seen which were too vague or inaccurate.

(a) Explain the purpose of the eyepiece in a telescope.

(2)

The eyepiele allows you to look through the telescope at a closer range which you cant see with the naked eye

ResultsPlus

Examiner Comments

As many as two thirds of the candidates correctly stated that the eyepiece magnified something. Less than a quarter of these then proceeded to identify what was being magnified. There was a variety of acceptable descriptions for this ranging from the image at the focal point (either lens), the real image or the image formed by the objective lens. Providing greater detail was acceptable but focussing the image or making it clearer was not. Many candidates mentioned inversion of the image or turning it the right way up. Apart from being too vague, neither is the purpose of the eyepiece.

Question 5 (b)

There were many valid ideas to suggest for this hypothetical situation.

One of the most popular responses featured provision of evidence. Other equally valid ideas included that Galileo would not have had to keep looking through his telescope while making the drawings and the concept that greater accuracy of scaling would be possible. Vague mentions of more detail, or the use of zoom were insufficient to merit credit.

(b) Galileo drew pictures of his observations of Jupiter.
Nowadays we can take photographs.
Suggest how photographs would have helped Galileo.

(1)

They would have helped
had Show the world his
findings accurately

ResultsPlus
Examiner Comments

This candidate earned the mark in two different ways.

(b) Galileo drew pictures of his observations of Jupiter.
Nowadays we can take photographs.
Suggest how photographs would have helped Galileo.

(1)

It can help him to look at stars and planets in more detail, it can also help for mapping different stars and planets positions. By leaving the telescope and shutter screen at different times and expose them you can see different amounts of light coming from the stars and planets.

ResultsPlus
Examiner Comments

By contrast, this candidate scored zero even though writing considerably more words.

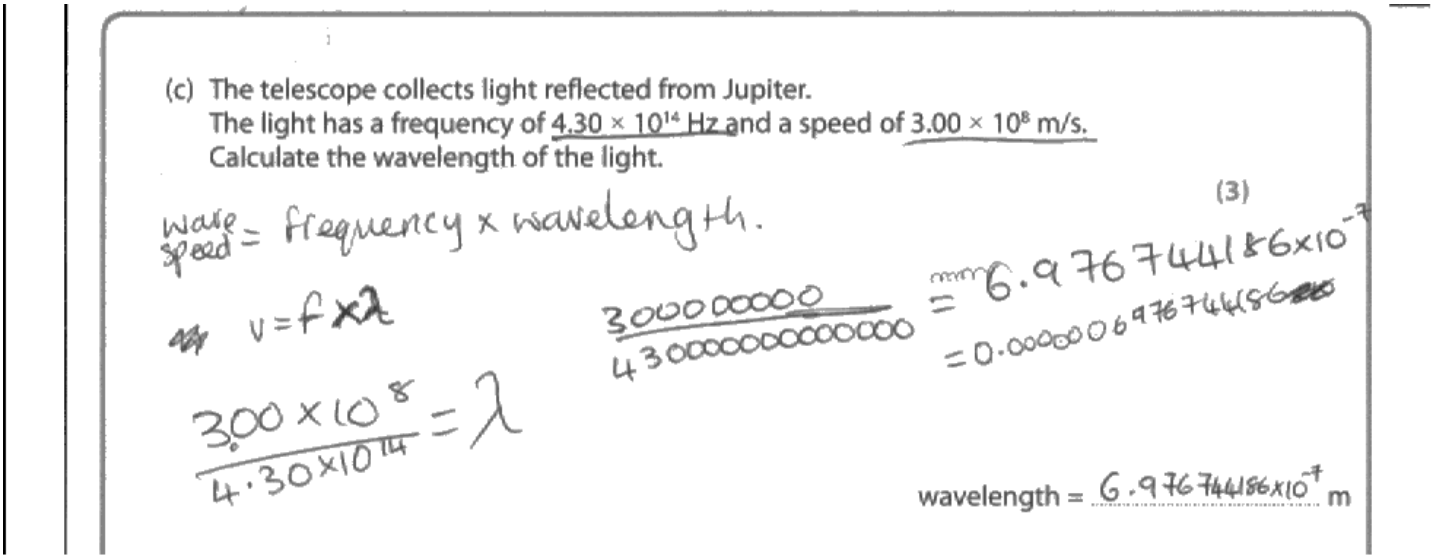
ResultsPlus
Examiner Tip

Candidates should be encouraged to spend a short time thinking about their response before launching into it. Many responses would be more creditworthy and be written in less time if this was done.

Question 5 (c)

Three mark calculations like this usually involve a mark for substitution, a mark for transposition and a mark for calculation (including relevant powers of 10 for the unit).

Most calculations at least got as far as 6.98 or equivalent and so qualified for the first 2 marks.



(c) The telescope collects light reflected from Jupiter.
The light has a frequency of 4.30×10^{14} Hz and a speed of 3.00×10^{8} m/s.
Calculate the wavelength of the light.

(3)

wave speed = frequency x wavelength.

$v = f \times \lambda$

$\frac{300000000}{430000000000000} = 6.976744186 \times 10^{-7}$

$= 0.000000697674418$

$\frac{300 \times 10^{8}}{4.30 \times 10^{14}} = \lambda$

wavelength = $6.976744186 \times 10^{-7}$ m

ResultsPlus
Examiner Comments

Of these, only about 50% were able, like this candidate, to use either standard form or decimal representations correctly to gain the third mark.

ResultsPlus
Examiner Tip

Although there was no penalty on this occasion for over-expression of significant figures, candidates should be introduced to the inadvisability of going to number of sf or dp beyond those in the given data.

No credit is given for simply writing 'the triangle' since, even if it is correct, no explanation is given as to how to use it. It qualifies for neither the substitution nor the transposition mark.

Question 5 (d)

To score full marks on this question it was necessary to describe three things - what each model was and what the observations of the moons were - and then explain the sufficiency of proving one wrong without proving the other one correct.

This candidate produced a clear and structured response.

*(d) Galileo's observations of the moons of Jupiter disproved the geocentric model. However, these observations were not enough to prove the heliocentric model of the Solar System.
Explain why Galileo's observations disproved one model but were not enough to prove the other model.

(6)

The Geocentric model was that everything orbited Earth. ~~The moons of J~~ When galileo found jupiters moons this proved the model wrong. This is because the moons are orbiting Jupiter and not the Earth, proving that not everything orbits Earth. On the other hand this was not ~~an~~ enough evidence to support the heliocentric model (everything orbits the sun) because it did not prove that the Sun or anything was in the centre it just proved that not everything orbits Earth.

(Total for Question 5 = 12 marks)

ResultsPlus
Examiner Comments

The explanation for not proving the heliocentric model was just sufficient to score all six marks.

*(d) Galileo's observations of the moons of Jupiter disproved the geocentric model. However, these observations were not enough to prove the heliocentric model of the Solar System.
Explain why Galileo's observations disproved one model but were not enough to prove the other model.

(6)

Because we didn't have evidence of the heliocentric model or any clear image of the heliocentric model, as well he only observed Jupiters moons and no other planets

(Total for Question 5 = 12 marks)

ResultsPlus
Examiner Comments

This candidate did not show any idea of what either model was or even what the observations of the moons were. It scored zero.

*(d) Galileo's observations of the moons of Jupiter disproved the geocentric model. However, these observations were not enough to prove the heliocentric model of the Solar System.
Explain why Galileo's observations disproved one model but were not enough to prove the other model.

(6)

Galileo's observations ~~of~~ disapproved the geocentric model because he showed that not everything orbited the earth but didnt prove the heliocentric ~~method~~ model because he had no evidence ~~everything orbited the sun~~ to the fact everything orbited the sun.

(Total for Question 5 = 12 marks)

ResultsPlus
Examiner Comments

There is no mention in this piece of prose that the moons orbit Jupiter. Thus, the (quite poor) description of the models was all that could be credited and it scored 2 marks.

Question 6 (a) (ii)

This item demanded a description of part of the full sequence involved in the evolution of a star.

(ii) Describe how the Sun reached its main sequence stage.

(3)

Gas clouds in space made up of hydrogen came together and became hotter and denser heating it up turning into a nebula then one it becomes even hotter it turns into a protostar then lastly one it had expanded enough it would go into its main sequence.

ResultsPlus
Examiner Comments

This response benefited from the description of the gases forming a nebula and becoming hotter and denser. It did not, however, show any knowledge of the specification statement regarding the role of gravity. Neither did it show what the star was like in the Main Sequence.

ResultsPlus
Examiner Tip

Candidates should be aware that 'describe' questions require more than a simple 'state' item. Mere statement of 'protostar' was insufficient.

By contrast, this candidate gave a much fuller description.

(ii) Describe how the Sun reached its main sequence stage.

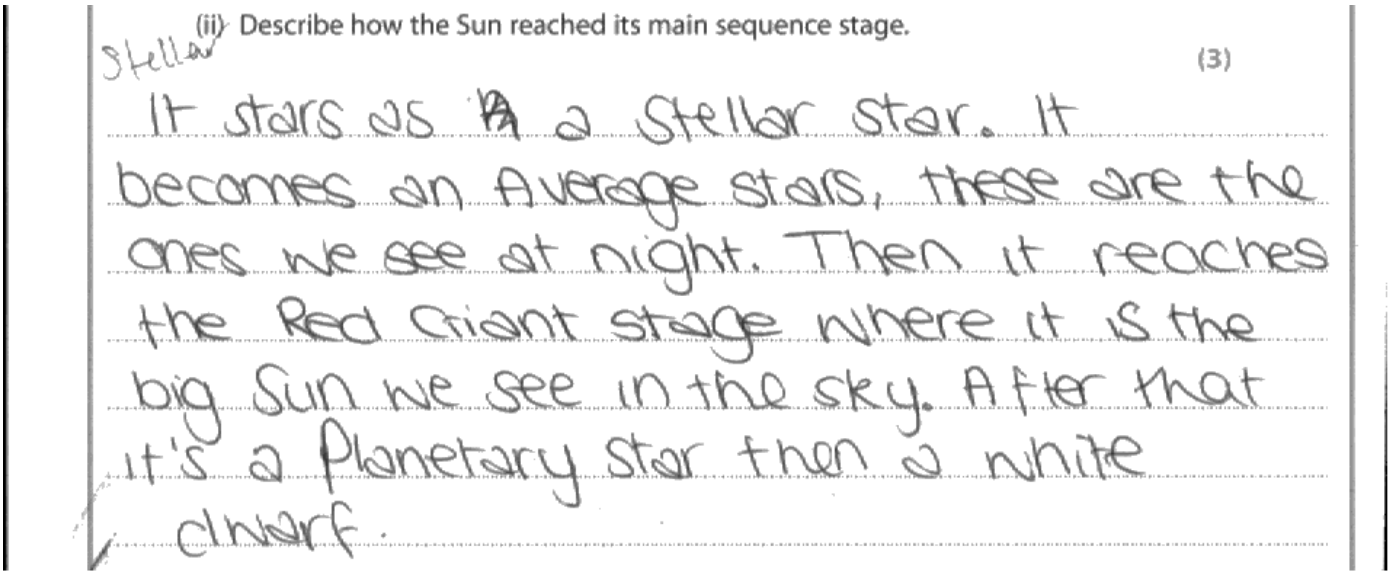
(3)

The Sun started off as a nebula formed from ~~the~~ gas and dust. The Sun then became a main sequence star as the hydrogen nuclei went through the process of ~~the~~ thermonuclear fusion to produce helium nuclei. In this stage the force of gravity acting inwards on the Sun balanced out the force from the reaction pushing outwards. This dust and gas circled and came together because of the force of gravity.

ResultsPlus
Examiner Comments

The three marks would have been scored without this amount of detail but it was good to see.

Some tried (unsuccessfully in this case) to answer just by naming the evolutionary stages of stellar development. There is no need even in these descriptions to go beyond the Sun as we know it.


(ii) Describe how the Sun reached its main sequence stage.

(3)

Stellar

It stars as ~~A~~ a Stellar Star. It becomes an Average stars, these are the ones we see at night. Then it reaches the Red Giant stage where it is the big Sun we see in the sky. After that it's a Planetary Star then a white dwarf.

ResultsPlus
Examiner Comments

This candidate included no explanation of *how* the main sequence stars develop. It scored zero.

Question 6 (a) (iii)

For this item, candidates were expected to use their knowledge of the meaning of the technical term 'Universe' and of the time scale involved in the evolution of stars to suggest why the results of a particular experiment were inadequate.

(iii) Scientists can estimate the age of a star. They want to find the age of the oldest star.

Suggest why knowing the age of the oldest star is not enough to tell scientists the age of the Universe.

(2)

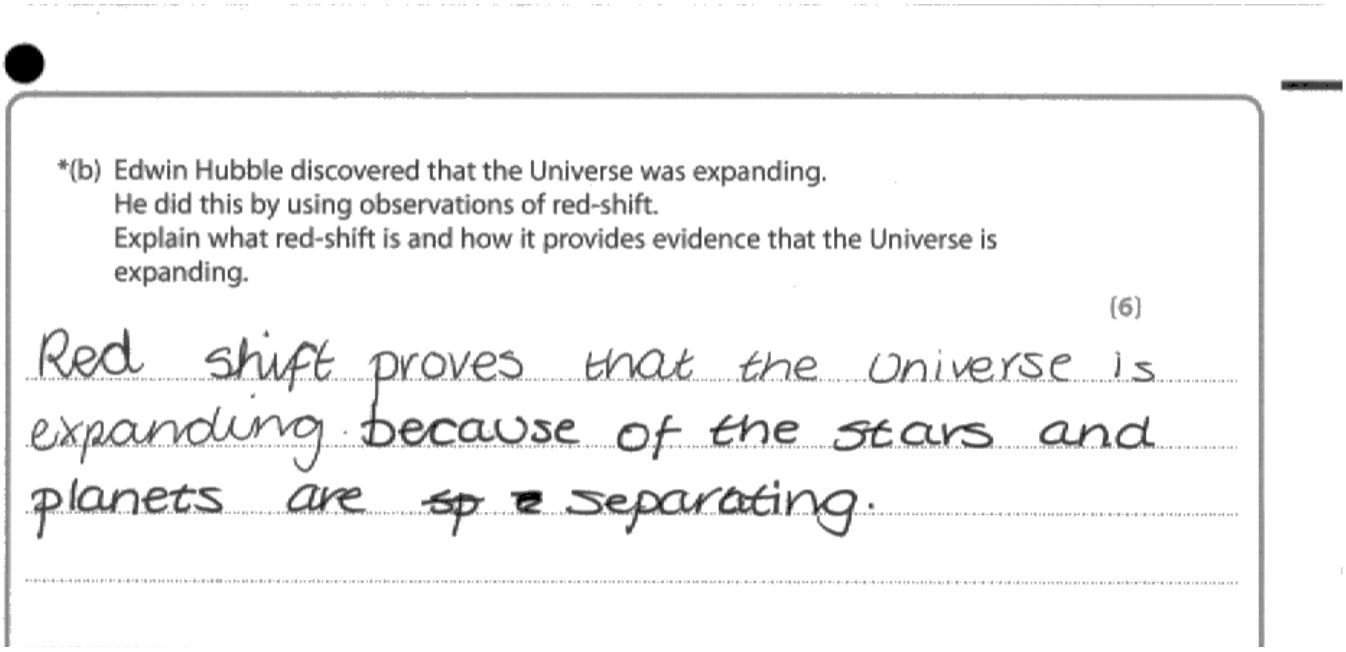
The stars took time to make as ah gasses had to come together to create it so the universe is older than the stars.

ResultsPlus
Examiner Comments

This is just sufficient to score both marks. It demonstrates the ideas that the Universe is older than (even) the (oldest) stars and that stars take time to form. These were the two marking points that candidates scored. A few mentioned the uncertainty of measurement and comparatively few mentioned the Big Bang as the start of the Universe.

Question 6 (b)

It was quite surprising to discover that a not insignificant number of people thought that the red-shift was either a distant place that astronomical objects are approaching, or a part of the electromagnetic spectrum somewhere between the red and infrared sections.



*(b) Edwin Hubble discovered that the Universe was expanding.
He did this by using observations of red-shift.
Explain what red-shift is and how it provides evidence that the Universe is expanding.

(6)

Red shift proves that the Universe is expanding because of the stars and planets are sp e separating.

ResultsPlus
Examiner Comments

This response adds little to the information supplied in the question. It scored zero.

*(b) Edwin Hubble discovered that the Universe was expanding.
He did this by using observations of red-shift.
Explain what red-shift is and how it provides evidence that the Universe is expanding.

(6)

Red-shift shows that galaxies are moving further away from us. It provides evidence that the universe is expanding because everything is moving further away from each other into space so it means that the universe is getting bigger.

ResultsPlus
Examiner Comments

Here the candidate successfully shows understanding of the idea of expansion in terms of everything moving away from everything else.

ResultsPlus
Examiner Tip

To move into level 2, the response should include an explanation of what red-shift is.

*(b) Edwin Hubble discovered that the Universe was expanding.
He did this by using observations of red-shift.
Explain what red-shift is and how it provides evidence that the Universe is expanding.

(6)

Red-shift is when light from other stars/galaxies is shifted more towards the red end of the spectrum than we would expect. Galaxies further away from us emmit light further towards the red end of the spectrum than galaxies near us. This suggests that galaxies further away from us are moving away faster as the light is taking even longer to reach us than we expect.

ResultsPlus
Examiner Comments

The first three lines adequately describe the red shift and the effect on this when the star is further away. This scored 4 marks.

ResultsPlus
Examiner Tip

To score 6 marks, the response in addition should include some idea of the wavelength/frequency change and an expression of the expansion idea such as that above.

Paper Summary

There has been a gradual improvement in the quality of expression in the extended writing questions.

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

- candidates need to realise that there are stepped changes in the levels not just a quantitative increase in the amount of information to be recalled
- for the higher levels, ideas often have to be linked or given in a logical sequence or used in discussion of evidence for various things (many candidates are now becoming adept at these and thus scoring highly on the six-mark questions)
- candidates need to be aware that it is not enough to write down ONLY the numerical answer to a calculation
- candidates need to remember that they fail to gain credit for any partially correct working which produces an incorrect number
- when candidates finish early they should always go back and re-read their responses, carefully reviewing them to identify contradictions/errors.

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

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE