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Examiners' Report
June 2012

GCSE Physics 5PH1H 01

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June 2012

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Introduction

This unit of the new specification has now been examined three times. The unit is divided into six topics and all six topics are tested in the examination.

The question paper should allow every candidate to show what they know, understand and are able to do. To achieve this, each paper is designed to increase in difficulty as a candidate progresses through it. Within the paper, a variety of questioning styles is included, such as objective questions, short answer questions worth one or two marks each and longer questions, each worth three, four or five marks. The two six mark questions are designed also to test the quality of written communication.

Successful candidates were:

- well-grounded in the fundamental knowledge required
- willing to think through the possibilities and apply their knowledge when the question asked for suggestions to explain new situations
- able to tackle calculations methodically and show the stages in their working
- able to construct their explanations in a logical order, using the mark allocations given beside the parts of each question as a guide.

Less successful candidates:

- had gaps in their knowledge
- found difficulty in applying their knowledge to new situations
- did not do well in calculations involving changing the subject of an equation
- did not show the stages in their working.

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

Question 1 (b) (ii)

Many candidates described the image itself, rather than how its position could be shown. The more able candidates appeared to be answering from practical experience.

(ii) Describe how the position of this image can be shown.

(2)

You can move a white peice of paper towards and away from the objective lens until a focussed, inverted and diminished image of the distant object appears on the paper, this is called the focal point.

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Examiner Comments

This full response covered all of the points required and more.

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Examiner Tip

When you describe an experiment that you have done, be sure to mention the equipment you used and the way you used it.

(ii) Describe how the position of this image can be shown.

(2)

You can focus the image on a screen

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Examiner Comments

This brief response gave just enough detail for two marks.

Question 1 (c)

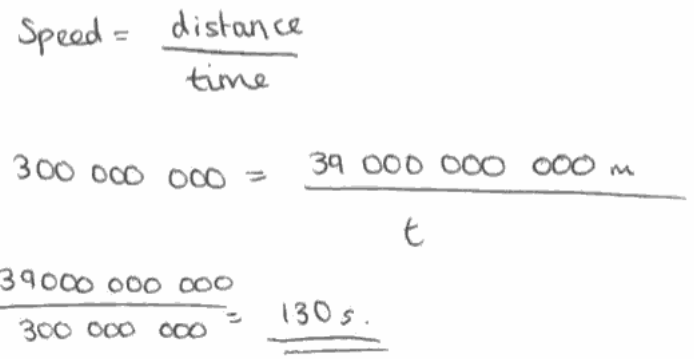
Candidates were expected to state that the eyepiece magnifies the image. Most could do this.

Question 1 (d)

The calculation involved transposing the equation given at the front of the paper, substituting the values from the question and working with large numbers. Candidates who did not transpose correctly, but showed their working clearly, could still gain a mark for their substitution. Few candidates took the opportunity to simplify their calculation by cancelling zeros. Most candidates who confused the powers of ten were still able to gain two marks.

(d) The telescope is used to look at the planet Venus.
Assume that the distance from Venus to the Earth is 39 000 000 km.
The speed of light is 300 000 000 m/s.

Calculate the time it takes for light to travel from Venus to the Earth.

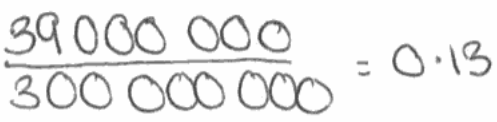


ResultsPlus
Examiner Comments

In this correct response the candidate showed their working.

(d) The telescope is used to look at the planet Venus.
Assume that the distance from Venus to the Earth is 39 000 000 km.
The speed of light is 300 000 000 m/s.

Calculate the time it takes for light to travel from Venus to the Earth.



ResultsPlus
Examiner Comments

This response was correct in all respects except for the power of ten. The candidate used mismatched units and so their final answer was 1000 times too small. Nevertheless, the response received two of the three marks available.

(d) The telescope is used to look at the planet Venus.
Assume that the distance from Venus to the Earth is 39 000 000 km.
The speed of light is 300 000 000 m/s.

Calculate the time it takes for light to travel from Venus to the Earth.

(3)

speed = distance x time

speed ÷ distance = time

300 000 000 ÷ 39 000 000 = 7.69

time = 8 s

ResultsPlus
Examiner Comments

This response showed an incorrect choice of equation. However the substitution (allowing for powers of ten) was correct on the basis of this initial error. Thus the candidate received one mark for a correct 'substitution'. There was no mark for the evaluation as that was bound to yield an incorrect result.

Examiners would ignore the triangle shown to the right, but there is no harm in candidates jotting down this sort of mnemonic if they find it helpful.

ResultsPlus
Examiner Tip

Always show your working. You can still get marks even if your final answer is wrong.

Question 2 (a) (i)

Some candidates found it difficult to express the idea of efficiency with adequate clarity. The best responses correctly linked the ideas of proportion and useful transfer.

(a) A 100 W filament lamp is 15% efficient.

(i) Explain the meaning of the term **15% efficient**.

(2)

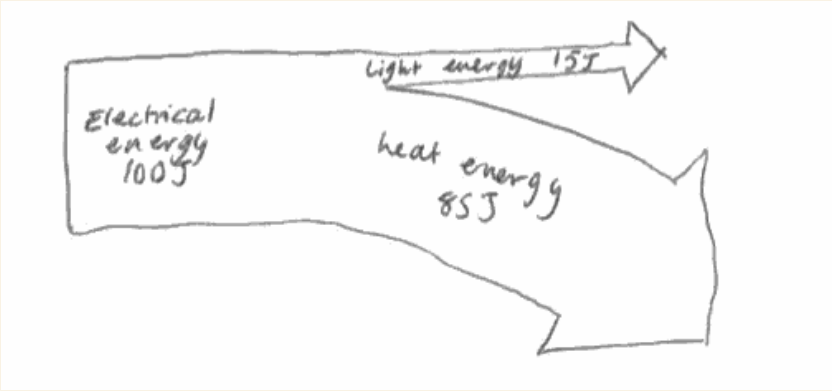
15% of the energy used by the ~~bg~~ lamp is for useful purposes (i.e. the light). The rest is wasted.

ResultsPlus
Examiner Comments

This is an example of a good response.

Question 2 (a) (ii)

Candidates were not necessarily expected to draw a Sankey diagram, although most did. Any diagram that clearly showed the fate of the energy involved was accepted. Most diagrams gained full credit, but some candidates showed unacceptable imprecision in their choice of terms (e.g. 'efficient' energy), use of units or mental arithmetic.



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Examiner Comments

Many candidates drew a good Sankey diagram with correct labelling.

ResultsPlus
Examiner Tip

Always label your diagrams clearly. Always use the correct unit for quantities.

Question 2 (b)

Most candidates were able to respond well here. Candidates also received credit for giving appropriate practical and economic reasons for choosing low-energy lamps.

(b) Many people choose to buy expensive low-energy lamps instead of cheaper filament lamps.

Give **two** reasons for this.

(2)

Low energy lamps will cost less to run and low energy lamps are better for the environment because they use less energy, burning less fossil fuels thus releasing less carbons emissions into the atmosphere.

ResultsPlus
Examiner Comments

This candidate made economic and environmental points well and the response gained two marks.

(b) Many people choose to buy expensive low-energy lamps instead of cheaper filament lamps.

Give **two** reasons for this.

(2)

• The low energy lamps last longer than the filament lamps • The low energy lamps do not waste as much energy as the filament lamps

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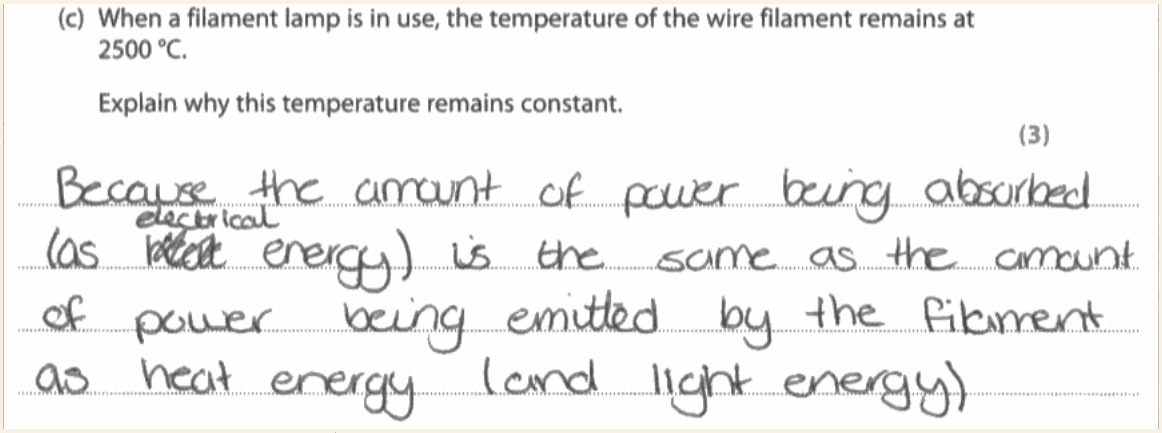
Examiner Comments

This response received two marks for a practical point and for the point about energy waste.

Question 2 (c)

Many candidates could explain the idea of equilibrium. An explanation, given in terms of a simple equality between amounts of energy lost and gained, was accepted. Some more thoughtful responses that mentioned the rates of energy loss and gain were also seen.

However, few candidates went on to link their explanation to the mechanisms by which energy is lost or gained. The idea that the energy loss from the filament is by radiation was rarely mentioned.



(c) When a filament lamp is in use, the temperature of the wire filament remains at 2500 °C.

Explain why this temperature remains constant.

(3)

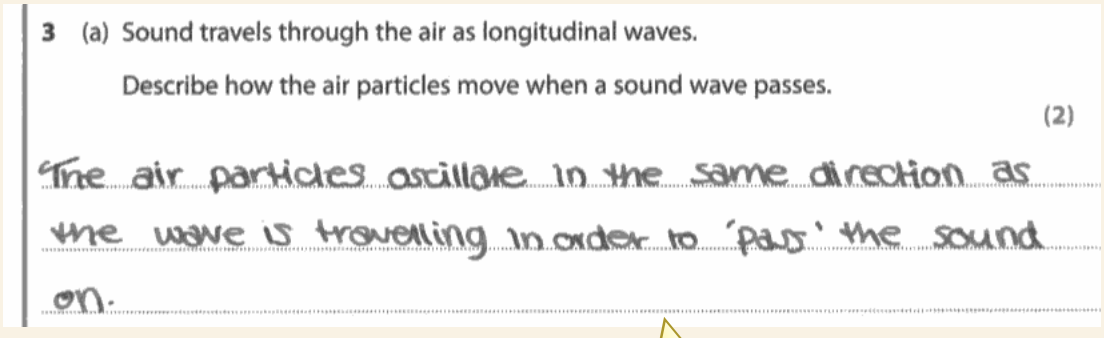
Because the amount of power being absorbed (as ~~heat~~ electrical energy) is the same as the amount of power being emitted by the filament as heat energy (and light energy)

ResultsPlus
Examiner Comments

Even though the word 'radiation' was not used the idea of emitting thermal (and light) energy was clearly stated. This response received three marks.

Question 3 (a)

Most candidates knew that the air particles would vibrate, but few could relate the direction of this vibration to the direction of the waves.



3 (a) Sound travels through the air as longitudinal waves.

Describe how the air particles move when a sound wave passes.

(2)

The air particles oscillate in the same direction as the wave is travelling in order to 'pass' the sound on.

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Examiner Comments

This was a good response to the question and it received two marks.

Question 3 (c) (i)

Again, some allowance was made for candidates who found it hard to transpose an equation correctly. Provided that their working showed clearly that they were using the equation sensibly to test the data, then at least some of the marks were available. Many candidates omitted to take the return journey into account, but still gained some credit for showing some appropriate working.

Elephant A emits an infrasound call.
When elephant B hears the infrasound, it calls back.
Elephant A hears the answering call from elephant B.
The speed of infrasound is 340 m/s.

(i) Show that the minimum time for elephant A to call and hear an ar elephant B is about 15 s.

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

$= \frac{2500\text{m}}{340\text{m/s}} = 7.4\text{s}$

ResultsPlus
Examiner Comments

Here the candidate showed that the time for the infrasound to travel one way was 7.4 s. The proof was incomplete, but there was still much creditworthy material. The marks for transposition and substitution were both given. The examiner gave a total of two marks for this response

Had the candidate transposed incorrectly, but still shown this much clarity of working, then it could have been possible to give a mark for substitution despite the error.

ResultsPlus
Examiner Tip

Always show your working. You can get some marks even if your final answer is wrong.

Elephant A emits an infrasound call.
When elephant B hears the infrasound, it calls back.
Elephant A hears the answering call from elephant B.
The speed of infrasound is 340 m/s.

(i) Show that the minimum time for elephant A to call and hear an answer from elephant B is about 15 s.

(3)

speed = distance / time

time = distance / speed

$t = \frac{2500}{340}$

$t = 7.352941176$ (one way)

(there and back)

$7.35... \times 2 = 14.70588235$

rounds up to approx.

time = 15 secs

ResultsPlus

Examiner Comments

This was an excellent response to the question. The candidate showed full working and made the effort to annotate their work.

Had there been an error in the final evaluation, then some of the marks would still have been available.

Question 3 (c) (ii)

This part of the question was generally answered well. Even candidates who had found the earlier calculation difficult were able to give a worthwhile response.

Question 3 (d)

This question yielded a number of responses that showed confusion between infrasound and ultrasound, though more able candidates gave good answers. Many mentioned the monitoring of volcanic activity.

(d) Describe a use of infrasound that does not involve animals.

(2)

To detect when volcanoes are going to erupt they emit infrasound.

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Examiner Comments

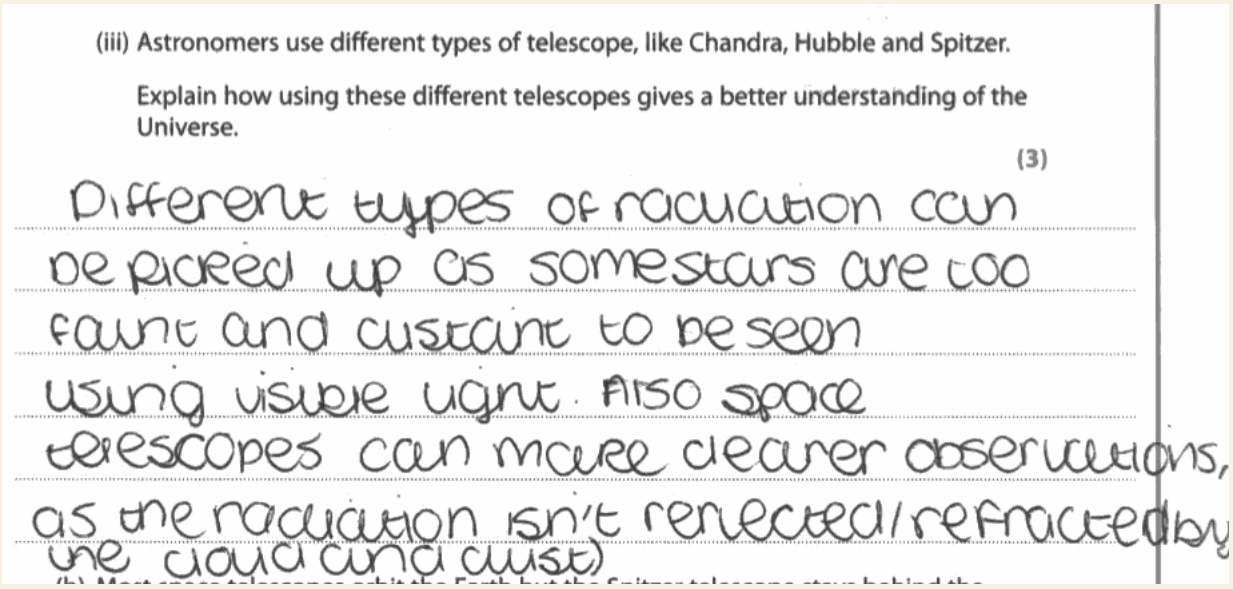
This was typical of a good response and received two marks.

Question 4 (a) (ii)

The majority of candidates were able to put the waves into the correct sequence.

Question 4 (a) (iii)

Many candidates were able to begin their explanation by making one valid point, but few were able to link it to any other ideas. Many responses merely reiterated the same point, for instance that the space telescopes could produce clearer or magnified images, without linking it to any additional information that the range of frequencies might give.



(iii) Astronomers use different types of telescope, like Chandra, Hubble and Spitzer.

Explain how using these different telescopes gives a better understanding of the Universe.

(3)

Different types of radiation can be picked up as some stars are too faint and distant to be seen using visible light. Also space telescopes can make clearer observations, as the radiation isn't reflected/refracted by the cloud and dust)

ResultsPlus

Examiner Comments

The idea that there are objects that are not detectable (some stars not seen using visible light) and the idea that space telescopes avoid atmospheric interference were both valid points. The examiner gave this response two marks.

This was one of the better responses seen. Very few candidates made three points in their explanation.

Question 4 (b)

There were some excellent responses to this question. Many candidates correctly reasoned that infrared radiation from the Sun would swamp the image. Since a suggestion was invited, credit was given for the correct ideas, even when these were expressed in loose terms.

(b) Most space telescopes orbit the Earth but the Spitzer telescope stays behind the Earth to hide from the Sun.

Suggest why this is necessary.

(2)

It uses infrared waves which detect heat and as the sun gives out heat it may interfere with the pictures it takes.

ResultsPlus

Examiner Comments

This suggestion makes the points that the telescope used infrared waves and that heat from the Sun could interfere with the image. Two marks were given for this response.

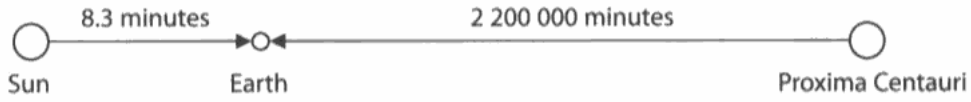
Question 4 (c) (i)

Most candidates were able to calculate at least one of the distances correctly, and many evaluated both.

The candidates were also expected to compare the distances, but some merely stated the two values and left it at that. Those who compared the distances successfully found various appropriate ways to express the idea.

(c) Outside our Solar System, the star closest to Earth is called Proxima Centauri.
Light from this star takes 2 200 000 minutes to reach the Earth.
Light from the Sun takes 8.3 minutes to reach the Earth.
The speed of light is 18 000 000 km/minute.

not to scale



(i) By calculation, compare the distance of Proxima Centauri from the Earth with the distance of the Sun from the Earth.

(2)

Sun to Earth (distance) = 149400000 km ← 8.3 x 18000000
Proxima Centauri to Earth (distance) = 2200000 x 18000000 = 3.96x10
$3.96 \times 10^3 = 3960000000000$

~~So Proxi~~

Proxima Centauri is much further away from the earth than the sun.

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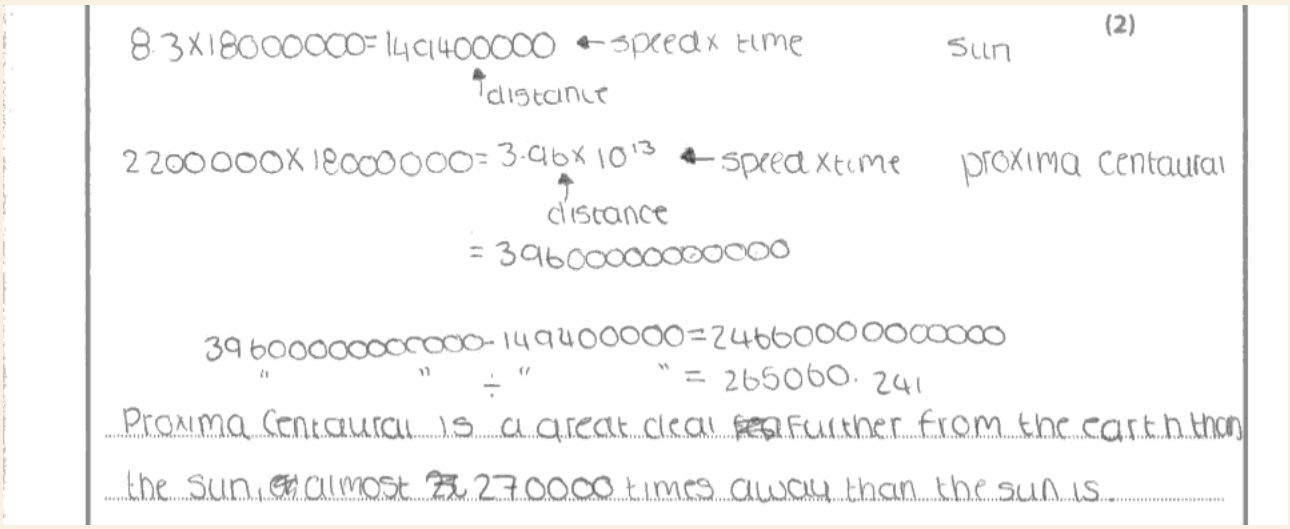
Examiner Comments

The candidate correctly calculated both distances and made a valid comparison. The examiner gave this response two marks.



ResultsPlus

Examiner Comments

The candidate calculated the distances correctly and compared them as a ratio (265060) and then confirmed this in a statement. This response received two marks.

The working was shown and also annotated carefully to ensure that the candidate's method was clear to the examiner. Excellent work.

Question 4 (c) (ii)

With the stimulus of the previous question, the candidates generally handled this unfamiliar concept very well. Again, the correct idea was expressed in a variety of ways.

(ii) A light year is the distance that light travels in one year.

Astronomers usually give the distance from stars as a number of light years instead of a number of kilometres.

Suggest a reason for this.

(1)

Stars and galaxies are so far away that to put the distance in km would be unsuitable. The length of numbers would be too big to write out otherwise.

(Total for Question 4 = 10 marks)

ResultsPlus
Examiner Comments

This response gave a good reason for the use of a larger unit and received one mark.

In space the distance is too vast for kilometers. A light year simply saves ink by removing a lot of noughts from the distance

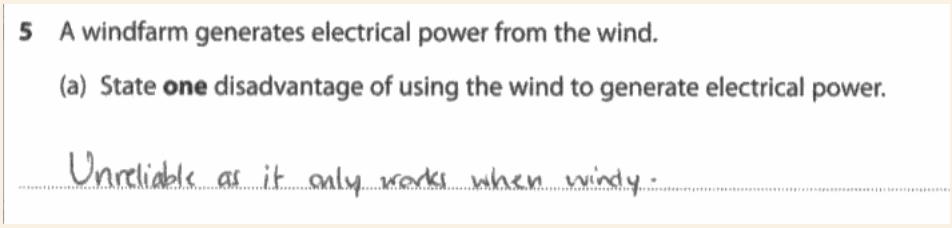
(Total for Question 4 = 10 marks)

ResultsPlus
Examiner Comments

This suggestion was also worth a mark.

Question 5 (a)

Most candidates gave a disadvantage of using the wind to generate electrical power; however, a few candidates chose to give an advantage instead. Some who had made this simple slip found time to reread their work and include a correction.



5 A windfarm generates electrical power from the wind.

(a) State **one** disadvantage of using the wind to generate electrical power.

Unreliable as it only works when windy.

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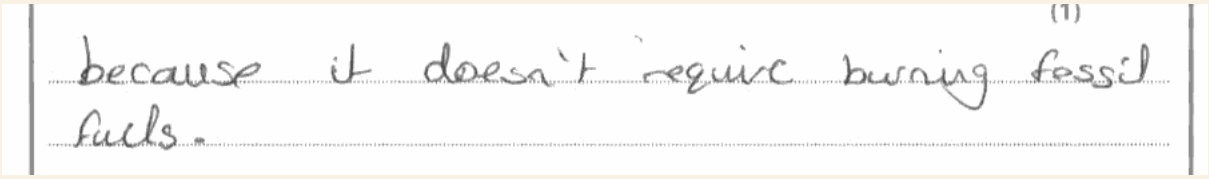
Examiner Comments

This brief answer was sufficient for the mark.



(1)

because it doesn't require burning fossil fuels.

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Examiner Comments

Here the candidate gave an advantage of using the wind to generate electrical power. The statement was true, but unfortunately no mark could be given in this case.

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Examiner Tip

Read the question carefully to make sure that you have given the right answer. If you have spare time at the end of the examination, use it to check your work.

A wind turbine is weather dependant

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Examiner Comments

This response was too vague for a mark.

Question 5 (b) (i)

This calculation was done well, but some candidates found it difficult to work with megawatts. Any error in the power of ten was taken into account only at the final stage. Thus, most responses received at least two marks for including the correct method of working, despite an error in the final value. The most common response was 2.44 A in place of 2440 A.

(3)

electrical power = current x potential difference

Current = ~~potential difference~~ electrical power ÷ potential difference

322MW ÷ 132kV = 2.439

current = 2.439 A

ResultsPlus
Examiner Comments

The candidate made a power of ten error by overlooking the different magnitudes of the units given in the data. Both transposition and substitution were correct so two of the three marks available were given for this response.

ResultsPlus
Examiner Tip

Always show your working. You can get marks for your working, even if your final answer is wrong.

(b) A windfarm generates 322 MW of electrical power.

The windfarm is connected to a transmission line at a potential difference of 132 kV.

(i) Calculate the current from the windfarm.

(3)

electrical power = current x potential difference.

$$\frac{322\,000\,000}{132\,000} = 2439.4$$

current = 2439.4 A

ResultsPlus
Examiner Comments

This was an excellent response and worth three marks.

ResultsPlus
Examiner Tip

You may write down a triangle equation if it helps you, but there are no extra marks for doing this.

Question 5 (b) (ii)

This question was usually answered well. Many candidates who did not complete the calculation still realised that they had to start by working out the difference in power.

(ii) The windfarm produces 322 MW of power.
The windfarm is to be extended by adding 75 improved turbines.
The extended windfarm will then produce a total of 539 MW.

Calculate the power produced by each improved turbine.

(2)

539
- 322
217

2·89...
75 | 217

power = 2·89 MW

ResultsPlus
Examiner Comments

This was an excellent response and was worth two marks.

The candidate has shown their working and had the final evaluation been wrong, there would still have been one mark available for the subtraction (539 - 322 = 217)

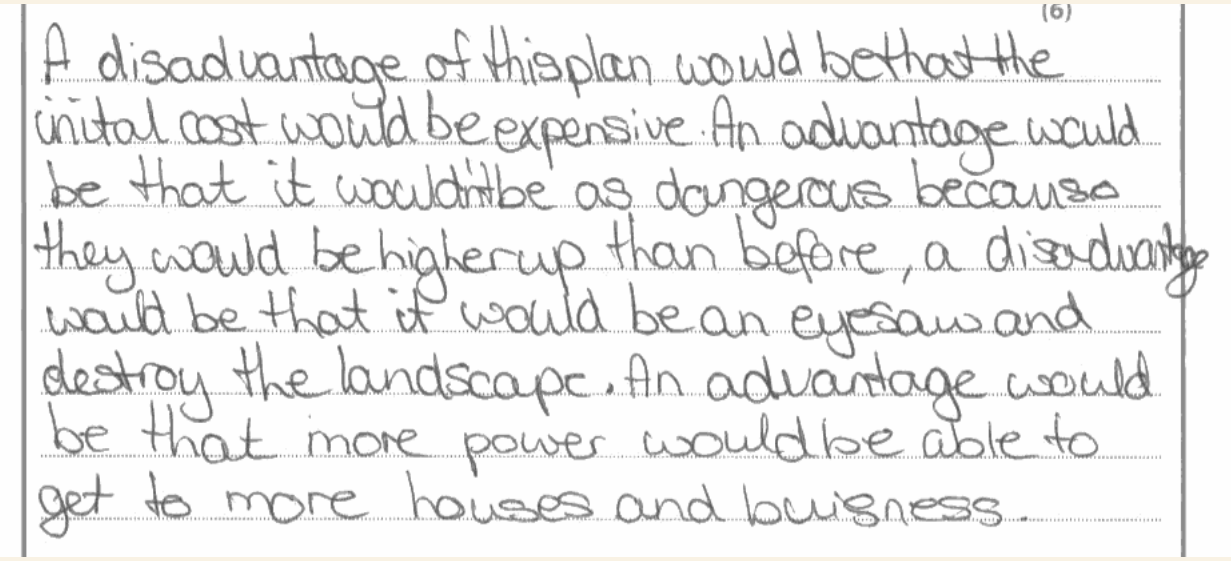
Question 5 (c)

The earlier parts of the question were designed to focus attention on the ideas of current and power before the discussion of this particular transmission line began. To gain full marks, candidates were expected to link ideas to give advantages and disadvantages of the proposed scheme and make appropriate use of the data supplied.

A minority of candidates fixed on the idea of the windfarm and instead of discussing power transmission responded with ideas about generating power from the wind. Others overlooked the specific data that was supplied at the start of the question and just gave a very general response about power transmission.

The mark scheme was designed to offer some credit in either case and the two approaches outlined above usually yielded a Level 1 and a Level 2 response respectively. Many of the Level 1 responses, which do not require the ideas to be linked, were merely bulleted lists of points. Candidates may find it difficult to develop a discussion properly if they respond using a bulleted format.

When data is supplied for discussion, the best responses made clear use of the data, and included more than just a passing reference to it. Some very good responses were seen and many candidates were able to display the quality of their written communication.


(6)

A disadvantage of this plan would be that the initial cost would be expensive. An advantage would be that it would'nt be as dangerous because they would be higher up than before, a disadvantage would be that it would be an eyesaw and destroy the landscape. An advantage would be that more power would be able to get to more houses and buisness.

ResultsPlus
Examiner Comments

This response gave some basic ideas, but these were not linked to form any kind of argument. The candidate made simple points about cost and visual pollution. The quality of written communication was appropriate to the level.

This was a Level 1 response and the examiner gave two marks.

*(c) There is a plan to replace the existing transmission line from the windfarm with one at the higher potential difference of 400 kV.

The new transmission line will cross more than 200 km of mountains.
The cables will hang 50 m above the ground from 600 new, taller pylons.
Eventually, about 1000 of the old, shorter pylons will be removed.

Discuss the advantages and disadvantages of this plan.

(6)

One advantage of this plan is that higher voltage and lower current, means that less energy is wasted through heat.* Also you will only need 600 pylons meaning less maintenance will be needed. A disadvantage would be the installation cost. This is going to cost alot to install. Another disadvantage is that the pylons are taller so any repairs needed will be more hazardous and take a longer time. Finally dismantalling the 1000 old, shorter pylons will take alot of time too, and will also be a big cost.

(Total for Question 5 = 12 marks)

* It will improve efficiancy.

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Examiner Comments

The candidate linked the ideas of higher voltage, lower current, less energy waste and improved efficiency to give a good advantage. The basic disadvantage of cost was given. The candidate goes on to make good use of the data to link the ideas of taller pylons and increased maintenance hazards and the additional cost of dismantling the old shorter pylons to offer well presented disadvantage. The quality of the written communication was perfectly good.

This response was a Level 3 and the examiner gave it six marks.

Question 6 (b) (i)

Most candidates knew a harmful effect of ultraviolet radiation and could describe it in some detail.

(b) Ultraviolet radiation and infrared radiation are emitted by the Sun and reach the surface of the Earth.

(i) Describe a harmful effect of ultraviolet radiation.

(2)

Ultraviolet can cause skin cancer as the rays can pentrate the skin.

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Examiner Comments

This was a good response and the examiner gave it two marks.

Question 6 (b) (ii)

Many weaker responses focussed on the differing outcomes of exposure to the two radiations, rather than on a comparison of the relevant dangerous physical properties. Stronger responses were able to compare the frequencies and the energies of ultraviolet and infrared.

(ii) Explain why ultraviolet radiation is likely to be more dangerous to humans than infrared radiation.

(2)

Ultra violet has higher frequency which means higher energy.

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Examiner Comments

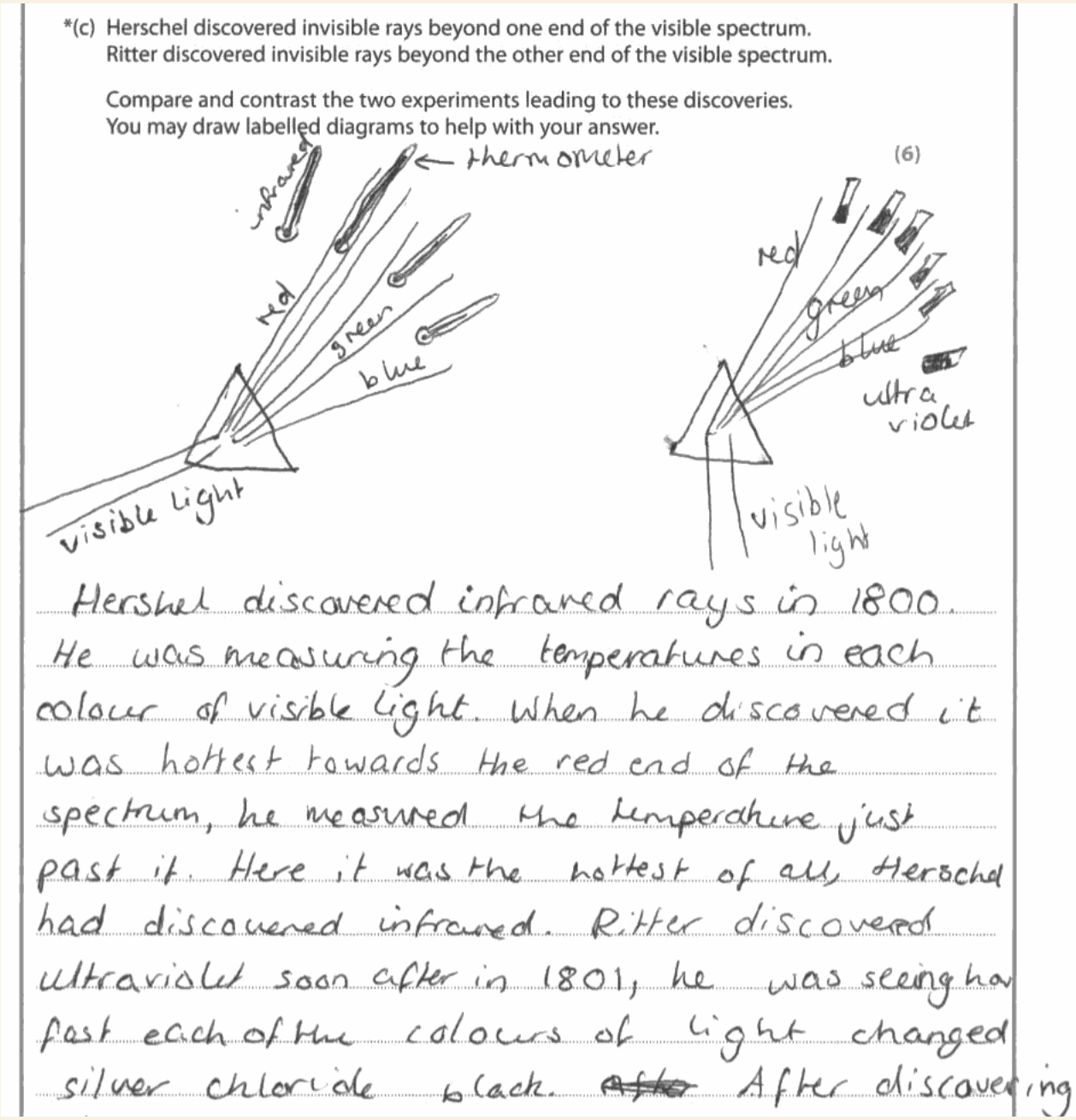
This concise response was worth two marks.

Question 6 (c)

This question elicited a full range of responses, with many candidates applying their knowledge, selection and communication skills very well. Weaker responses tended to be limited to a description of just one of the experiments (usually Herschel's) and gave enough relevant but disconnected facts to merit Level 1.

Stronger responses linked some ideas, for instance that Ritter's sensitive paper turned black more quickly when it was placed nearer to, or beyond, the violet end of a spectrum. These responses also included a simple point of similarity or difference between the two experiments and merited Level 2.

To gain full marks points of both similarity and difference and linked ideas were expected. Candidates who gave detailed descriptions of both experiments usually managed to achieve this and reached Level three.



*(c) Herschel discovered invisible rays beyond one end of the visible spectrum.
Ritter discovered invisible rays beyond the other end of the visible spectrum.

Compare and contrast the two experiments leading to these discoveries.
You may draw labelled diagrams to help with your answer.

(6)

Herschel discovered infrared rays in 1800. He was measuring the temperatures in each colour of visible light. When he discovered it was hottest towards the red end of the spectrum, he measured the temperature just past it. Here it was the hottest of all, Herschel had discovered infrared. Ritter discovered ultraviolet soon after in 1801, he was seeing how fast each of the colours of light changed silver chloride to black. ~~after~~ After discovering

it changed fastest towards the blue end of the spectrum he tried just measured passed it, and it changed black the fastest of all. This was ultra violet.

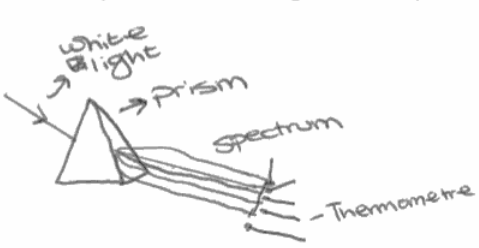
(Total for Question 6 = 12 marks)

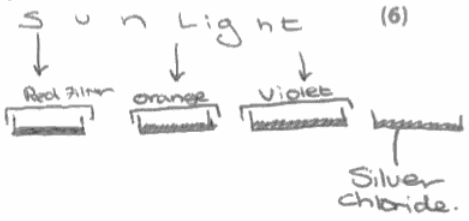
TOTAL FOR PAPER = 60 MARKS

ResultsPlus
Examiner Comments

The candidate included good descriptions of both experiments. Ideas were linked (e.g. Herschel ... measuring temperature ... hottest towards the red ... hottest of all past the red). Valid similarities (e.g. use of a prism as shown in the diagrams) and differences (e.g. use of a thermometer as opposed to sensitive paper) were given. The diagrams were not totally accurate, but they were well-labelled and gave a good idea of the arrangements used. The quality of written communication was appropriate to the level.

This was a Level 3 response and the examiner gave six marks.





Herschel split white light in the spectrum using a prism. He was interested in the temperature of the colours. Red was hottest. He then measured just past the red light, the temperature was higher still. He had just discovered infrared. Though Ritter used silver chloride. He placed ~~them~~ samples under different coloured filters, and timed which took longest to turn black. After violet he placed some just after violet it changed quickest. He had just discovered ultra violet radiation. The two experiment are completly different and find radiation with a higher and with a lower frequency of visable light. using two completally different experiments. One uses a prism to split visablelight the other filters, but both use visable light.

(Total for Question 6 = 12 marks)

ResultsPlus
Examiner Comments

The candidate described both experiments and included some linked ideas (e.g. Herschel ... measured temperatures ... red was hottest ... beyond red hotter still). The response contrasted the experiments well and included several points of difference. However, there was no clear point of similarity in the response, in fact there was a statement claiming that the experiments were completely different.

The candidate could have improved this response with small changes, for instance by mentioning (or showing in their diagram) that both experiments made use of a prism. Pointing out that both scientists used visible light as their starting point merely repeats the information given at the start of the question.

This was a Level 2 response and the quality of written communication was appropriate to that level. The examiner gave this four marks.

Herschal used 4 thermometers to record the eliffernent temperatures, he found out that when visible light is put through a prism ~~then~~ it splits the light so you can see the light spectrum thats what herschal discovered.

ResultsPlus
Examiner Comments

This candidate limited the response to a description of Herschel's experiment and there was no attempt at a comparison. There were some appropriate, but disconnected ideas such as use of thermometers and use of a prism. The quality of written communication was appropriate to the level.

This was a Level 1 response and the examiner gave it two marks.

Paper Summary

Candidates should:

• make sure that they have a sound knowledge of the fundamental ideas in all six topics

• get used to the idea of applying their knowledge to new situations

• show their working at each stage of a calculation

• use the available time effectively by writing answers appropriate to the command words such as state, describe, explain

• read the question carefully and underline or highlight the key words, for example in question 5 (a): 'State one disadvantage of using the wind...'.

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