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Examiners' Report
June 2023

GCSE Physics 1PH0 1F

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June 2023

Publications Code 1PH0_1F_2306_ER

Introduction

Candidates sitting this examination had in the main covered the course without disruption to their learning. Some mitigation was allowed for possible disruption with the equations that needed to be used for calculations being given in each question.

Questions forces, frequency and wavelength of ripples and thermal energy were used to test candidates' familiarity with the methods used to make measurements and establish the relationship between results.

The candidates' knowledge and understanding of physical principles were tested by applying these principles to various situations. Mathematical skills were not only tested in the use of equations, but candidates also needed to be able to interpret information given in a graphical form and use ratios and percentages. However it was still changing the subject of an equation that candidates found most challenging.

Questions were set on the following topics:

- Topic 1 Key concepts of physics
- Topic 2 Motion and forces
- Topic 3 Conservation of energy
- Topic 4 Waves
- Topic 5 Light and the electromagnetic spectrum
- Topic 6 Radioactivity
- Topic 7 Astronomy

Question 1 (a)(i)

Most candidates were able to gain at least one mark for this question usually linking visible light to colour photography. The most common error was to confuse the uses of microwaves and ultraviolet.

The example shows the boxes correctly linked.

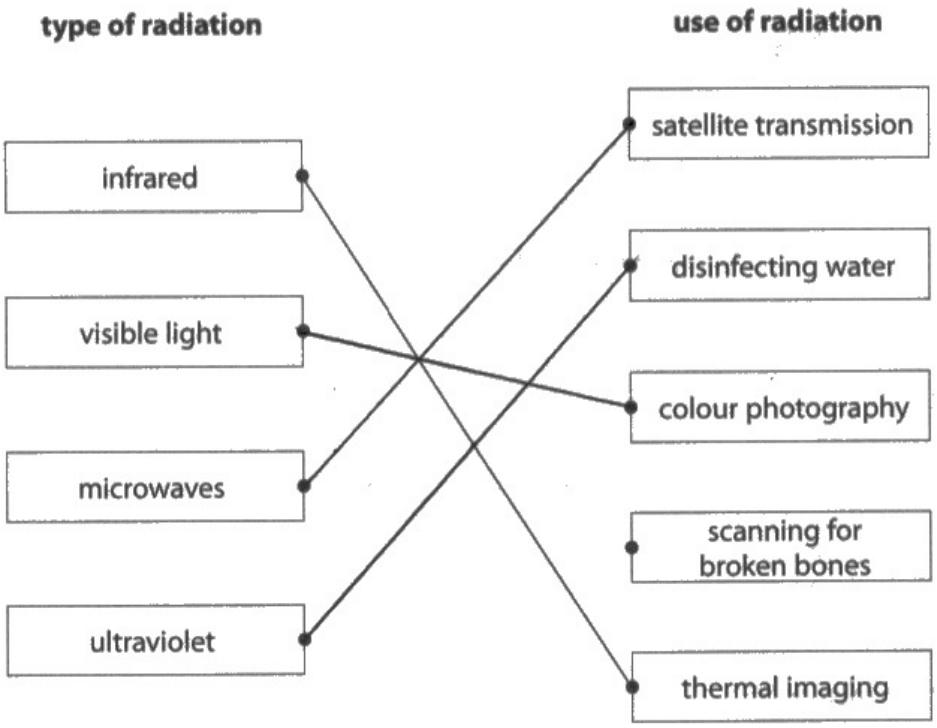
1 This question is about waves in the electromagnetic (e-m) spectrum.

(a) (i) Figure 1 shows some types of radiation that form part of the e-m spectrum and some uses of e-m radiation.

Draw **one** straight line from each type of e-m radiation to its use.

One line has been drawn for you.

(3)



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Examiner Comments

The specific knowledge of the use of microwaves and ultraviolet was lacking.

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Examiner Tip

Learn the uses of all the parts of the electromagnetic spectrum.

Question 1 (b)(i)

The image in the question showed an airport security scanner allowing objects inside the baggage to be seen. The majority of candidates were able to gain 1 mark by realising that the contents of the bags can be seen.

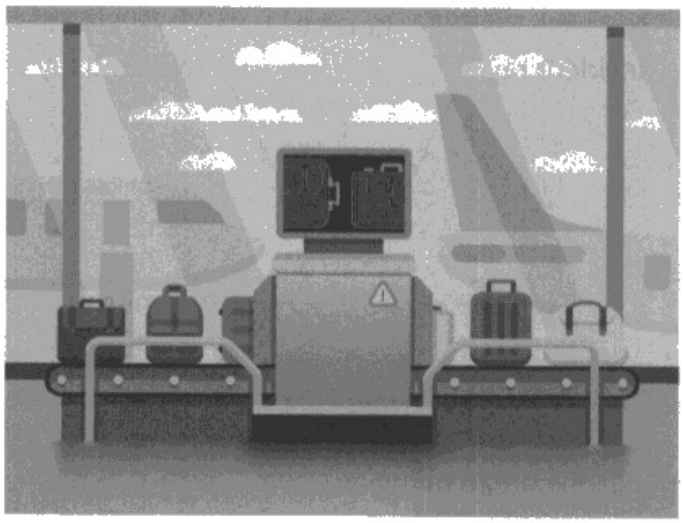
The question then asks 'explain why X-rays are used to scan passengers' bags'. Candidates needed to link that X-rays were able to penetrate the bags and therefore the contents could be seen.

The 'penetration' of X-rays, though material, was rarely given but 'pass through' was acceptable.

'Goes through' is acceptable for 'penetrates' and the second mark is given for 'see what is inside'.

(b) X-rays are also part of the e-m spectrum.

Figure 2 shows an airport security scanner using X-rays to scan passengers' bags.



(Source: © Net Vector / Shutterstock)

Figure 2

(i) Explain why X-rays are used to scan passengers' bags.

(2)

It goes through the material of the bags, showing what is inside the bags. Saving time by not having to search through the bags.

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Examiner Comments

Many candidates did not include an explanation for the use of the X-rays to be able to 'see' what was inside and only gained one mark.

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Examiner Tip

The question is about X-rays. Remember to relate the answer to the uses of X-rays.

Question 1 (b)(ii)

This question required knowledge of the properties of X rays in order to explain why humans are not scanned with rays at airports.

Explains that X-rays are ionising and gives an example of why they are dangerous.

(ii) Explain why passengers are **not** scanned with X-rays.

(2)

Because x-rays are ionising and have the ability to cause uncontrolled cell division, creating cancerous tumours

ResultsPlus
Examiner Comments

Relates the high frequency of X-rays to specifically being ionisation which is dangerous and then explains why.

ResultsPlus
Examiner Tip

An explain question must have a reason ('because') to gain the second mark.

The candidate provides an explanation knowing that X-rays are dangerous and then expands on this by stating that X-rays can mutate cells.

(ii) Explain why passengers are **not** scanned with X-rays.

(2)

X-rays are harmful to a person and they could cause the cells to mutate causing cancer.

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Examiner Comments

Harmful, dangerous were accepted as a description of ionising and the second mark was given for the reason the X-rays are harmful.

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Examiner Tip

Candidates should know that X-rays have a high frequency and are therefore potentially dangerous.

Question 2 (b)(i)

About a quarter of candidates gave a use for a microscope rather than a telescope by referring to a small object but not giving that the object must be far away.

Correct answer

(b) Figure 4 shows two lenses, P and Q, arranged to form a simple telescope.

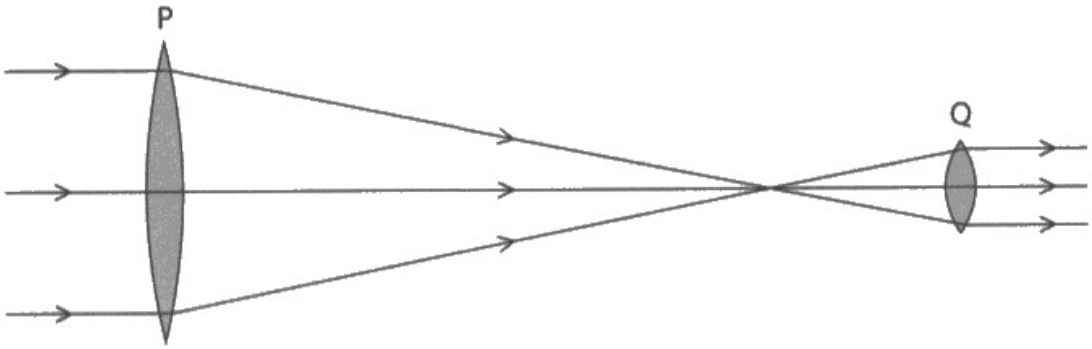

Figure 4

(i) State **one** use for a telescope.

(1)

To look at objects from a far distance e.g. the moon or another planet.

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Examiner Comments

The candidate gives the use as looking at distant objects then gives an example either of which would have scored a mark.

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Examiner Tip

Know the use of all the instruments used in this specification. It should also be noted that both the lenses in the telescope are the same type (converging).

Question 2 (b)(iii)

The question required candidates to calculate the power of a lens given the equation for the power of a lens and the focal length of the lens in metres. Almost all candidates were able to substitute and calculate correctly.

Correct answer.

(iii) The focal length of lens Q is 0.14 m.

Calculate the power of the lens.

(2)

Use the equation

$$\text{power} = \frac{1}{\text{focal length in m}}$$

$\frac{1}{0.14} = 7.1$

power of lens = 7.1 dioptre

ResultsPlus Examiner Comments

The candidate has shown the correct substitution and the correct answer is calculated.

ResultsPlus Examiner Tip

Always show the substitution into the equation as this gains a mark.

Acceptable answer

(iii) The focal length of lens Q is 0.14 m.

Calculate the power of the lens.

(2)

Use the equation

$$\text{power} = \frac{1}{\text{focal length in m}}$$

$$\frac{1}{0.14}$$

power of lens = 7.142857 dioptre

ResultsPlus
Examiner Comments

As there are only two significant figures given for the focal length then two significant figures are all that is necessay for the answer. However, the candidate does not appear to understand the meaning of 'recurring', although this was ignored.

ResultsPlus
Examiner Tip

Note the number of significant figures used in the question to judge the number of significant figures to give your answer. Do not use 'recurring' when it is not appropriate.

Acceptable answer

(iii) The focal length of lens Q is 0.14 m.

Calculate the power of the lens.

(2)

Use the equation

$$\text{power} = \frac{1}{\text{focal length in m}}$$

$\frac{1}{0.14}$

$= 7.142857143$

power of lens = 7 dioptre

ResultsPlus
Examiner Comments

Although only given to one significant figure this answer was accepted because it was correctly rounded.

ResultsPlus
Examiner Tip

Make sure your rounding is correct, Practice rounding correctly.

Question 2 (c)

The majority of candidates were not able to descibe how the image of a window frame can be produced on a piece of paper using a converging lens. It would appear that this very simple practical which can be used to estimate the focal length of a convex lens is not routinely carried out.

Correctly describes the procedure.

(c) A student is in a laboratory that has windows.

The student is given a converging lens, and a sheet of paper.

Describe how the student can produce an image of the window frame on the sheet of paper.

(2)

By holding the lens towards the window and the paper on the opposit side so the lense focuses the imag on the page

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Examiner Comments

The candidate positions the lens between the window and the paper and focuses the image.

ResultsPlus
Examiner Tip

Drawing a diagram would have made the position of the window lens and paper much clearer than some of the written descriptions.

Question 3 (a)(iii)

The same graph is used for parts 3(a)(i), 3(a)(ii), 3(a)(iii) and 3(a)(iv).

The graph can be seen in 3aiv.

3(a)(iii) gave the equation for acceleration and candidates needed to use the graph to find the change in velocity for the first ten seconds of the journey shown on the graph.

Almost all candidates were able to gain both marks.

Correct answer

(iii) Calculate the acceleration of the car in the first 10 s shown on the graph.

(2)

Use the equation

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

$a = \frac{(v-u)}{t}$ $\frac{15 - 0}{10s} = 1.5$

acceleration = 1.5 m/s²

ResultsPlus Examiner Comments

The candidate has shown their working by rewriting the equation and substituting.

ResultsPlus Examiner Tip

Always show the substitution.

Correct answer but no substitution shown.

(iii) Calculate the acceleration of the car in the first 10 s shown on the graph.

(2)

Use the equation

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

acceleration = 1.5 m/s²

ResultsPlus
Examiner Comments

The correct answer gains full marks.

ResultsPlus
Examiner Tip

It is always better to show the substitution into the equation because without that if the answer is incorrectly calculated no marks can be awarded.

Question 3 (a)(iv)

This question asks candidates to use the graph to find the distance travelled by the car over the region marked QR.

Candidates have to know that the distance travelled is represented by the area underneath the length QR shown on the graph, that is 10s for the time interval (horizontal) and 15 m/s for the vertical axis.

About half of candidates were able to gain full marks for this question.

Question 3 (b)

Calculation of force with the equation given as F=m x a and the mass as 1200Kg and acceleration 2.4m/s^2

The majority of candidates were able to correctly complete this calculation.

Correct answer

(b) A different car has a mass of 1200 kg.

Calculate the force needed to give this car an acceleration of 2.4 m/s^2.

(2)

Use the equation

$$F = m \times a$$

1200 X 2·4 = 2880

force = 2880 N

ResultsPlus
Examiner Comments

Both marks awarded for correct answer.

ResultsPlus
Examiner Tip

The substitution is shown which will get the first mark even if the answer is incorrect.

(b) A different car has a mass of 1200 kg.

Calculate the force needed to give this car an acceleration of 2.4 m/s^2.

(2)

Use the equation

$F = m \times a$

1200×2.4^2

$= 6912$

force = 6912 N

ResultsPlus
Examiner Comments

No mark awarded as the candidate has squared the acceleration. The acceleration is measured in m/s^2 and the candidate has confused the unit with the value that goes in the equation.

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Examiner Tip

F=m x a. Just put in the value for acceleration a. Do not consider the unit. a is not squared.

Question 4 (a)(ii)

This question tested knowledge of the use of ratios and standard form.

The majority of candidates were unable to score a mark on this question although it was only necessary to express the two values as a ratio for the first mark to be awarded. The division using standard form was found to be challenging with some candidates attempting to rewrite the values with the correct number of zeros and then cancelling.

Correct answer.

(ii) An atom has a radius of 1.0×10^{-10} m.

A nucleus has a radius of 1.0×10^{-15} m.

Calculate the ratio of the radius of the atom to the radius of the nucleus.

(2)

$$\frac{1.0 \times 10^{-10}}{1.0 \times 10^{-15}}$$

$= 100\ 000$

ratio of radius of atom to radius of nucleus = 100 000 : 1

5 : 1

ResultsPlus
Examiner Comments

The candidate showed the ratio and applied standard form to give the correct answer and gain both marks.

ResultsPlus
Examiner Tip

Learn to express values as ratios and to evaluate ratios.

Correct answer

(ii) An atom has a radius of 1.0×10^{-10} m.

A nucleus has a radius of 1.0×10^{-15} m.

Calculate the ratio of the radius of the atom to the radius of the nucleus.

(2)

$1 \times 10^{-10} : 1 \times 10^{-15}$

0.0000000001 : 0.0000000000000001

100000 : 1

ratio of radius of atom to radius of nucleus = 100000 : 1

ResultsPlus
Examiner Comments

The candidate gained both marks for the correct answer having written out the ratio with the correct number of zeros and cancelled.

ResultsPlus
Examiner Tip

Learn to use standard form.

Question 4 (a)(iii)

The question was intended to test the understanding of the neutrality of atoms.

Most candidates knew that atoms contained protons, electrons and neutrons but only about a quarter of candidates could correctly explain why atoms are neutral.

A good answer.

(iii) Explain why an atom has no charge overall.

(2)

All atoms have the same number of electrons and protons balancing the charge.

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Examiner Comments

Two marks for the idea of equal numbers of protons and electrons or positive and negative charges. The first marking point was not awarded for 'cancelling out'

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Examiner Tip

Remember protons have a positive charge and it is the electrons that have a negative charge.

Question 4 (b)(i)

The question gives the symbol for carbon-14 and asks for the number of protons in the atom.

Question 4 (b)(ii)

Using the same symbol for carbon-14, candidates were asked for the number of neutrons in the atom.

Less than half of the candidates were able to give the value of 8 neutrons correctly by taking 6 from 14.

Question 4 (b)(iii)

Ths question tested the candidates' ability to understand a half-life graph for a radioactive element and to determine the half-life from the graph.

Only about a third of the candidates were able use the graph correctly and read the x-axis scale correctly.

Correct answer

(iii) Figure 6 shows a graph for the decay of the radioactive isotope carbon-14.

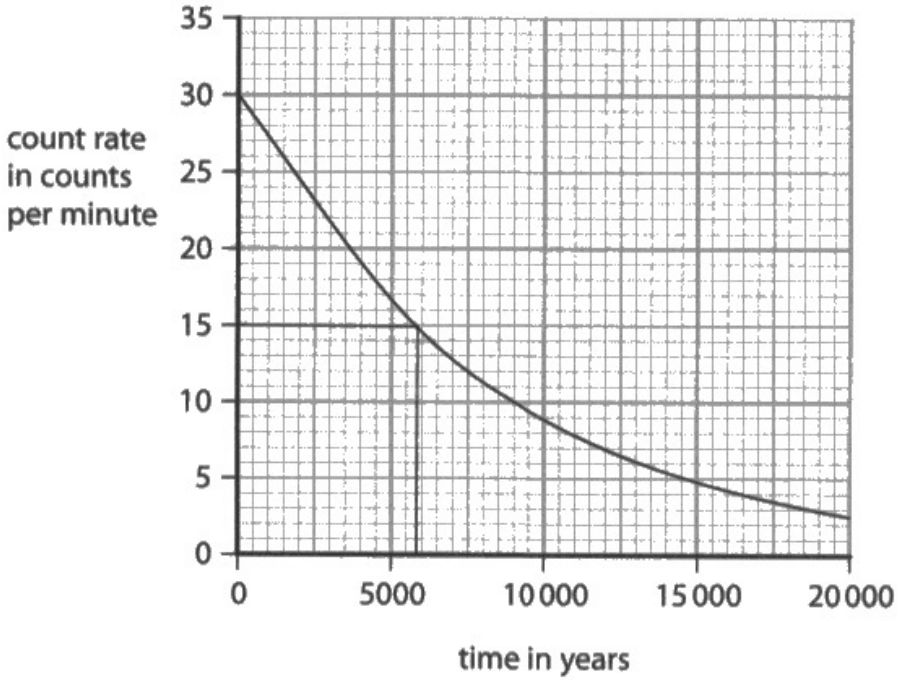

Figure 6

Use the graph to estimate the half-life of carbon-14.

(2)

half-life = 5,800 years

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Examiner Comments

The candidate recognises that the half-life will be at 15 counts per minute, half of the original count: draw a horizontal line to the graph line and then a vertical line to the time axis.

The candidate scores both marks as the scale is read correctly and the answer is within the limits allowed 5250 – 6250.

ResultsPlus
Examiner Tip

Remember the half-life is when the count rate is halved and draw horizontal and vertical lines on the graph to determine the time (half-life).

(iii) Figure 6 shows a graph for the decay of the radioactive isotope carbon-14.

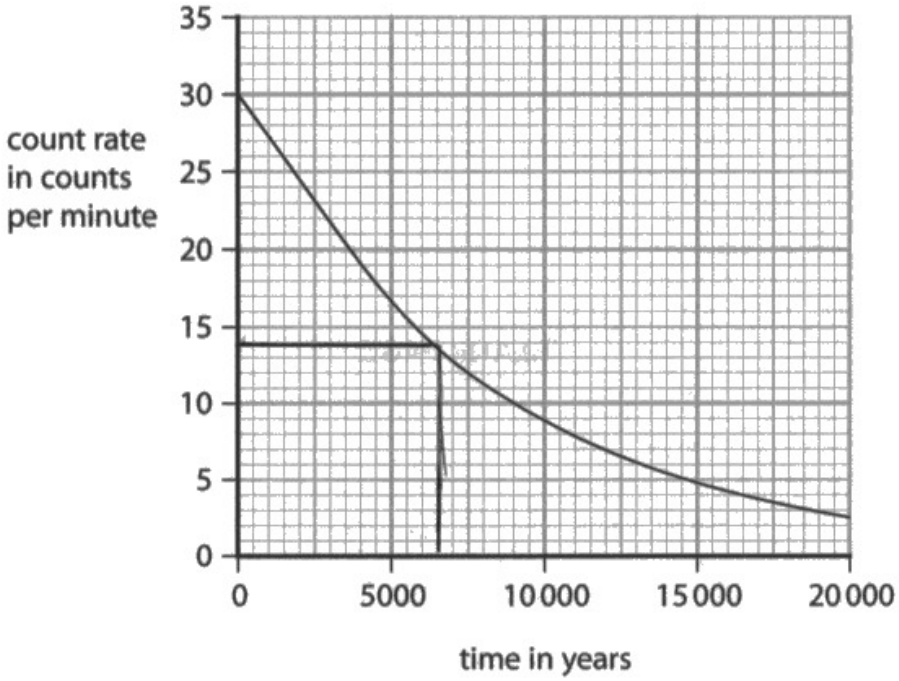

Figure 6

Use the graph to estimate the half-life of carbon-14.

(2)

half-life = 6 500 years

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Examiner Comments

The horizontal line is drawn a t 14 which is within limits 14-16 and score the first mark. However the vertical line is not drawn carefully enough and the time reads as 6500 which is outside the values allowed.

Only scores 1 mark.

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Examiner Tip

Take care that lines are drawn accurately and use a fine pencil.

Question 5 (a)(ii)

The diagram showed a transverse wave but candidates found it difficult to explain why the wave was transverse.

The majority of candidates were not able to recall the main features of a transverse wave and use this in their explanation.

Good answer.

(ii) Explain why the wave shown in Figure 7 is a transverse wave.

(2)

transverse waves vibrate up and down . and they have a crest and trough

ResultsPlus
Examiner Comments

This response scores two marks, as it gives vibrations and states 'up and down'.

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Examiner Tip

Learn the main features of transverse and longitudinal waves.

Question 5 (b)(i)

Questions 5(b)(i) and 5(b)(ii) test the practical ability of candidates to measure frequency and wavelength of ripples in a ripple tank.

About half of candidates were able to gain 1 or two marks for describing how they would measure the frequency of the ripples in a ripple tank.

(b) Figure 8 shows a ripple tank.

A screen is placed below the ripple tank.

The wave pattern produced by the ripples can be seen on the screen.

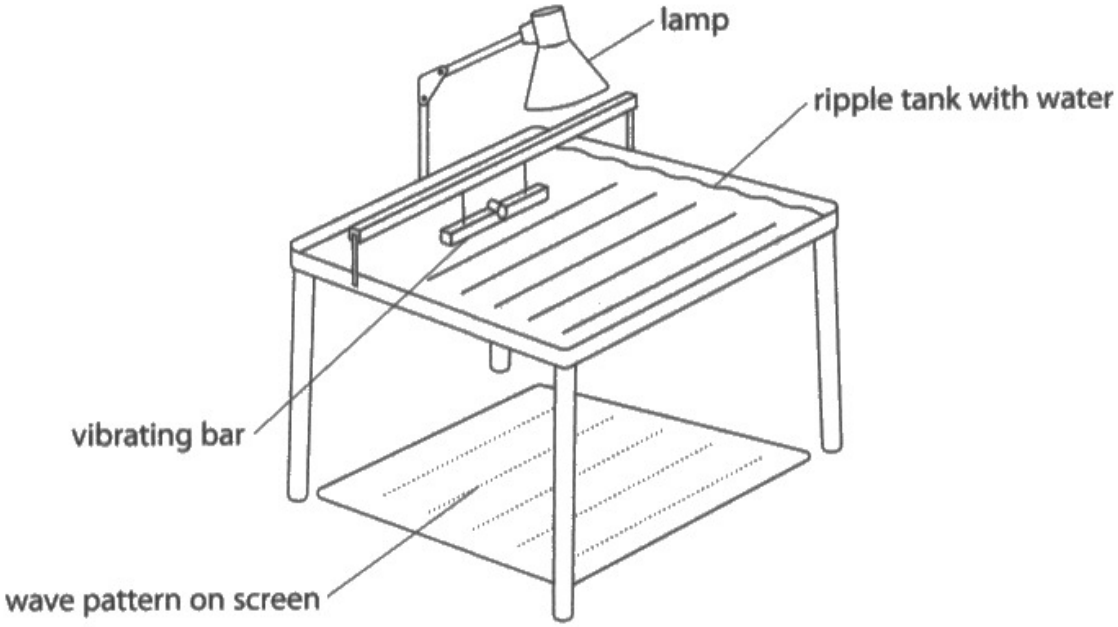

Figure 8

A student has a stop clock and a ruler.

(i) Describe how the student could measure the frequency of the ripples.

(2)

measure how many waves pass a certain point in a given time

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Examiner Comments

Counting the number of ripples that passed a point in a given time was sufficient to gain both marks.

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Examiner Tip

Remember to keep notes on the way that you did practical investigations and the measurements you made.

Question 5 (b)(ii)

5(b)(ii) was found to be more challenging than 5(b)(i).

Very few candidates described a way of making the waves look stationary, for example taking a photograph of the ripples with a ruler next to the wave pattern of the ripples in order to measure the distance between one ripple and the next.

It was often the length of the wave in the wave pattern that was mistakenly measured as the wavelength rather than the distance between the ripples.

A large number of candidates ignored that the student in the question had a ruler and that the wavelength had to be measured and not calculated using frequency and velocity.

Very good answer.

(b) Figure 8 shows a ripple tank.

A screen is placed below the ripple tank.

The wave pattern produced by the ripples can be seen on the screen.

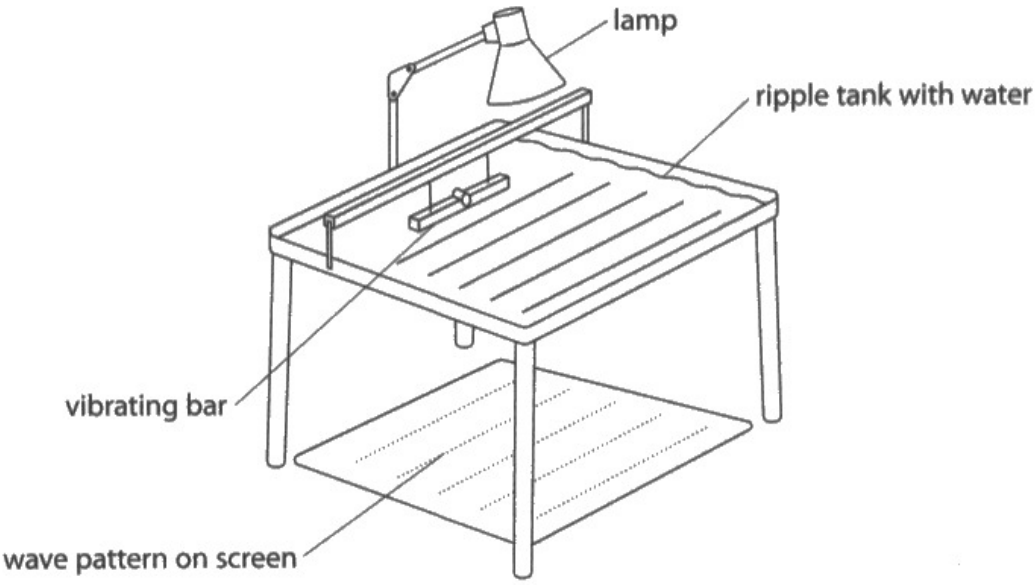

Figure 8

A student has a stop clock and a ruler.

(i) Describe how the student could measure the frequency of the ripples.

(2)

The student can do this by drawing a line onto the paper and starting the timer when a wave meets this line. Then after a few seconds, stop the timer and measure where that same wave ends.

(ii) Describe how the student could measure the wavelength of the ripples.

(2)

To measure the wavelength, they should place a ruler on the paper and take a clear image of the paper with the ripples being reflected. Then using the ruler in the image, ~~compare~~ measure the distance between a point on one wave and the same point on the next wave.

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Examiner Comments

Both marks were awarded for this answer as it gives a method of measuring the distance between the waves when the waves are stationary.

ResultsPlus
Examiner Tip

A way of measuring wavelength in a ripple tank needs to be noted and learned.

Question 6 (a)(i)

This question is about the detection of thermal energy from different surfaces using Leslie's cube.

The majority of candidates were able to suggest a possible millimetre reading that was acceptable due to the wide range allowed.

Question 6 (a)(ii)

As the temperature of each surface was said to be the same and a cube is being used the only variable to control was the distance of the voltmeter from each surface or the time of exposure.

Very few candidates realised the importance of the distance of the detector from each of the different surfaces.

Correct answer.

(ii) State what must be kept the same to take the measurement for each surface.

(1)

the distance between the detector and each surface

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Examiner Comments

Scores one mark as the candidate clearly states the distance which is to be kept the same.

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Examiner Tip

Be specific about the control rather than just stating 'distance'.

Question 6 (a)(iii)

About half of the candidates realised that the wooden block was a good insulator/poor conductor and some were more practical and suggested that the block made the cube the same height as the detector.

Correct answer.

(iii) Suggest why the cube is placed on a block of wood.

(1)

doesn't conduct heat so it can be used as a stand

ResultsPlus
Examiner Comments

One mark for knowing that wood does not conduct heat.

ResultsPlus
Examiner Tip

In any question about thermal energy consider how conductors, insulators, radiators and emitters are used.

Correct answer.

(iii) Suggest why the cube is placed on a block of wood.

(1)

So it is at eye level with the thermal energy detector

ResultsPlus
Examiner Comments

Score a mark for a practical approach the detector needs to be at the same height as the surfaces.

ResultsPlus
Examiner Tip

Consider the practical application and feasibility of taking measurements with apparatus shown.

Question 6 (b)

Just under half of candidates were able to gain 2 marks for describing the graph.

Most candidates were able to describe the initial increase in intensity with wavelength but then needed to specify that the decrease in intensity came after the peak had been reached or identify the peak to score the second mark.

Good answer.

(b) A hot surface emits radiation of different wavelengths.

The graph in Figure 11 shows how the intensity of the radiation emitted changes with the wavelength.

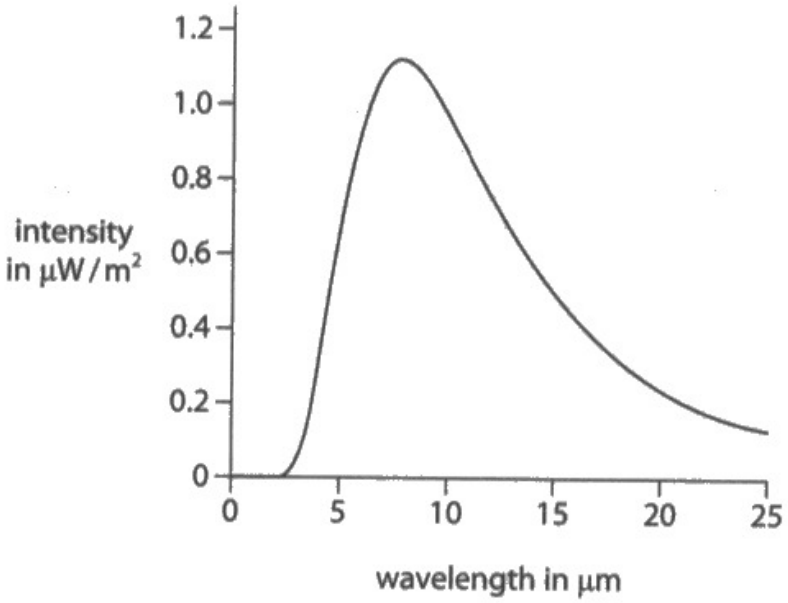

Figure 11

Describe how intensity changes with wavelength in Figure 11.

(2)

As intensity increases so does wavelength, until it reaches it's peak wavelength continues to increase yet intensity decreases.

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Examiner Comments

Two marks awarded. The relationship between intensity and wavelength is given and the correct relationship is given after the peak has been reached.

ResultsPlus
Examiner Tip

Specify the axes you are referring to and give the point at which the relationship changes.

Acceptable answer.

(b) A hot surface emits radiation of different wavelengths.

The graph in Figure 11 shows how the intensity of the radiation emitted changes with the wavelength.

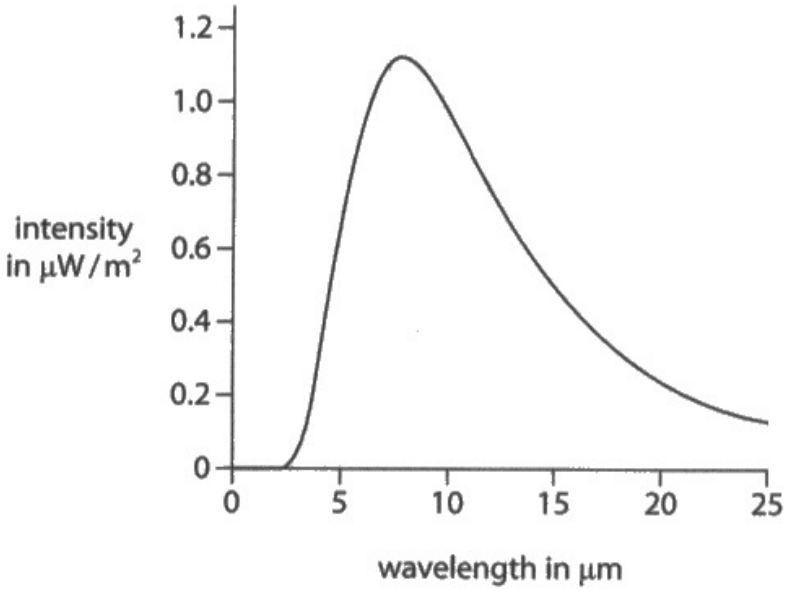

Figure 11

Describe how intensity changes with wavelength in Figure 11.

(2)

The intensity has an optimum when the wavelength is around 7 - 10 μm. After that the intensity decreases

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Examiner Comments

Scores two marks by giving a value for the peak at 7 to 10 micrometres and refers to wavelength, then describes how the intensity decreases after the peak (called the optimum)

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Examiner Tip

Use reference points to ensure that the examiner knows what you are describing.

Question 6 (c)

The question tested experimental method and required candidates to give a conclusion.

Candidates were asked to describe an experiment to determine which of two cans with different surfaces was the better absorber of heat.

The apparatus showed the same amount of water at the same temperature in each can to start with.

The majority of candidates were able to score two or three marks out of four for this question.

Very good answer.

(c) Figure 12 shows two cans, a radiant heater and some other apparatus.

The cans absorb thermal radiation from the heater.

One can has a matt black surface and the other can has a shiny silver surface.

Both cans contain water at the same temperature.

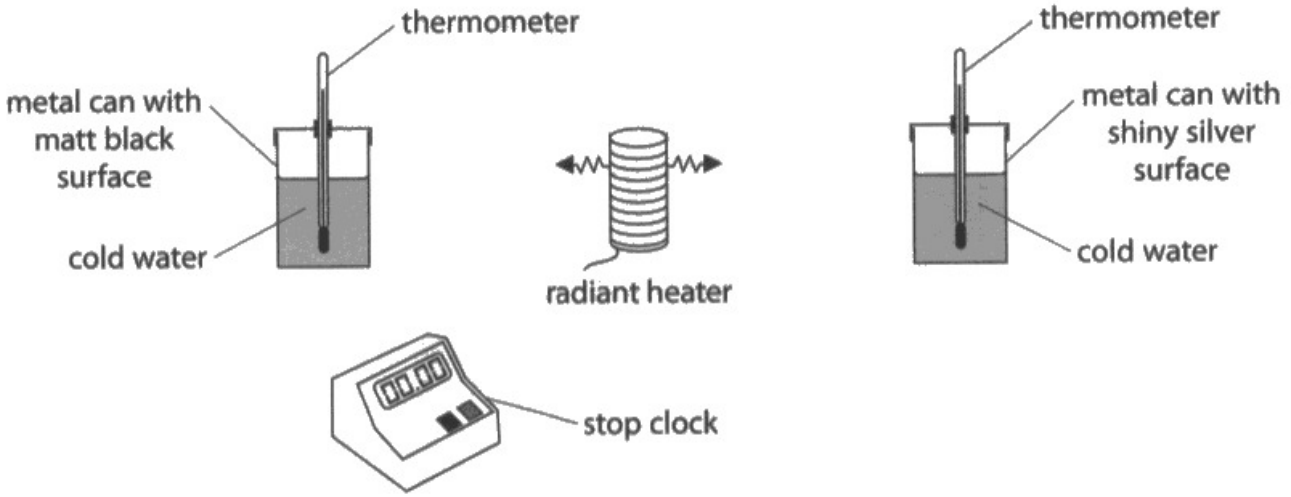

Figure 12

Describe how a student could use the apparatus in Figure 12 to determine which can is the better absorber of thermal radiation.

(4)

- The student can put the two cans next to the radiant heater. They need to make sure that the distance between the can and the heater is the same for both cans.
- They should use the stop clock to measure a time (e.g. 5 mins)
- They can then check the temperature of both cans.
- The can with the higher temperature is the better absorber of thermal radiation.

(Total for Question 6 = 9 marks)

Scores four marks. The experiment is described in a logical order. The control of keeping the heater the same distance from both cans is given. Time is set, temperature is measured and a conclusion is given.

Describe experiments in a logical order and remember to include controls as well as the measurements to be taken.

Very good response.

(c) Figure 12 shows two cans, a radiant heater and some other apparatus.

The cans absorb thermal radiation from the heater.

One can has a matt black surface and the other can has a shiny silver surface.

Both cans contain water at the same temperature.

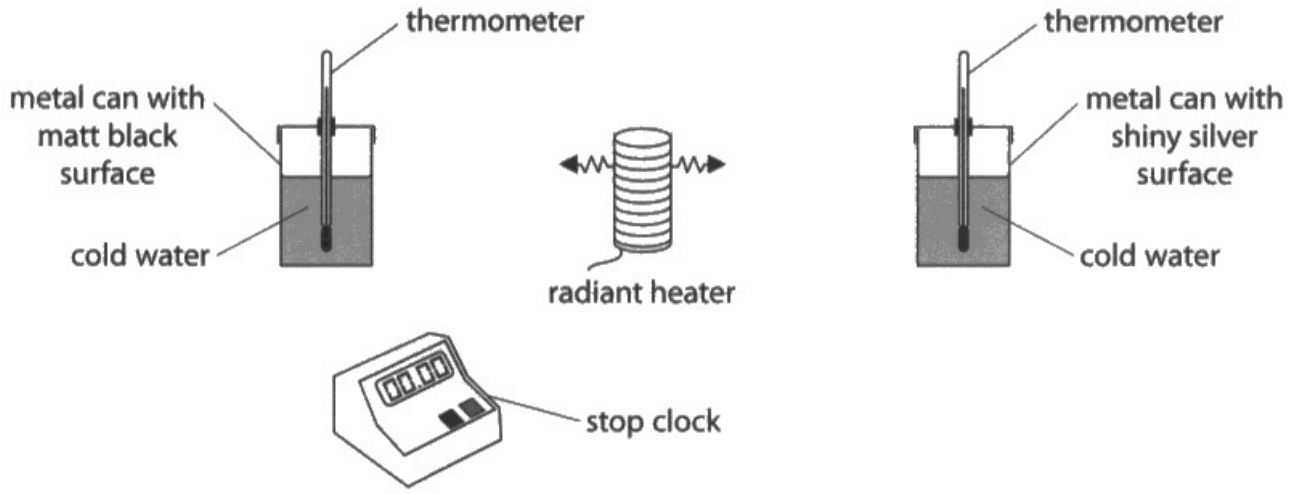

Figure 12

Describe how a student could use the apparatus in Figure 12 to determine which can is the better absorber of thermal radiation.

(4)

1. Place the radiant heater at an equal distance from both cans.
2. Use the stop clock to time up until 2 minutes
3. Once you reach 2 minutes look at both thermometers and compare the difference in temperature
4. Work out the difference, and see which can has the higher temperature. The one with the higher temperature is the better absorber of thermal radiation.

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Examiner Comments

The response scores 4 marks. It has control, time, temperature and a correct conclusion.

ResultsPlus
Examiner Tip

Be logical and concise.

Question 7 (c)(i)

This question tested the application of radioactivity to check the thickness of paper.

Only about a quarter of candidates were able to identify the radioactive source used for this as beta.

Question 7 (c)(ii)

The majority of candidates knew that a Geiger-Muller tube could be used to detect beta radiation, but the spelling proved to be problematic.

Any recognisable spelling or abbreviation was accepted.

Acceptable answer

(ii) Give the name of **one** device which could detect this type of radiation.

(1)

giger counter

ResultsPlus
Examiner Comments

Scores the mark although the spelling is incorrect.

ResultsPlus
Examiner Tip

Although phonetic spelling is accepted learn the correct version.

Acceptable answer.

(ii) Give the name of **one** device which could detect this type of radiation.

(1)

GM tube

ResultsPlus
Examiner Comments

One mark scored for use of initials.

ResultsPlus
Examiner Tip

Better to use correct initials rather than misspell names.

Question 7 (c)(iii)

More than half of the candidates could give a reason for the count rate increasing when the beta particles were passing through the paper becoming thinner.

When the paper is the correct thickness, the count rate is 4000 counts per minute.

(iii) The count rate increases when the paper gets thinner.

Give **one** reason for this increase.

(1)

more radiation gets through the paper to hit the detector

ResultsPlus
Examiner Comments

One mark scored for realising that more radiation will pass through the paper when it gets thinner.

ResultsPlus
Examiner Tip

Remember this is part three of this question so relates back to the diagram at the start of the question.

Question 7 (c)(iv)

More than half of candidates were able to calculate 5% of 4000 and give the maximum count allowable as 4200.

However some candidates assumed the count rate should be a little lower than 4200 and calculated 4% or 4.99%. Any answer which rounded to 4200 was accepted.

Acceptable answer

(iv) The rollers need to be adjusted if the count rate increases by 5%.

Calculate the maximum count rate that would be allowed before the rollers need to be adjusted.

(2)

10% = 400 4200

5% = 200

maximum count rate = 4199 counts per minute

ResultsPlus
Examiner Comments

Scores two marks, the calculation is shown and 4199 is a reasoned answer.

ResultsPlus
Examiner Tip

Use the values given in the question.

Correct answer.

(iv) The rollers need to be adjusted if the count rate increases by 5%.

Calculate the maximum count rate that would be allowed before the rollers need to be adjusted.

(2)

4000 × 5%

= 200

4000 + 200

= 4200

maximum count rate = 4200 counts per minute

ResultsPlus
Examiner Comments

Scores two marks. Correct answer and working shown.

ResultsPlus
Examiner Tip

Always show your working.

Question 7 (d)

This was an extended response question.

The majority of candidates were able to show some knowledge of the medical uses of radioactivity in the diagnosis and treatment of cancer.

The use of gamma rays in PET scanners and the use of tracers was well described as a means of diagnosis by a few candidates.

However many responses included the use of X-rays, CAT scans and MRI scans as a means of diagnosing cancer. Although these scans do not involve the use of radioactivity credit at level 1 was given for relevant knowledge of medical procedures for the diagnosis of cancer.

Many more candidates could describe the use of gamma rays in radiotherapy for the treatment of cancer.

The internal use of alpha, beta and gamma radiation for treatment was also quite frequently seen in responses.

*(d) Radioactivity from radioactive sources can be used in the diagnosis and treatment of cancer.

Describe **one** way radioactivity can be used in the diagnosis of cancer and **one** way radioactivity can be used in the treatment of cancer.

(6)

gamma rays can be used to treatment of cancer, but also can increase in the chance of you getting cancer.

ResultsPlus
Examiner Comments

Level 1, 2 marks.

ResultsPlus
Examiner Tip

The question refers to radioactive sources. You can gain credit for being specific about the type of radioactivity used.

*(d) Radioactivity from radioactive sources can be used in the diagnosis and treatment of cancer.

Describe **one** way radioactivity can be used in the diagnosis of cancer and **one** way radioactivity can be used in the treatment of cancer.

(6)

Radioactivity can be used to both diagnose and treat cancer. When diagnosing cancer, a doctor injects a ~~red~~ harmless radioactive serum into the patient. This serum is taken into the bloodstream and is carried around the ~~bloodstream~~ body. Doctors then use a PET scanner to detect cancerous cells.

ResultsPlus
Examiner Comments

Level 2, 4 marks

The response only considers the diagnosis of cancer and gives a description of the use of a PET scanner to make the diagnosis.

Although the type of radiation used is not specified however, the way the radiation is used is specified.

ResultsPlus
Examiner Tip

Give information that is not just in the stem of the question.

*(d) Radioactivity from radioactive sources can be used in the diagnosis and treatment of cancer.

Describe **one** way radioactivity can be used in the diagnosis of cancer and **one** way radioactivity can be used in the treatment of cancer.

(6)

Though the radioactivity is ionising there are lot of uses in medicine. Radioactivity sources with a short half life are used to diagnosis of cancer. Those isotopes which are radioactive ~~is~~ are named as medical tracers. These tracers can ~~inde~~ either ~~ingec~~inject the patient or swallowed by the patient. When they enter the human body they can be traced by the radiation that they emit from the outside the body. This helps to diagnosis of cancer cells. Also the gamma rays are used as a treatment for cancer. In this process, gamma rays are given to the ~~part of~~ cancer in many angles externally.

(Total for Question 7 = 13 marks)

~~Thes~~ All of these rays can't kill the cancer cell. but they damage the cancer cell.

ResultsPlus
Examiner Comments

Level 3, 6 marks

The response includes detail of both the treatment and diagnosis of cancer.

The use of radioactive tracers is described for treatment and although radiotherapy is not mentioned the use of 'gamma rays at many angles' is sufficient to describe the process.

ResultsPlus
Examiner Tip

Try to answer both parts of the question.

*(d) Radioactivity from radioactive sources can be used in the diagnosis and treatment of cancer.

Describe **one** way radioactivity can be used in the diagnosis of cancer and **one** way radioactivity can be used in the treatment of cancer.

(6)

Diagnosis: cancer patients with cancer can have a PET scan ~~twitch~~ which sends radiation thraugh the patients body and stops when it hits the cancer cell which helps the doctor locate the cancer and find where the turmour is towards the healthy cells.
Treatment: some cancer patients have radio therapy which sends radiation at the cancer cell to kill the cancer cell and try to stay clear of harming healthy cells.

ResultsPlus
Examiner Comments

Level 3, 6 marks

The response describes a method of diagnosis (PET scan)and a method of treatment (radiotherapy).

ResultsPlus
Examiner Tip

Answer both parts of the question and add information which is not in the stem of the question.

Question 8 (b)(i)

This question tested knowledge of a core experiment which required speed of falling cupcake cases to be determined.

Most candidates were able to score two or three marks out of a maximum of four.

The question gives that a ruler and a stop clock are supplied so the majority of responses included the measurement of a distance and time of fall of the cupcake cases.

Those candidates who quoted the equation speed =distance /time usually gave a logical description and gained four marks.

Very good answer.

(i) The student also has a stop clock and a metre rule.

Describe an investigation to show how the speed of the falling stack of cupcake cases depends on the number of cupcake cases in the stack.

(4)

. Hold up a metre ruler, ensuring it is straight
. Drop a singular cupcake case from the top of the ruler, and start the stopclock immediately
. Stop the stopclock as soon as the cupcake case reaches the bottom of the ruler
. Record the time taken for the case to reach the bottom
. Repeat this process with different quantities of cases, and record these times.
. Work out the speed of each stack of cases by doing distance (1m) ÷ time.
. Compare results and record your findings, determining how the number of cases in each stack affects the speed.

ResultsPlus
Examiner Comments

Response scores four marks.

Measures height, time, and shows how to find the speed and uses different stacks of cupcake holders.

ResultsPlus
Examiner Tip

Read the question carefully to note the apparatus that is given.

Question 8 (b)(ii)

Most candidates calculated the correct answer. The main error was trying to convert the kilograms to grams. Kilograms is the correct SI unit for the calculation, no conversion is needed.

(ii) A stack of cupcake cases has a mass of 0.005 kg.

Calculate the weight, in newtons, of the stack of cupcake cases.

Gravitational field strength = 10 N / kg

(2)

Use the equation

$W = mg$

$0.005\text{kg} \times 10\text{N/kg} = 0.05$

weight = 0.05 N

ResultsPlus Examiner Comments

Scores 2 marks.

Shows substitution and correct answer in answer line.

ResultsPlus Examiner Tip

Always put the answer from a calculation in the answer line.

Question 8 (b)(iii)

As the cupcake case falls it is subject to air resistance. The question required the direction of the air resistance to be shown as upwards on the diagram.

The majority of candidates were able to show the direction of air resistance on the diagram.

Completely correct.

Figure 16 shows a cupcake case that is falling at a constant velocity.

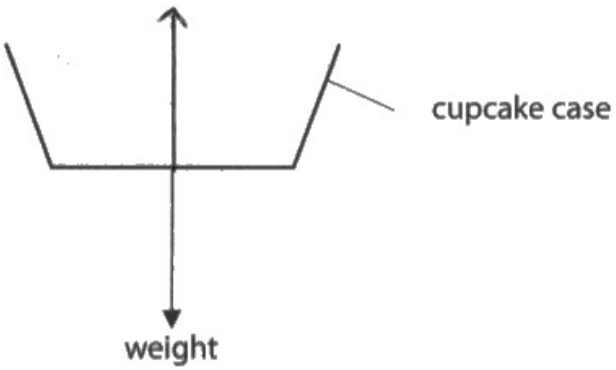


Figure 16

(iii) Draw an arrow on Figure 16 to show the force due to air resistance on the cupcake case.

ResultsPlus
Examiner Comments

1mark scored. The response shows an upwards force being equal and opposite to the weight acting downwards.

An upward arrow anywhere on the diagram would score this mark.

ResultsPlus
Examiner Tip

As the cupcake case is falling the air resistance must be upwards.

Question 8 (b)(iv)

The question tests knowledge of Newton's laws of motion, the velocity is constant, there is no resultant force and therefore no acceleration.

The majority of candidates were unable to score the mark on this question.

Question 8 (c)

The majority of candidates were able to substitute into the equation and calculate an answer.

However a significant number squared the acceleration due to the confusion between the quantity and the unit which contains a square.

(c) A car travels along a straight road.

The car accelerates at 3 m / s^2 for a time of 7 s.

Calculate the change in velocity of the car.

Use the equation

change in velocity = acceleration × time taken

(2)

3 x 7 = 21

change in velocity = 21 m/s

ResultsPlus
Examiner Comments

2 marks scored. Correct answer shows the substitution and correct answer.

ResultsPlus
Examiner Tip

Always show the substitution.

Question 9 (a)(i)

The majority of candidates found this calculation challenging. The equation was given but candidates confused gravitational field strength (g) and gravitational potential energy GPE.

It was also necessary to rearrange the equation to be able to calculate the height the ball reached.

Correct answer.

9 (a) Figure 17 shows a football kicked against a wall.

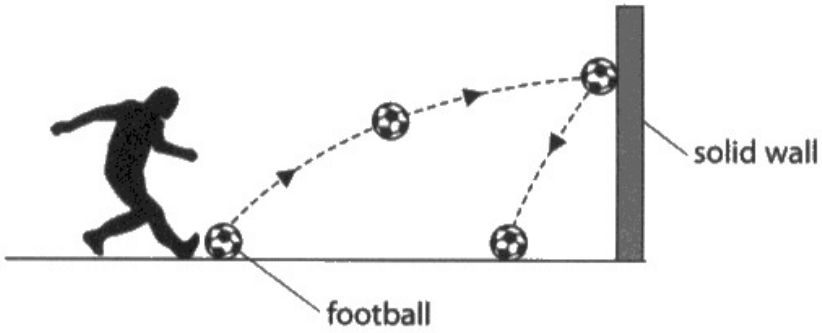


Figure 17

The football has a mass of 0.42 kg.

(i) The football gains 11 J of gravitational potential energy as it moves from the ground to the wall.

Calculate the height at which the ball hits the wall.

(3)

Gravitational field strength = 10 N / kg

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

$11 = \underbrace{0.42 \times 10}_{= 4.2} \times \Delta h$

$11 \div 4.2 = 2.619047 = 2.62$

height = 2.62 m

ResultsPlus
Examiner Comments

Scores 3 marks and shows substitution, rearrangement and evaluation.

ResultsPlus
Examiner Tip

Read the question carefully to get the substitution correct.

Question 9 (a)(ii)

Almost three quarters of candidates scored both marks on this calculation. The common errors were not squaring the velocity in the equation or not referring back to the stem of the question to find the mass of the football.

Correct answer.

(ii) Calculate the kinetic energy of the football when it is moving at a velocity of 12 m/s.

(2)

Use the equation

$KE = \frac{1}{2} \times m \times v^2$

$\frac{1}{2} \times 0.42 \times 12^2$

$= 30.24$

kinetic energy = 30.24 J

ResultsPlus
Examiner Comments

This calculation scores both marks. It shows the working and the correct answer although this could be given as 30J to two significant figures.

ResultsPlus
Examiner Tip

The correct substitution is shown.

Question 9 (a)(iii)

About half of candidates achieved one or two marks.

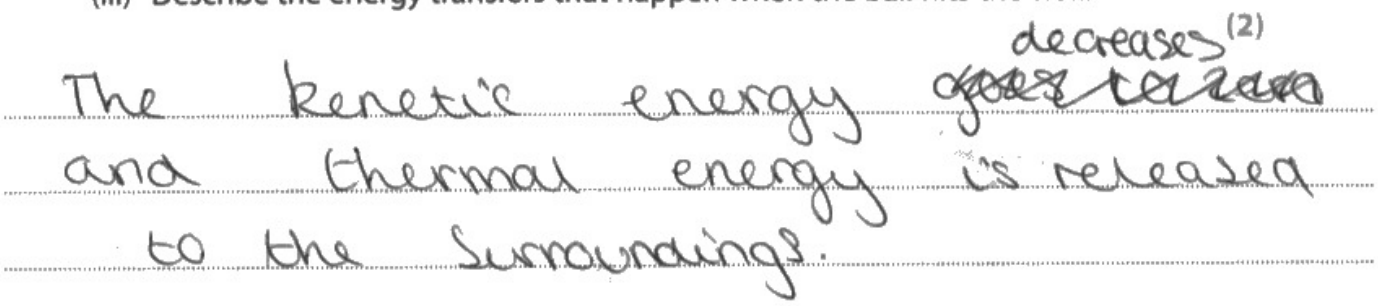
The question asks for a description of energy transfer and no marks can be given without an energy transfer or store being mentioned.

The majority of candidates that gained at least one mark started with the ball having kinetic energy or stated that energy was transferred mechanically.

The transfer of energy could be to elastic potential or thermal or dissipated to the surroundings.

As the energy transfer required is for when the ball hits the wall, there is no change in height, therefore any mention of gravitational potential energy was ignored.

(iii) Describe the energy transfers that happen when the ball hits the wall.



ResultsPlus Examiner Comments

This response scores two marks. Kinetic energy goes to thermal energy released (dissipated) to surroundings.

ResultsPlus Examiner Tip

Mention forms of energy when the question is about energy transfer.

(iii) Describe the energy transfers that happen when the ball hits the wall.

(2)

The energy starts off as in the kinetic store but then it travels ~~to as~~ to the wall and turns into t a sound store where the ball hits the wall and a sound is emitted.

ResultsPlus
Examiner Comments

This response scores two marks. Kinetic energy to start with, and then sound was allowed as equivalent to thermal energy in this context.

ResultsPlus
Examiner Tip

When the question asks about energy transfer, forms of energy or enegy transfer should be included in the answer.

Question 9 (b)

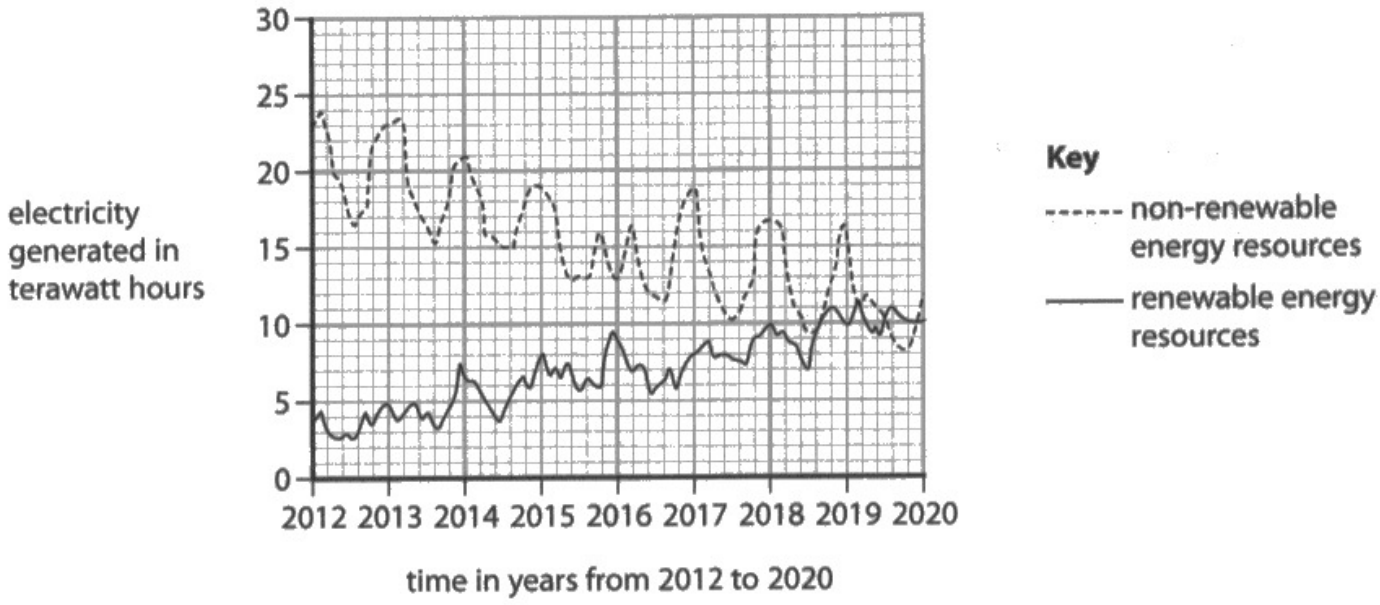
This is an extended response question and tests the ability of candidates to extract information from a graph and then to use their knowledge of renewable and non-renewable energy resources to comment on the trends the graph shows.

The majority of candidates were able to make some comment on the trends seen in the graph.

However candidates found it more difficult to relate these changes to give reasons why the use of non-renewables, like fossil fuels, were being used less to generate electricity and renewable sources like wind farms were being used more.

*(b) In the UK, electricity is generated using non-renewable and renewable energy resources.

The graph in Figure 18 shows how the amount of electricity generated by these resources changed from 2012 to 2020.



Explain how and why the amount of electricity generated by renewable and non-renewable energy resources has changed from 2012 to 2020.

Your answer should include

- the trends shown in Figure 18
- the change in the amount of electricity generated by at least one renewable resource
- the change in the amount of electricity generated by at least one non-renewable resource.

(6)

From 2012 to 2020 the amount of non-renewable energy sources went down and renewable sources increased

ResultsPlus
Examiner Comments

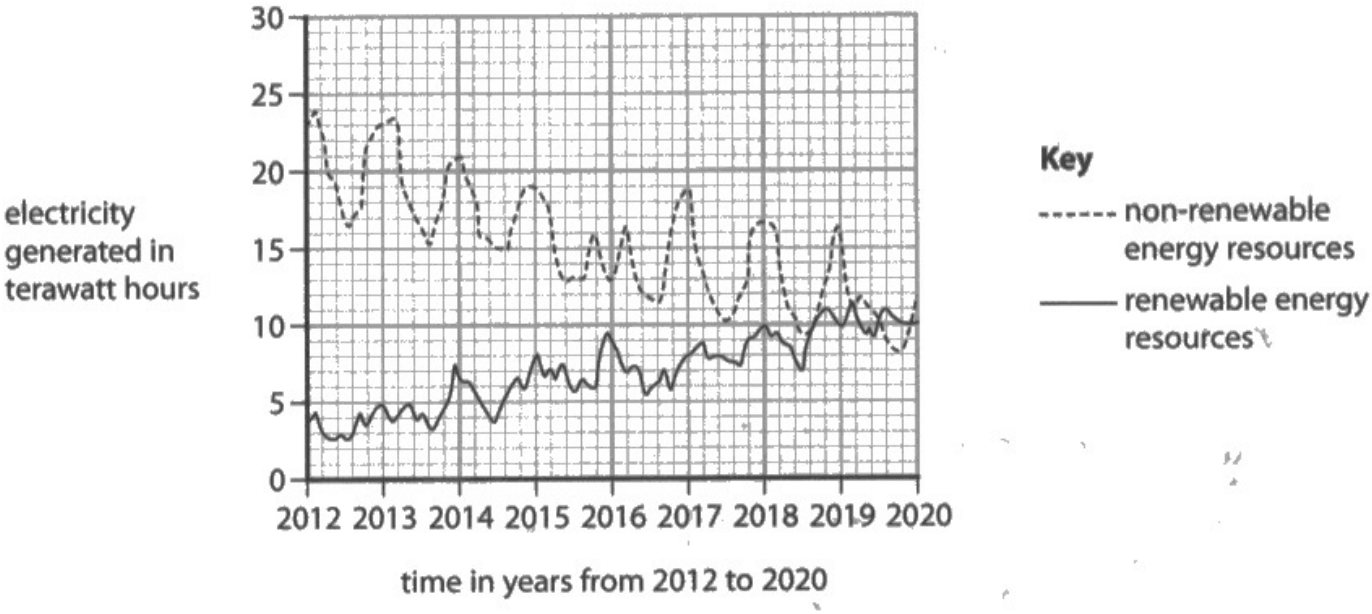
Level 1, 2 marks. The response gives the trends shown on the graph but nothing else.

ResultsPlus
Examiner Tip

Read the whole question and attempt to give some information on each part.

*(b) In the UK, electricity is generated using non-renewable and renewable energy resources.

The graph in Figure 18 shows how the amount of electricity generated by these resources changed from 2012 to 2020.



Explain how and why the amount of electricity generated by renewable and non-renewable energy resources has changed from 2012 to 2020.

Your answer should include

- the trends shown in Figure 18
- the change in the amount of electricity generated by at least one renewable resource
- the change in the amount of electricity generated by at least one non-renewable resource.

(6)

• As the amount of energy needed increases the more energy is needed to produce.
• renewable energy has had a massive increase in usage from 4 terawatt hours in 2012 to 10 terawatt hours in 2020.
• Non-renewable energy had decreased and increased many times over the past 8 years, from once being 23 terawatts in 2012 to 12 terawatts in 2020.
Over the past 8 years the increase in pollution and global warming has made the world slowly switch from non-renewable to renewable energy.

ResultsPlus
Examiner Comments

Level 2, 4 marks. The response gives the trend in renewable and non-renewable resources, and comments on the increase in pollution and global warning which accounts for the change in resources used for energy generation.

This is sufficient to achieve level 2 but more detail and mention of at least one renewable or non-renewable source is needed to award level 3.

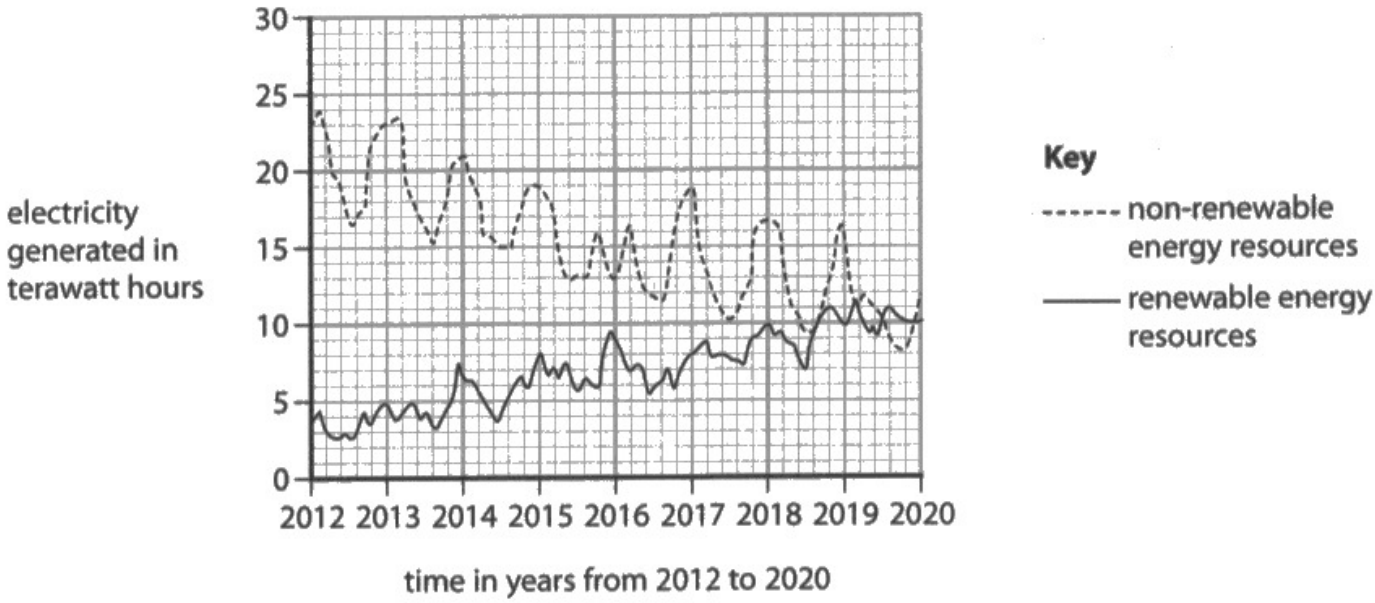
ResultsPlus
Examiner Tip

Answer all parts of the question.

Very good answer.

*(b) In the UK, electricity is generated using non-renewable and renewable energy resources.

The graph in Figure 18 shows how the amount of electricity generated by these resources changed from 2012 to 2020.



Explain how and why the amount of electricity generated by renewable and non-renewable energy resources has changed from 2012 to 2020.

Your answer should include

- the trends shown in Figure 18
- the change in the amount of electricity generated by at least one renewable resource
- the change in the amount of electricity generated by at least one non-renewable resource.

(6)

Non-renewable energy resources have dropped significantly from 2012 to 2020 as they're finite and some are fossil fuels such as coal, our increase in knowledge of climate change has increased which is why fossil fuels like coal have decreased, also the fact that non-renewable energy sources are running out or will run out is a reason for the drop in usage of them that is shown in figure 18. Renewable energy sources have increased for similar reasons but opposites, they don't run out so it's sustainable to use them and they don't get burnt so no release of CO_2 and therefore they're much better for the environment than non-renewable resources, our increase in knowledge and worry of climate change has caused the increase in use that is shown in figure 18.

ResultsPlus
Examiner Comments

Level 3, 6 marks.

The answer gives the trends as seen on the graph and gives reasons logically and succinctly for these changes occurring. Naming non-renewable and renewable resources and giving specific reasons for the change in usage related to climate change.

ResultsPlus
Examiner Tip

Read the question carefully to make sure all the points necessary are included.

Question 10 (a)(i)-(ii)

The first part of this question is based on the Doppler effect. Having worked out an answer for the change in wavelength candidates then had to use that as a given equation to determine the velocity of an object.

The majority of candidates were able to complete part a(i) and a high percentage of these were then able to use the equation to get the answer tp a(ii).

Question 10 (b)

Very few candidates were able to score both marks on this question.

One mark was scored for recognising that the wavelength increased but rarely was the second mark scored.

The typical answer was that the wavelength increased because the galaxies were further away. This was not sufficient for the second mark.

Candidates needed to state that the galaxies were 'moving' away to score the second mark.

Question 10 (c)

The majority of candidates were unable to gain marks on this question. It would seem that candidates did not know the acronym CMB as cosmic microwave background.

If the meaning of CMB was known the value of the wavelength for microwaves could then have been found from the table.

Question 10 (d)(i)-(ii)

The majority of candidates found this question very challenging with only a few gaining more than one mark.

The question tests knowledge of the evolution of stars and the balance between thermal expansion effects and gravity, but candidates did not know the origins of the forces involved to give essential detail.

Excellent answer.

(d) During the evolution of a star, the nebula collapses and becomes a main sequence star.

(i) State what causes the nebula to collapse.

(1)

Gravity

(ii) Explain why the nebula stops collapsing as it becomes a main sequence star.

(3)

As the gravity increases the pressure in the collapsing nebula, nuclear fusion occurs from the high heat and pressure which pushes out with a force equal to the gravity of the collapsing nebula. This stops the nebula from collapsing

ResultsPlus
Examiner Comments

This response scored 1 for part d(i) and 3 marks for part d(ii). The candidate states that gravity causes the collapse of the nebula for the first part of the question.

The explanation of why the nebula stops contracting details the cause of the forces acting in the nebula to balance the effect of gravity.

ResultsPlus
Examiner Tip

Learn how the balance between thermal expansion and gravity affects the life cycle of stars.

Paper Summary

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

- Learn the uses of all the parts of the electromagnetic spectrum.
- Know the use of all the instruments used in the specification.
- Use drawings and diagrams where possible.
- Always show substitutions.
- Learn to express values and to evaluate ratios.
- Learn the main features of transverse and longitudinal waves.
- Keep notes on practical investigations you have made.

Grade boundaries

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