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Examiners' Report
June 2023

GCSE Combined Science 1SC0 1PF

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June 2023

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Introduction

This was the sixth year of examining this specification, being paper 3 of combined science at foundation level. Questions were set to test students' knowledge, application and understanding from six topics in the specification:

- 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

It was intended that the examination paper would allow every candidate to show what they knew, understood and were able to do. Within the question paper, a variety of question types were included, such as objective questions, short answer questions worth one or two marks each and longer questions worth three or four marks each. Two questions assessed candidates' knowledge of practical procedures, namely Q04b(i) and b(ii) on measurements on a ripple tank and Q05(b)(i) on describing an investigation with falling cupcakes.

Students continued to do well with most calculation questions, although when rearrangement of an equation was needed, then they struggled a lot more.

Successful candidates were:

- well-acquainted with the content of the specification
- skilled as a result of having been engaged with practical work during their course
- competent in quantitative work, especially in using equations
- well-focused in their comprehension of the question-at-hand
- willing to apply physics principles to the novel situations presented to them

Less successful candidates:

- had gaps in their conceptual knowledge of the topics of this paper
- had gaps in their procedural knowledge, relating to their practical work
- misread and / or misunderstood the symbols used in equations
- did not focus sufficiently on what the question was asking
- found difficulty in applying their knowledge to new situations

This report will provide exemplification of candidates' work, together with tips and/or comments, for a selection of questions. The exemplification will come from responses which highlight successes and pitfalls, with the aim of aiding future teaching of these topics.

Question 1 (a)(i)

A variety of marks was obtained in this question. It differentiated well. There may be an English language issue with the contents of type and uses of radiation; most uses were envisaged to be within everyday experience. “Disinfecting Water” was the least well known response.

This clip shows a fully correct response, unambiguously drawn. The candidate puts a line through scanning bones, presumably having thought correctly through and realised that is not a relevant application of any of the types of radiation given. Such processing in answering questions is greatly commended.

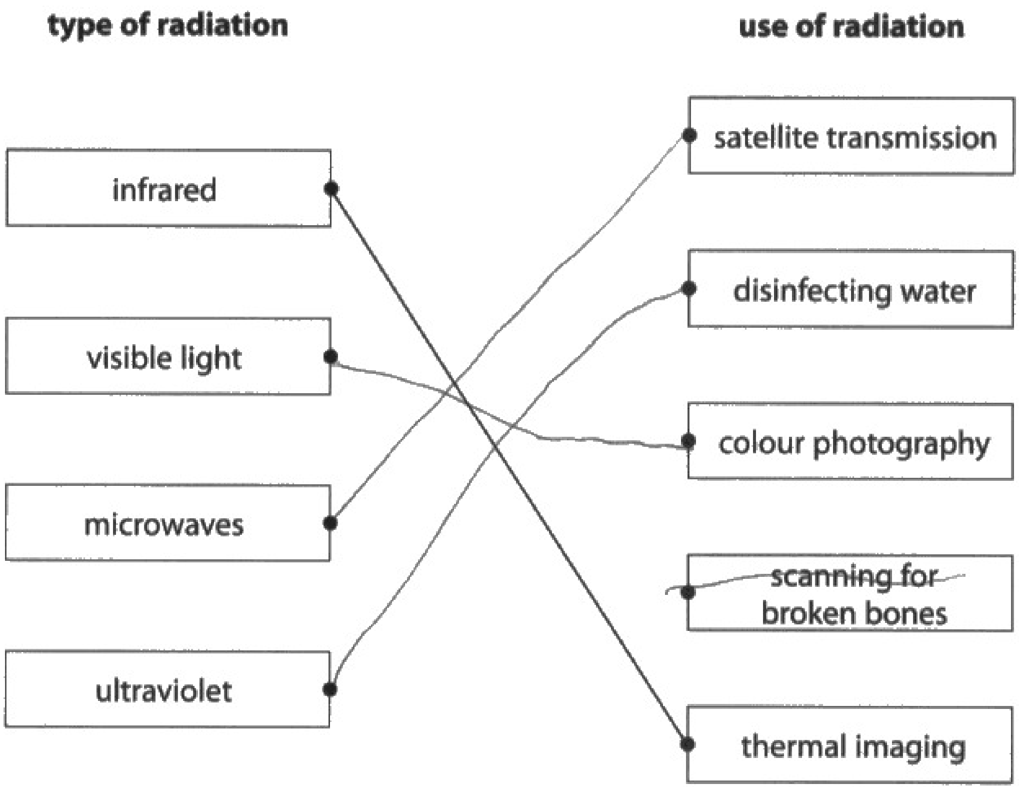
1 This question is about waves in the electromagnetic (e-m) spectrum.

(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)



ResultsPlus
Examiner Comments

See above.

ResultsPlus
Examiner Tip

Work actively and constructively on the contents of a question, as this candidate has done through eliminating a response.

Mark schemes always penalise ambiguity such as drawing two links from a type to a use here. The question explicitly states draw **one** line from the type to the use. Thus microwaves are associated with satellite transmission, but a mark for that is negated by the multiple drawing of lines.

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

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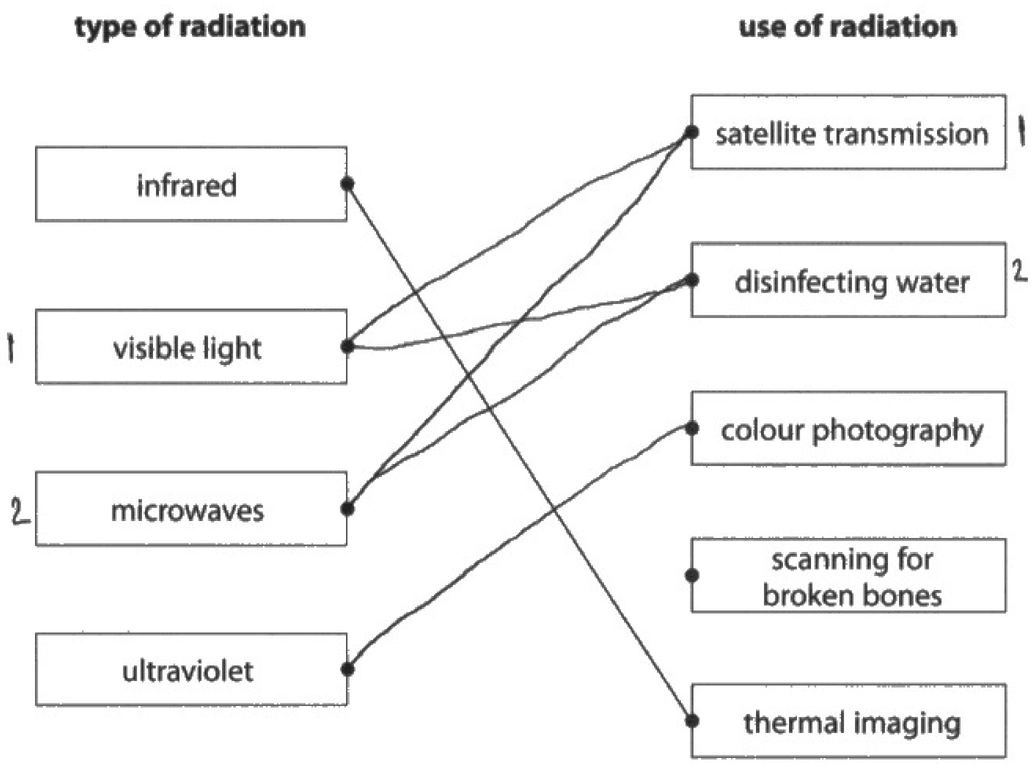


ResultsPlus
Examiner Comments

See above.

ResultsPlus
Examiner Tip

In answering the question look at what the question is saying. If any word is in BOLD, there is a reason for that. Hedging your bets may be counter-productive.

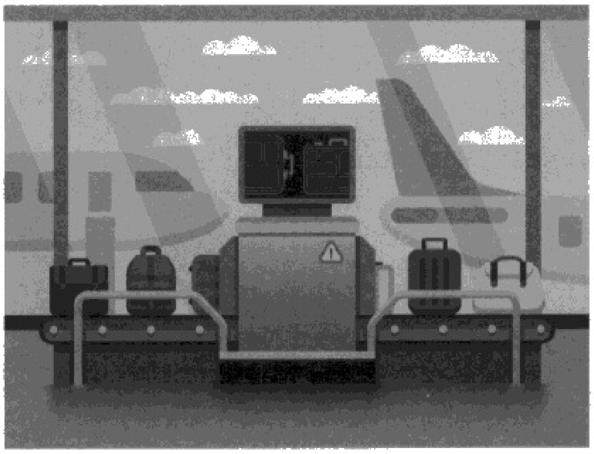
Question 1 (b)(i)

Many candidates showed a clear understanding of the use for x-rays (to look inside the bag without opening it) but most did not go on to explain this was because the x-rays were able to penetrate or go through the bags.

Rays 'going through' is a very acceptable explanation for mark point 1. Then 'see what's inside' gains mark point 2. Many candidates scored mark point 2 but not so many the explaining mark point 1.

(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)

the rays ~~th~~ go through the bag and you can uee whats inside

ResultsPlus Examiner Comments

See above.

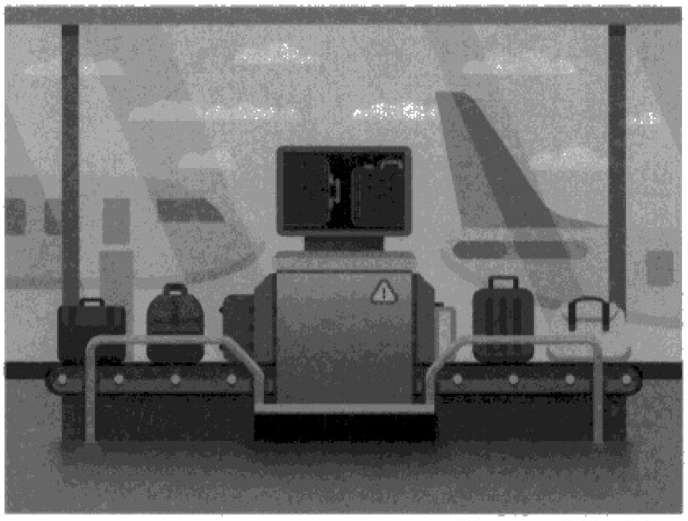
ResultsPlus Examiner Tip

Try to aim for an in depth explanation with reference to what is going on from a scientific perspective.

The mark scheme quite broadly allowed for varieties of 'look to see what's inside'. Many students focused on illegal substances, gaining a mark.

(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)

To check if they have something that is not allowed in airplanes.

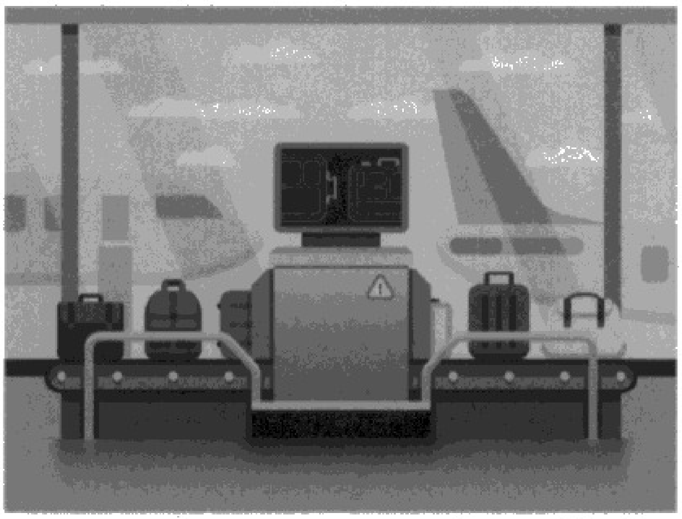
ResultsPlus
Examiner Comments

See above.

'See internally' is an alternative response gaining mark point 1, as dealt with in the additional guidance opposite that mark point in the mark scheme.

(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)

X-rays can see internalley through the wall of bags, so [illegible] security can identify anything illegal.

ResultsPlus
Examiner Comments

See above.

Question 1 (b)(ii)

Many candidates were able to gain one mark with a reference to either 'harmful' or 'causes cancer'. The ionising aspect of x-rays didn't really feature in student explanations. Many made remarks linked to seeing passengers bones, a point that was not required. This was not in the mark scheme as a valid reponse. The real reason x-rays are not used on persons is because of the harm and health consequences such practices might produce. These two points are reflected in the mark scheme points.

'Causes harm' gains mark point 1 – see additional guidance. 'Causing mutations / cancer' is what mark point 2 is looking for.

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

(2)

if exposed to humans too much x-ray radiation, it can cause mutations in cells, and cause harm to the body, ~~with harm~~ such as cancers.

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Examiner Comments

See above.

The mark is awarded for an equivalence being seen with 'they are harmful', mark point 1 in the mark scheme (additional guidance).

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

(2)

Because it is ~~Bl~~ not good for people. Bad for eyes and skin / blood cells.

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Examiner Comments

Examiners use their professional judgement regarding equivalence many times in assessing candidates' responses.

Once again 'causes harm' is seen in a response with the candidate's poisoning reference reinforcing that. The 'causes cancer' idea is clearly present for the second mark.

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

(2)

x-rays emmit a small amount of radiation poisning that's dangerous to humans can cause cancer.

ResultsPlus
Examiner Comments

See above.

Question 2 (a)(iii)

This part, aiii, involved calculating acceleration from a simple Dv/t formula given. Candidates scored very highly on this.

The candidate sets out the calculation well, arriving at the correct answer. Full marks obtained.

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

(2)

Use the equation

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

$$a = \frac{15}{10}$$

acceleration = 1.5 m/s^2

ResultsPlus Examiner Comments

See above.

ResultsPlus Examiner Tip

It's always a good idea to show working. This candidate does well on that, including having the subject of the equation in 'a ='. This means if a subsequent arithmetical error is made marks may be still awarded for correct working.

This candidate does well but then leaves their answer in fractional form. In physics values need always to be stated in decimal form, since they are measurable quantities, with associated precision.

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

(2)

Use the equation

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

$\frac{15}{10}$ =

acceleration = $\frac{3}{2}$ m/s^2

ResultsPlus
Examiner Comments

If mark schemes are studied it will be noticed that accuracy of the evaluation is assessed via inspecting that decimal form. The same applies with square roots (surd form). Evaluations from calculations require decimal precision to be stated.

ResultsPlus
Examiner Tip

Don't leave answers in physics as fractions, unless ratios are asked for.

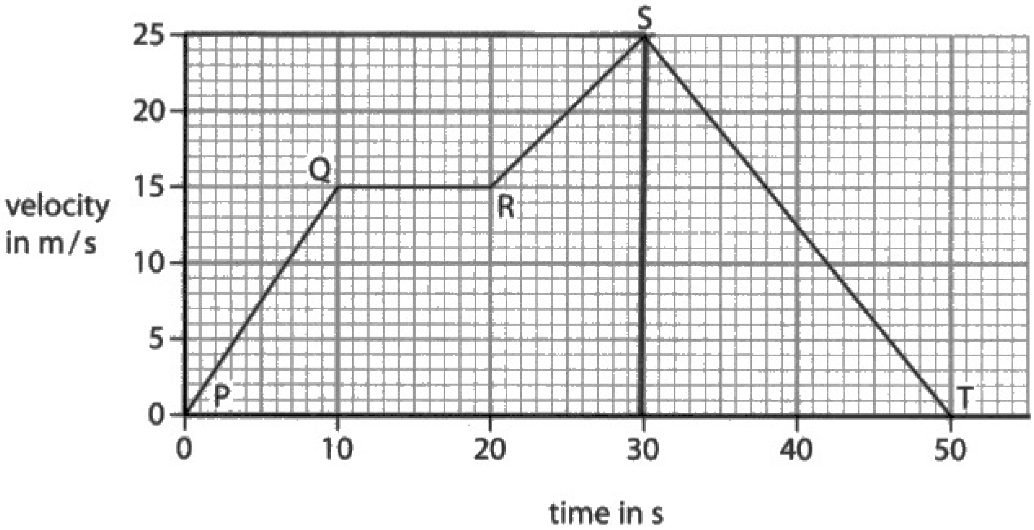
Question 2 (a)(iv)

A small number of learners did identify the area under the graph but they were in the minority. Where a learner did not score full marks they were highly likely to pick up compensation marks for the use of the values in some way.

An exemplary response, explaining their working carefully along the way.

2 (a) The graph in Figure 3 shows how the velocity of a car changes with time.

The car starts from rest and travels along a level, straight road for 50 s.



(iv) Calculate the distance the car travels in part QR shown on the velocity/time graph in Figure 3.

(3)

distance = average speed × time

15 × 10 = 150

distance = 150 m

ResultsPlus
Examiner Comments

See above.

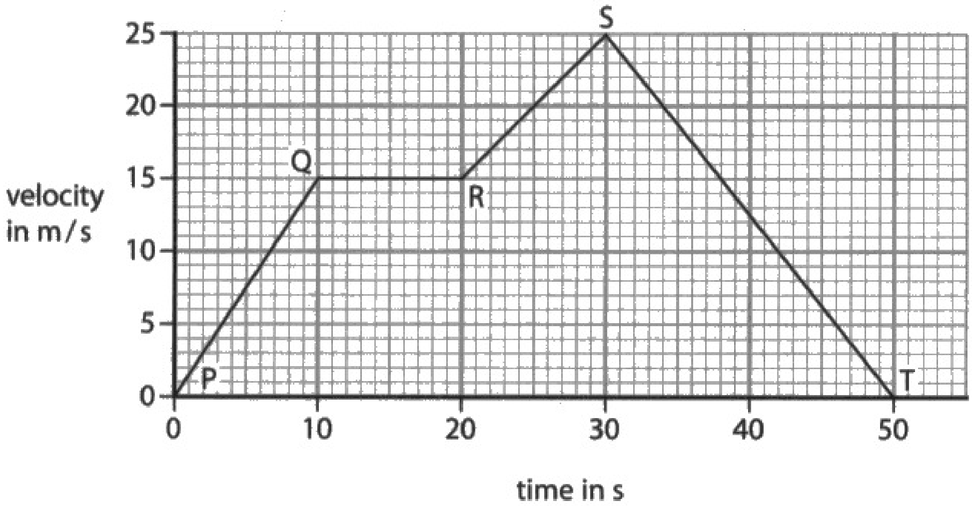
ResultsPlus Examiner Tip

Try and show your work, including some words of explanation of what you are doing, like this.

A bare bones correct answer like this will always score maximum marks. However, students should ensure that they show working out in case any slips are made en route in order to achieve intermediate marks for their working out.

2 (a) The graph in Figure 3 shows how the velocity of a car changes with time.

The car starts from rest and travels along a level, straight road for 50 s.



(iv) Calculate the distance the car travels in part QR shown on the velocity/time graph in Figure 3.

(3)

distance = ...150...... m

ResultsPlus
Examiner Comments

See above.

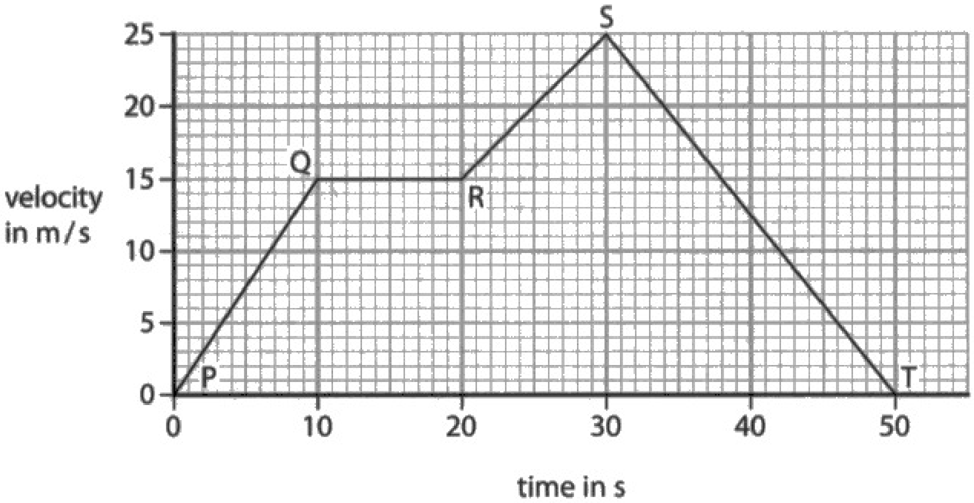
ResultsPlus
Examiner Tip

Show working out as an insurance policy in case of an arithmetical mistake during calculation.

You may wonder where this mark came from. The mark scheme says 'if no other marks awarded, 1 mark for use of 15 (m/s) or 10 (s)'. It is an example of the instruction to this question's statement about picking up compensation marks for the use of the values in some way.

2 (a) The graph in Figure 3 shows how the velocity of a car changes with time.

The car starts from rest and travels along a level, straight road for 50 s.



(iv) Calculate the distance the car travels in part QR shown on the velocity / time graph in Figure 3.

(3)

$$\frac{15}{5} = 3$$

distance = 3 m

ResultsPlus
Examiner Comments

See above.

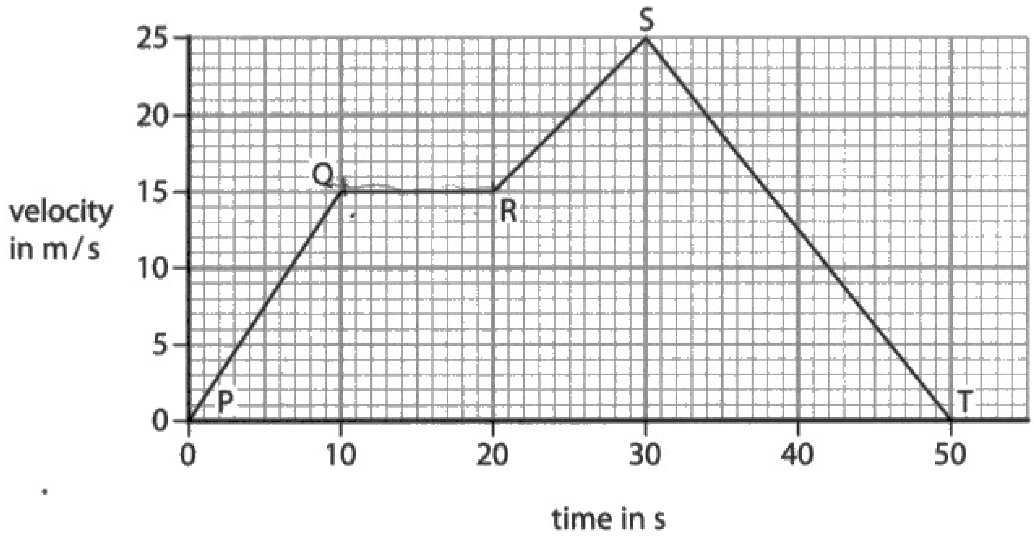
ResultsPlus
Examiner Tip

It's always worth attempting a calculation using data from the question, including from graphs.

As with the previous clip, this scores that compensatory mark for just using 10(s).

2 (a) The graph in Figure 3 shows how the velocity of a car changes with time.

The car starts from rest and travels along a level, straight road for 50 s.



(iv) Calculate the distance the car travels in part QR shown on the velocity/time graph in Figure 3.

(3)

D = speed × T

D = ~~15~~ × 10s · acceleration = speed.

1.5.

St = D = 15

distance = 15 m

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Examiner Comments

See above.

Question 2 (b)

This was a straightforward question substituting into $F = ma$.

This was answered well by the vast majority of candidates.

Most candidates left the evaluation at 2880 N, rather than round to 2900 N, which may be better practice, in the long run. It does not attract any penalty here, since significant figures were not explicitly asked for. On the other hand rounding incorrectly to 2800N was penalised since the mark scheme only accepted 2900N or 2880N. There was one mark for an answer with a power of ten error (or where the substitution mark was plain to see).

Full marks in this example, laying down the values substituted, with a correct evaluation.

(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

See above.

One mark for the correct substitution into the equation.

Evaluation mark not allowed on the mark scheme, if the rounding was wrong as in this question.

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

Calculate the force needed to give this car an acceleration of 2.4 m/s².

(2)

Use the equation

$$F = m \times a$$

$1200 \times 2.4 = 2800$

force = 2800 N

ResultsPlus
Examiner Comments

See above.

Question 3 (a)(ii)

Candidates found calculating ratios, with the added complexity of powers of ten, very challenging.

(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)

10 : 15
5
2 : 3

0.0000000001 : 0.000000000000001
1000 000 : 1

100,000 : 1

ratio of radius of atom to radius of nucleus = 2M

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Examiner Comments

The candidate sets out their calculation, with a conversion from standard form to decimal, accurately achieving the correct answer.

ResultsPlus
Examiner Tip

There is no substitute for clear methodical working, which this candidate demonstrates.

(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)

1.0×10^{-20}
$= 1 \times 10^{-10}$

1×10^{-10} 1×10^{-15}

1.0×10^{-5}
$= 1 \times 10^{-15}$

ratio of radius of atom to radius of nucleus = $1 \times 10^{-10} : 1 \times 10^{-15}$

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Examiner Comments

It's a halfway house to simply write down the ratio with the numbers presented, so 1 mark was due. To complete the candidate should have calculated a simplified outcome.

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Examiner Tip

With two marks available always aim to complete a simplification of ratios. Dividing on your calculator gives 100000:1.

(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)

1.0×10^{-10}

1.0×10^{-15}

0.0000000001

0.000000000000001

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

ResultsPlus
Examiner Comments

A number of candidates calculated the ratio the wrong way round, being awarded 1 mark.

(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)

0.0000000001

0.000000000000000001 ÷

1.00000.0

0.00000.1

ratio of radius of atom to radius of nucleus = 1000000 : 1

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Examiner Comments

This candidate has a factor of ten out in their final stated value. Unfortunately no other intermediate mark is seen, with the setting out of their very unclear.

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Examiner Tip

Set out your working clearly and you may get a mark even if you slip up along the way.

Question 3 (a)(iii)

Variable responses were seen to this question. Unfortunately a large number of students often mixed up the charges of the subatomic particles or wrote about the charges of each of the subatomic particles with no mention of them being a balanced/equal number.

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

(2)

Same number of Protons as electrons.

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Examiner Comments

This hits both mark points succinctly.

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Examiner Tip

Aim for simple answers like this where you are convinced you are answering the question at hand directly.

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

(2)

protons and electrons balance out equally.

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Examiner Comments

1 mark for protons and electrons and 1 mark for 'balance out'.

'Cancel out', seen in other answers, was not sufficient in this regards.

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

(2)

Atoms have no overall charge due to it consisting of protons, neutrons and electrons. The protons and ~~neutrons~~ electrons cancel out making no overall charge.

ResultsPlus
Examiner Comments

The mark scheme says ignore (neutral) neutrons, so 1 mark was given for talking of protons and electrons. Then we needed equal numbers of those. 'Cancel out' was never sufficient.

Question 3 (b)(i)

The number of protons being the same as the Z number in the symbols was known by many candidates.

Question 3 (b)(ii)

Using the standard formal for symbols, the top number alongside the 'C' symbol is the mass number. The lower number (atomic number) needs to be subtracted from the mass number to give the number of neutrons. A good number of candidates got this mark, but not as many as scored the proton number mark in part Q03b(i).

(ii) State the number of neutrons in one atom of carbon-14.

(1)

number of neutrons = ~~18~~ 14

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Examiner Comments

This candidate does not appreciate what the upper number with the standard format, using symbols, stands for.

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Examiner Tip

Subtract '*top number – bottom number*' to get the number of neutrons.

See below.

(ii) State the number of neutrons in one atom of carbon-14.

(1)

number of neutrons = 8

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Examiner Comments

See below.

ResultsPlus
Examiner Tip

Correctly subtracted 14 – 6 = 8.

Full marks.

Question 3 (b)(iii)

A majority of students achieved success with this question.

Blank answers, or guesses of 10000 years, were often not accompanied by any working out on the graph.

Quite a number of candidates misread the graph.

(iii) Figure 4 shows a graph for the decay of the radioactive isotope carbon-14.

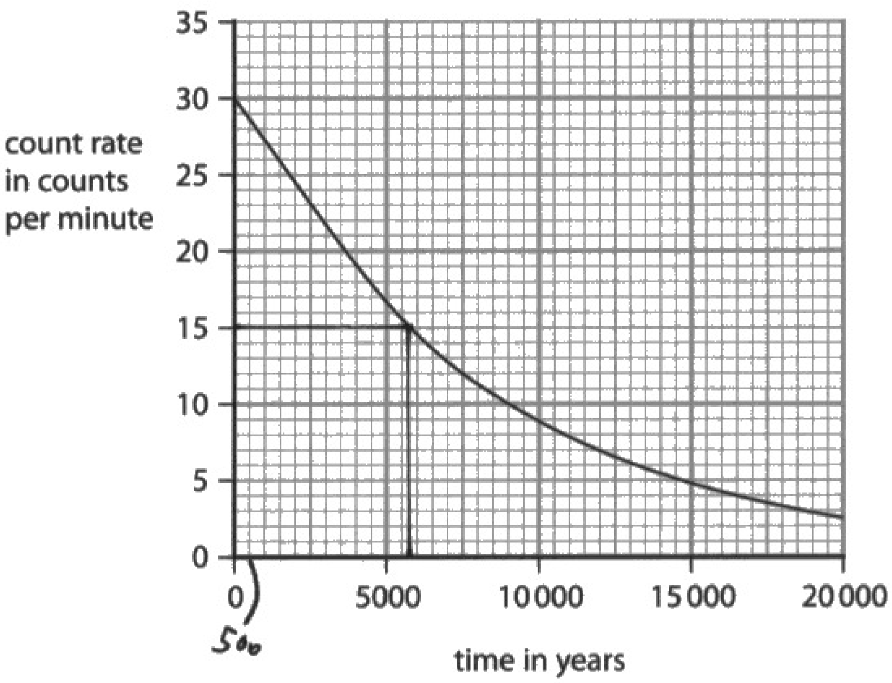

Figure 4

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

(2)

half-life = 5750 years

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Examiner Comments

Clear working out on the graph, with an accurate final answer.

ResultsPlus
Examiner Tip

You do have to do something with the graph to get the answer, like this candidate.

(iii) Figure 4 shows a graph for the decay of the radioactive isotope carbon-14.

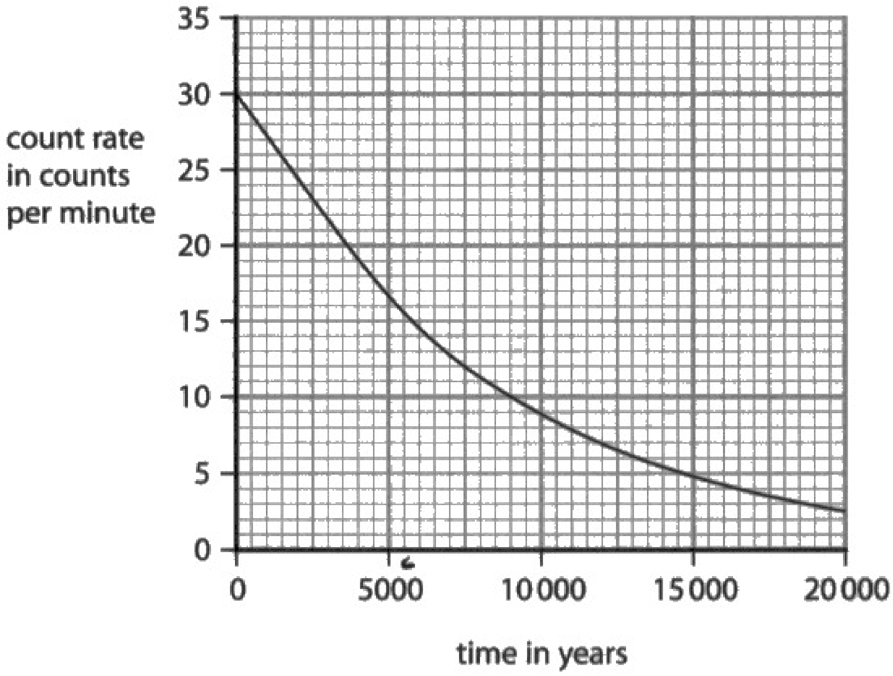

Figure 4

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

(2)

half-life = 6000 years

ResultsPlus
Examiner Comments

This gets both marks because it is within the stipulated range 5250 – > 6250 (years).

It doesn't represent best practice though, as even if the candidate were marginally out they would get no marks then. No intermediate mark without working on the graph.

ResultsPlus
Examiner Tip

Show your working always – here on the graph.

(iii) Figure 4 shows a graph for the decay of the radioactive isotope carbon-14.

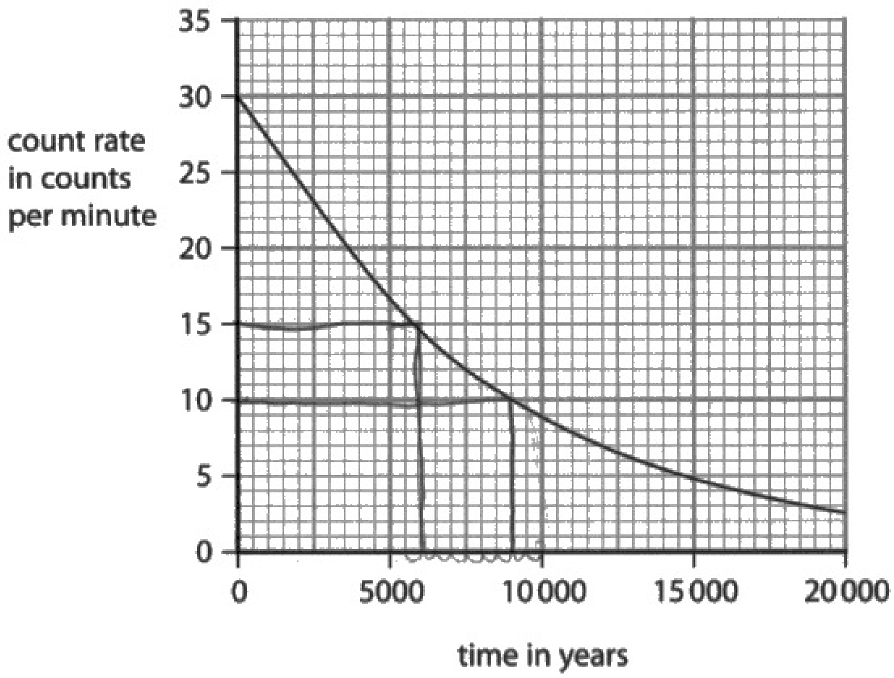

Figure 4

5800

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

5200

$$N(t) = N_0 \left(\frac{1}{2}\right)^{\frac{t}{t_{\frac{1}{2}}}}$$

(2)

half-life = 5200 years

ResultsPlus Examiner Comments

This answer is outside the accepted range. They can get a mark for the working out on the graph. It is clear how they then misread the 'time in years' scale to arrive at 5200 wrongly.

ResultsPlus Examiner Tip

Ask yourself 'What does one small square on the graph represent?'

Here on the x axis one small square represents 500 years (two whole squares 1000 years).

Question 4 (a)(ii)

The answer to this question was effectively from a traditional explanation/definition of what transverse waves are. A few candidates stated that the waves are vibrations/oscillations. The most popular answer for the second marking point was declaring they are 'up and down' (additional guidance).

(ii) Explain why the wave shown in Figure 5 is a transverse wave.

(2)

because it shows the constant vibrations and has a low frequency, large wave length. It R travels on a 90°

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Examiner Comments

This response is not well put together linguistically, but the elements 'vibrations' and the 90^{o} reference earned the two marks.

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Examiner Tip

It is worth learning fundamental definitions such as this.

(ii) Explain why the wave shown in Figure 5 is a transverse wave.

(2)

Figure £ 5 is a transvers wave because it is Perpandicller and the ossilation towords it

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Examiner Comments

Again full marks obtained via addressing key points even though not well-expressed.

Examiners have some sympathy towards answers with language issues.

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Examiner Tip

The answers accepted here are with ideas that have some complexity when putting together. You should still always be aiming for clarity in what you are saying. If it doesn't make sense you may well lose out on marks.

(ii) Explain why the wave shown in Figure 5 is a transverse wave.

(2)

Figure 5 is a transverse wave because its water and also the wave isnt a Soundwave, also its traveling ~~up~~ Side to side, whereas transverse go up and down.

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The comment 'transverse go up and down' earned the solitary mark.

(ii) Explain why the wave shown in Figure 5 is a transverse wave.

(2)

Because it has both an amplitude and a Wave Length.

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Examiner Comments

An effort was made using some of the words used in describing waves but nowhere near what was needed.

Question 4 (b)(i)

The key elements for an answer were 1) counting waves and then 2) that pass in a certain time.

Many candidates referenced timing waves without linking to how many pass.

(b) Figure 6 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.

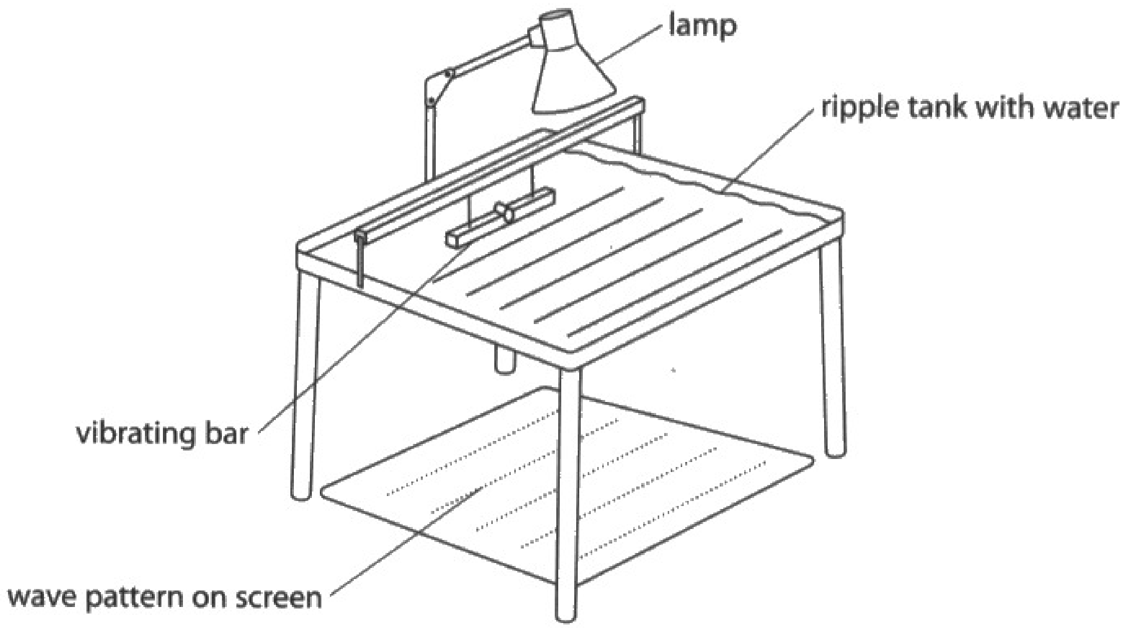


Figure 6

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 use the Stopwatch to time how many ripples go ~~by~~ by a certain amount of time.

ResultsPlus
Examiner Comments

An exemplary answer. It is concise and well-expressed.

(b) Figure 6 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.

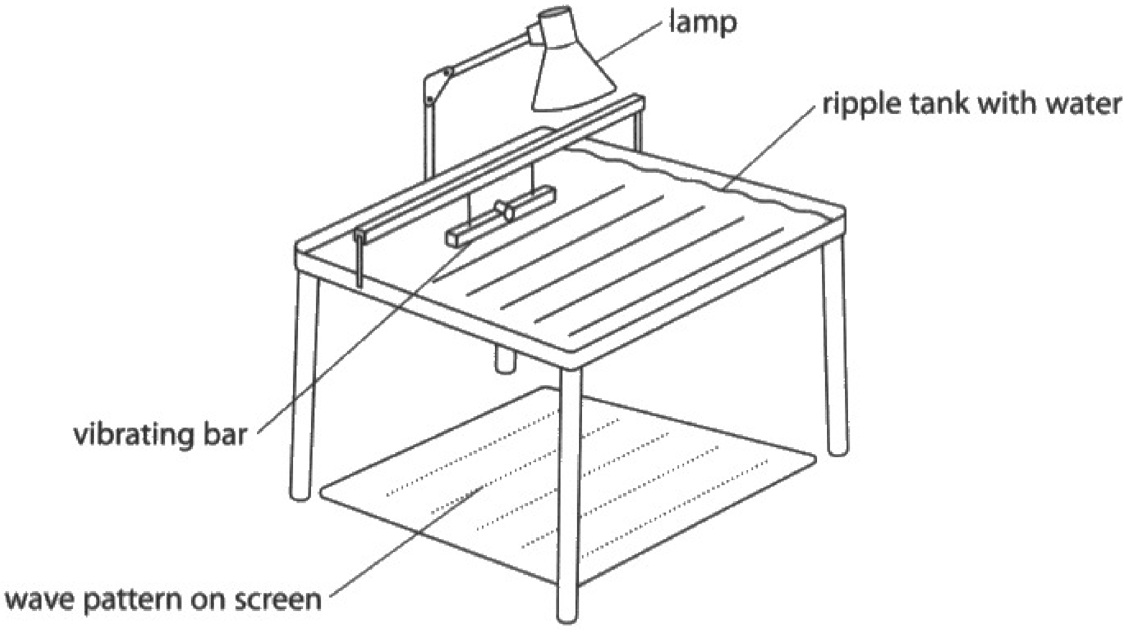


Figure 6

A student has a stop clock and a ruler.

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

(2)

~~She~~ They could count how many there is within a certain time then use that to estimate.

ResultsPlus
Examiner Comments

This answer has the two elements looked for, and is well expressed.

(b) Figure 6 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.

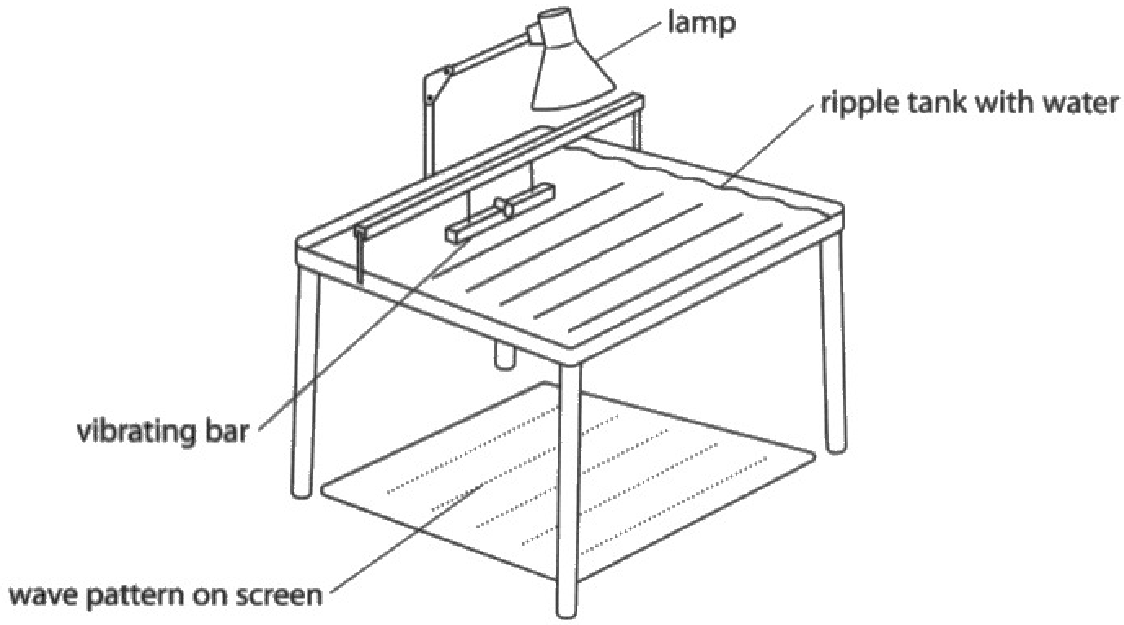


Figure 6

A student has a stop clock and a ruler.

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

(2)

by counting how many ripples they are

ResultsPlus
Examiner Comments

The candidate matches the first marking point – counting the number of waves, but does not bring in the necessary time interval association.

(b) Figure 6 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.

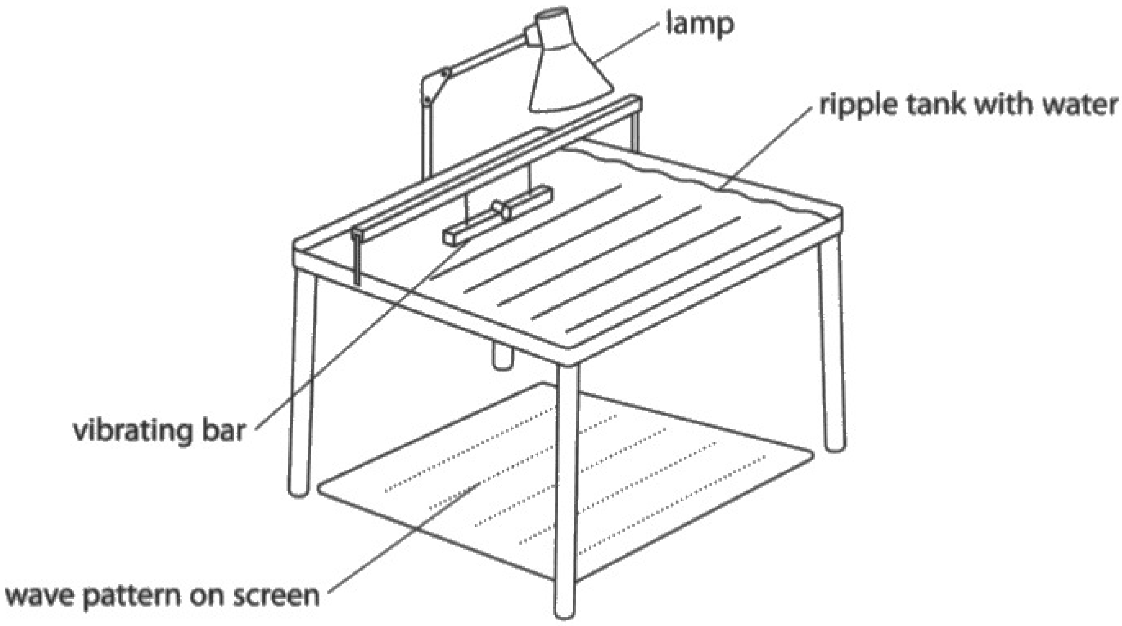


Figure 6

A student has a stop clock and a ruler.

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

(2)

A student could measure the frequency by putting a ~~his~~ phone on wave pattern and go back and count them after.

ResultsPlus
Examiner Comments

Some benefit of doubt given regarding 'count them after' from the phone record. 1 mark.

Question 4 (b)(ii)

Good answers were few and far between on this one. Candidates seemed to lack experience of such measuring.

(b) Figure 6 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.

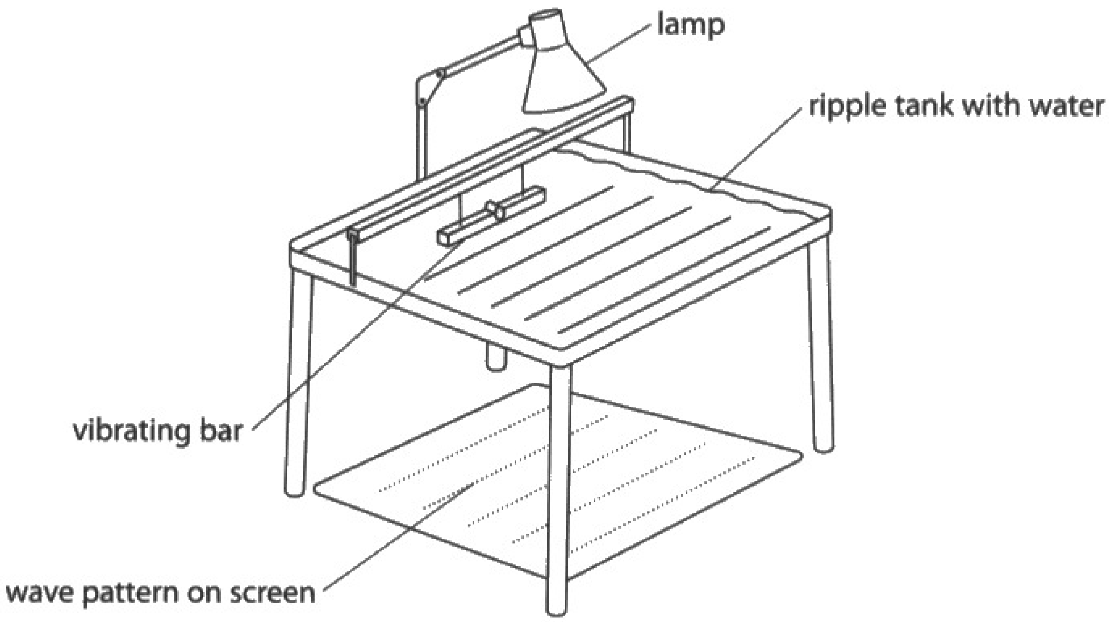


Figure 6

A student has a stop clock and a ruler.

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

(2)

By counting the number of waves that pass a point in 10 seconds, then they should divide their answer by 10 to get the frequency. A slow motion camera could help with counting the waves if they move to fast.

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

(2)

By taking a picture of the waves then measuring from the top of one wave to the next one.

ResultsPlus
Examiner Comments

Well described full marks answer, easy to follow.

(b) Figure 6 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.

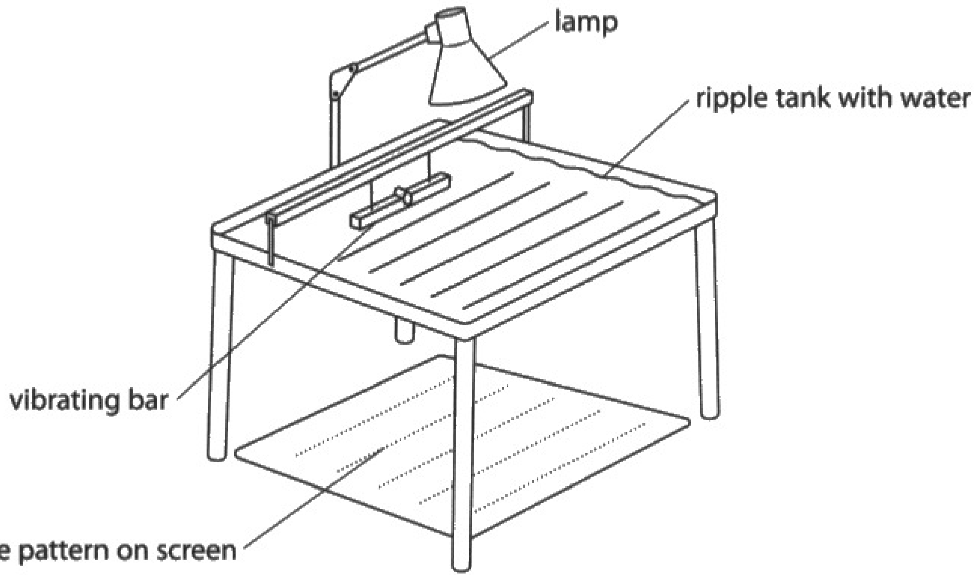


Figure 6

A student has a stop clock and a ruler.

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

(2)

Use a stop clock to measure ~~[illegible]~~ the frequency of thw ripples

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

(2)

Take a picture with a ruler next to the ripple tank to measure ~~the~~ wavelength

ResultsPlus
Examiner Comments

This gets mark point 1, for using a camera; a correct way through this question.

(b) Figure 6 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.

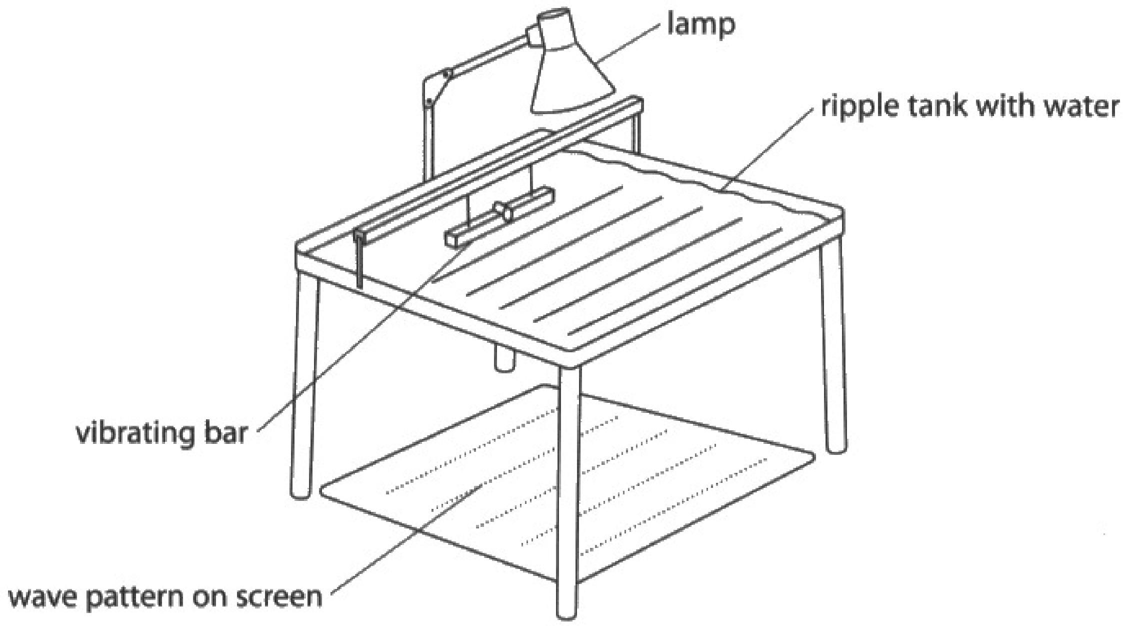


Figure 6

A student has a stop clock and a ruler.

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

(2)

By seeing how many ripples go pass a certain point in a certain amount of time

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

(2)

By measuring the distance between one ripple and another - the one after it.

ResultsPlus
Examiner Comments

Succinctly answered, thinking aloud with the little addition 'the one after it', which is precisely what was asked for.

(b) Figure 6 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.

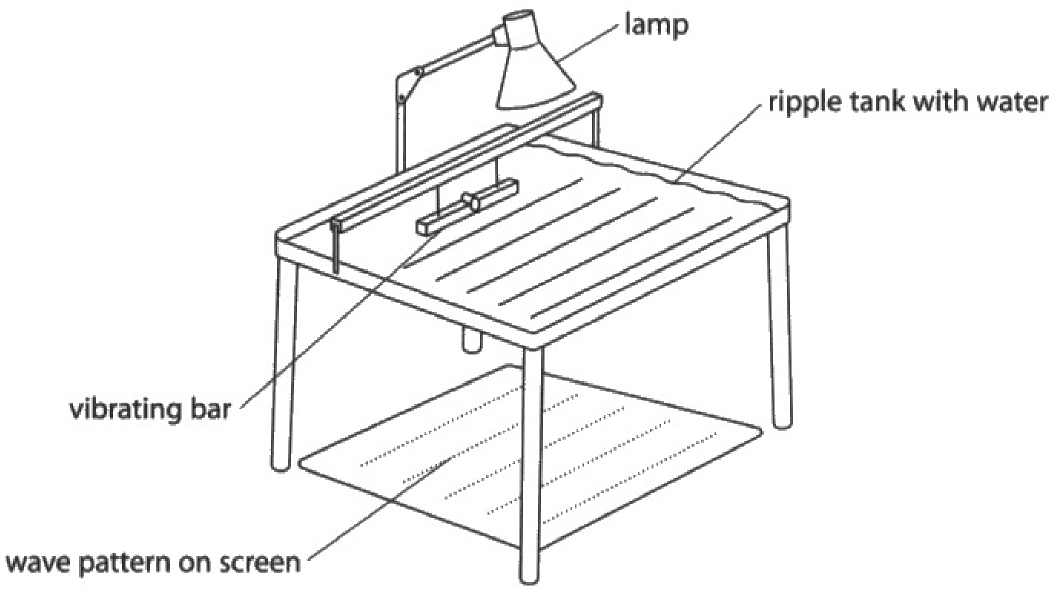


Figure 6

A student has a stop clock and a ruler.

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

(2)

....

....

....

....

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

(2)

Count how many ripples pass each second

ResultsPlus
Examiner Comments

The candidate is clearly muddling the ideas of frequency and wavelength.

ResultsPlus
Examiner Tip

It is worth committing to memory a good number of fundamental definitions.

(b) Figure 6 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.

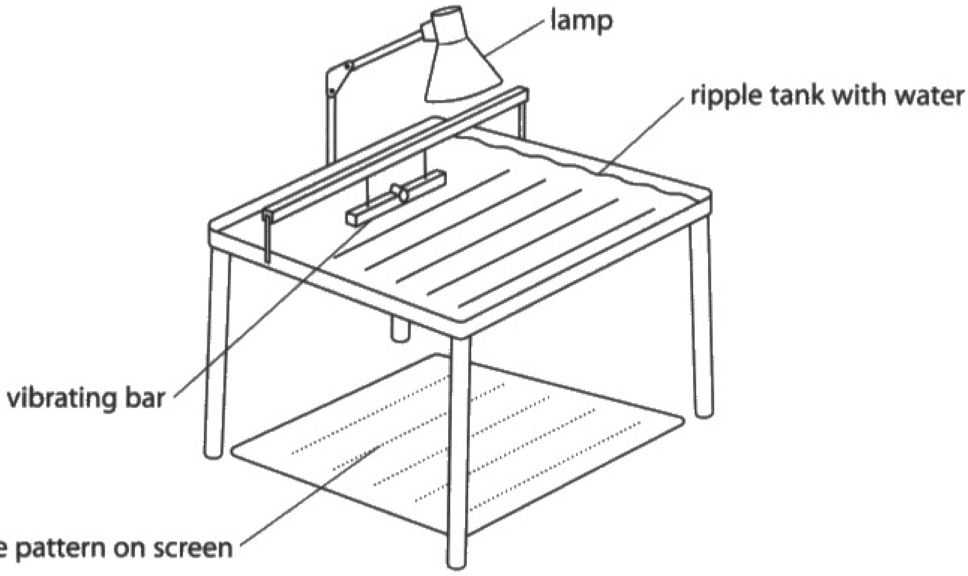


Figure 6

A student has a stop clock and a ruler.

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

(2)

time each ripple and measure each one ~~length~~ wavelength ~~and~~ with with ruler

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

(2)

Photo of the ripple and zoom in and measure for accurate results.

ResultsPlus
Examiner Comments

'Taking a photo' was a fair way of accessing mark point 1.

Then we needed to know 'measure what?'

Question 4 (c)

This question required the rearrangement of an equation and substitution into that equation, together with recalling the units of frequency.

Many candidates seemed confused by the term 'use the equation' in the question, and simply multiplied the two values from the text (0.8 x 4.0).

(c) In a swimming pool, a wave is produced with a wavelength of 4.0 m and a velocity of 0.8 m / s.

Calculate the frequency of the wave.

State the unit of frequency.

(3)

Use the equation

$$v = f \times \lambda$$

velocity = frequency x wavelength

frequency = velocity ÷ wavelength

0.8 ÷ 4 = 0.2

frequency of wave ......0.2...... unit ......hertz......

ResultsPlus
Examiner Comments

This candidate rearranges the equation, then substitutes and recalls the correct unit.

ResultsPlus
Examiner Tip

You may have to rearrange an equation to make the subject of the equation the quantity you want.

Units are vital in science, and in the physics component in particular.

(c) In a swimming pool, a wave is produced with a wavelength of 4.0 m and a velocity of 0.8 m/s.

Calculate the frequency of the wave.

State the unit of frequency.

(3)

Use the equation

$$v = f \times \lambda$$

4.0 x 0.8 = 3.2

frequency of wave 3.2 unit m

ResultsPlus
Examiner Comments

This candidate just multiplies the two numbers from the stem of the question, giving an incorrect answer. The unit was incorrect.

(c) In a swimming pool, a wave is produced with a wavelength of 4.0 m and a velocity of 0.8 m / s.

Calculate the frequency of the wave.

State the unit of frequency.

(3)

Use the equation

$$v = f \times \lambda$$

0.8 m/s × 4.0 m =

frequency of wave 3.2 unit Hz

ResultsPlus
Examiner Comments

This candidate goes down the false multiplication path but does earn a mark for a correct unit.

(c) In a swimming pool, a wave is produced with a wavelength of 4.0 m and a velocity of 0.8 m/s.

Calculate the frequency of the wave.

State the unit of frequency. ~~Hz~~ ~~Hz~~ Hz **(3)**

Use the equation

$$v = f \times \lambda$$

$4.0 \div 0.8 = 5$ Hz

frequency of wave ....5.... unit ....~~hz~~ Hz....

ResultsPlus
Examiner Comments

This candidate attempts the rearrangement but unfortunately arrives at an upside-down version of the correctly rearrangement equation. They do get the unit mark, however.

(c) In a swimming pool, a wave is produced with a wavelength of 4.0 m and a velocity of 0.8 m / s.

Calculate the frequency of the wave.

State the unit of frequency.

(3)

Use the equation

$$v = f \times \lambda$$

$\frac{0.8}{4.0} = 0.2$

frequency of wave 0.2 unit 3.2

ResultsPlus

Examiner Comments

This student makes a correct numerical evaluation, but gives a wrong unit. 2 marks given in total.

Question 5 (b)(i)

This question produced some good experimentally based responses. However, a lot of candidates misunderstood the question and discussed the results they would expect without giving any details of how the investigation should be carried out.

(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)

If there is more cases in the stack the cases will fall faster due to their being more weight whereas if there is less then the airtime will be greater because there is less weight

ResultsPlus Examiner Comments

The question's 'Describe an investigation' has not been followed unfortunately. Quite a number of candidates did this.

ResultsPlus Examiner Tip

'How would you' and 'Describe an investigation' should invite you to focus entirely on practical details – what would you do in a laboratory?

(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)

the student can use the stopwatch to calculate the the speed of 1 cupcake case as it falls, then repeat this as well as increasing the number of cupcake cases. the student can then compare the speed.

ResultsPlus
Examiner Comments

On the mark scheme this only gets 1 mark for matching mark point 4, repeating with a different number of cupcakes.

ResultsPlus
Examiner Tip

You must say exactly what you will measure, including which time and how you get speed. What else would you have to measure? Answer: distance through which they fall (height).

(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)

You would time how long it takes for one ~~cupke~~ cupcake case to fall then time how long it takes for a stack of cupcake cases to fall. That would give you the speed the cupcakes fall at.

ResultsPlus
Examiner Comments

This scores two marks, for timing how long it takes and then varying the number of cupcakes.

(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)

you time how long the cupcake cases, fall for and also measure the height you are dropping them from.

ResultsPlus
Examiner Comments

Two clear marks now, for measuring height (of fall) and timing how long to fall.

(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)

You could get a timer, drop a cupcake case from the same height point needing 2 people for this, one person to hold the ruler at the ~~Point~~ measurment it needs to get dropped, drop the cupcake case and measure the time it takes for each one to hit the ground, writing the information down and increasing the cupcake case after each drop to see if it really does depend on the number of cupcake cases in stack.

ResultsPlus
Examiner Comments

Mark points 1, 2 and 4 matched so 3 marks, very clearly.

(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)

You have the Metre rule Standing on the ground. You drop ~~the~~ one Cupcake case from the top of the Metre rule in line every time. When you release the Cupcake case you Start the Stopwatch when it hits the floor you stop the Stopwatch. Every time you add another Cupcake ~~Cass~~ case and record the time. Then you ~~&~~ use the equation ~~average~~ [illegible]

ResultsPlus
Examiner Comments

Mark points 1, 2, 3 and 4.

This has the added point of how a calculation would be done.

ResultsPlus
Examiner Tip

Investigations involve doing – describing steps in a method, but they may also involve how you would use the results (processing), as this candidate has done.

Question 5 (b)(ii)

This was a very straightforward question, with a simple immediate substitution into the equation for weight. So then just multiplying the two numbers together was all that was needed. A large majority of students achieved success with this question.

(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

$$W = mg$$

weight = mass x gravity field strength

0.005 x 10

weight = 0.5 N

ResultsPlus
Examiner Comments

One mark for substituting but then a mistake occurs in evaluation leaving the final answer a factor of 10 out.

(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 × 10

weight = 0.05 N

ResultsPlus
Examiner Comments

This represents a model answer. Clearly set out with an accurate final answer stated.

Question 5 (b)(iii)

Most candidates achieved success with this question, realising that air resistance opposed the motion of the cupcake.

Figure 9 shows a cupcake case that is falling at a constant velocity.

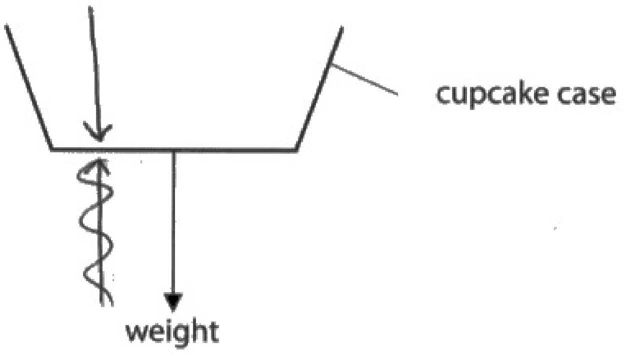


Figure 9

(iii) Draw an arrow on Figure 9 to show the force due to air resistance on the cupcake case.

ResultsPlus
Examiner Comments

Arrow acting downwards is in the wrong direction.

No marks.

ResultsPlus
Examiner Tip

Air resistance has to act against motion so that energy can be conserved.

Think through physics consequences – if it acted in the direction shown you would get energy for nothing.

Figure 9 shows a cupcake case that is falling at a constant velocity.

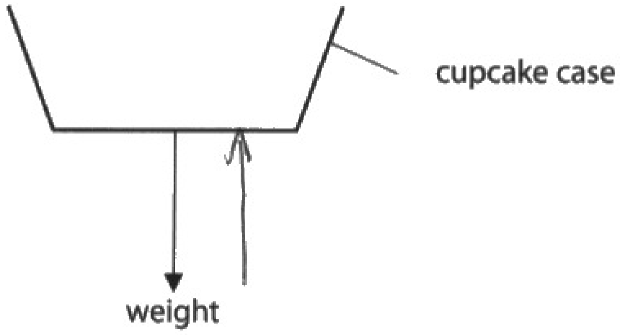


Figure 9

(iii) Draw an arrow on Figure 9 to show the force due to air resistance on the cupcake case.

ResultsPlus
Examiner Comments

Air resistance shown as an arrow acting vertically upwards, gaining the mark.

Question 5 (b)(iv)

Very few candidates scored this mark for stating that the **value** of acceleration of a cupcake with constant velocity was 0. There seemed a lack of comprehension as to what 'value' meant as indicated in many answers such as 'constant' or 'm/s^2'.

(iv) State the value of the acceleration of the cupcake case when it is falling at a constant velocity

(1)

$\frac{\text{change in velocity}}{\text{time}} = \frac{0}{10} = 0$

ResultsPlus
Examiner Comments

State the value just needed '0'.

ResultsPlus
Examiner Tip

'State the value' – just one number required.

(iv) State the value of the acceleration of the cupcake case when it is falling at a constant velocity

(1)

10

ResultsPlus
Examiner Comments

See below.

ResultsPlus
Examiner Tip

'10' was another commonly seen erroneous answer – presumably associated in students' minds with falling.

(iv) State the value of the acceleration of the cupcake case when it is falling at a constant velocity

(1)

gravity

ResultsPlus
Examiner Comments

Another answer showing miscomprehension of what was being asked for with a 'value' being asked for.

ResultsPlus
Examiner Tip

'Value' expects an amount, in numbers, which includes 0/zero.

Question 5 (c)

This was another high mark earner for candidates.

It just required direct substitution of acceleration (7) x time taken (3), resulting in an answer of 21 (m/s).

This only needs a couple of exemplars showing where candidates went wrong now.

(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)

$3m/s^2 \times 7s = 63$

change in velocity = 63 m/s

ResultsPlus
Examiner Comments

Substitution mark awarded.

Then the student seems to have taken the square in m/s^2 as an invitation to square the number 3, wrongly. This was seen a number of times.

(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

$$\text{change in velocity} = \text{acceleration} \times \text{time taken}$$

(2)

3 ÷ 7

change in velocity = 0.42 m/s

ResultsPlus
Examiner Comments

Another mistake made was for students seeing simple multiplication as too easy and therefore rearranging the equation, wrongly as it happens.

No credit is due here, unfortunately.

Question 6 (a)(i)

In this case a rearrangement of the equation was needed, making Δh the subject of the equation. Candidates did find this hard.

6 (a) Figure 10 shows a football kicked against a wall.

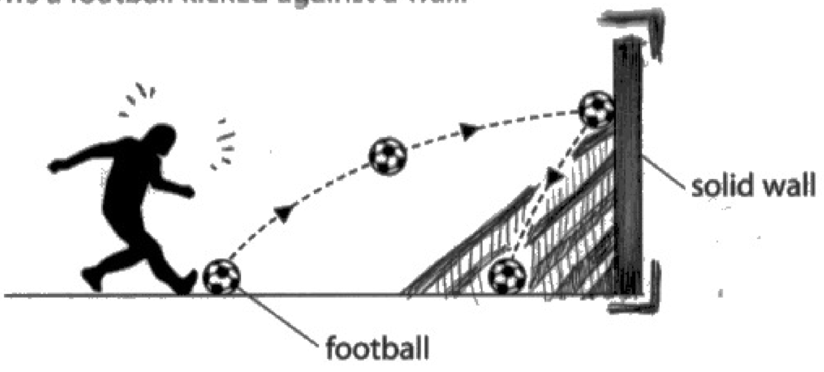


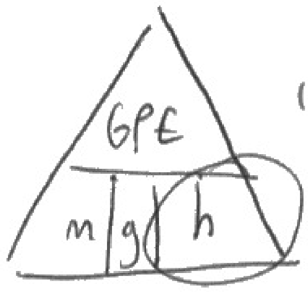
Figure 10

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

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

$11 J = 0.42 \times 10 \times \text{height}$

$\frac{11 J}{m \times g}$ $\frac{11 J}{0.42 \times 10}$ $\frac{11 J}{4.2} = 2.619047$

height = 2.619047 m

ResultsPlus
Examiner Comments

This candidate displays their equations very well; the working may be easily followed.

Yielded maximum marks (3).

6 (a) Figure 10 shows a football kicked against a wall.

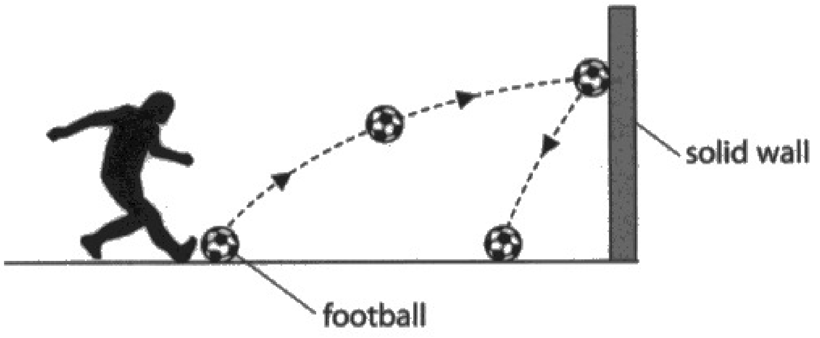


Figure 10

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

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

GPE = M × g × h

11J = 0.42 × 10 × ?

0.42 × 10 = 4.2

11 ÷ 42 = h

h = 0.2619047

0.26

height = 0.26 m

ResultsPlus
Examiner Comments

A power of ten error led to a mark of 2.

In this case the 4.2 became 42 halfway through the calculation, yielding an answer which was a factor of 10 out.

6 (a) Figure 10 shows a football kicked against a wall.

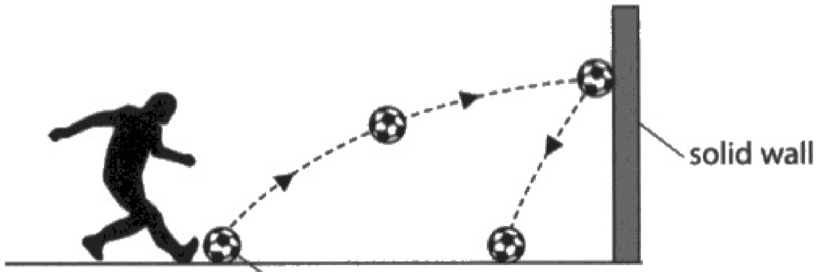


Figure 10

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

11J 10

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

0.42

11 × 10 × 0.42

height = 46.2 m

ResultsPlus
Examiner Comments

This was a common answer, whereby the candidate just multiplies the three numbers given in the stem of the question together. It was awarded one mark – see additional guidance in the mark scheme.

6 (a) Figure 10 shows a football kicked against a wall.

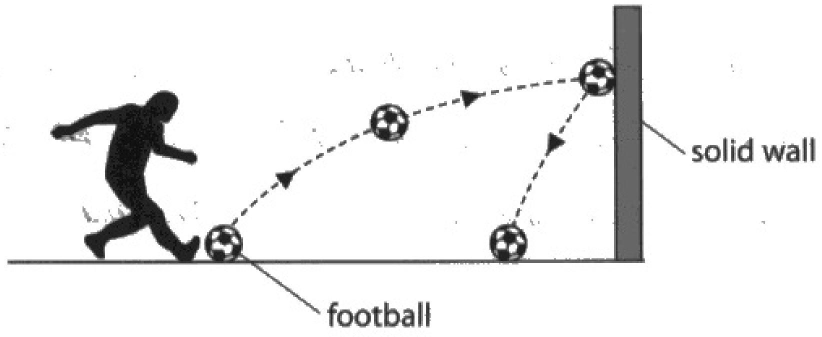


Figure 10

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

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

$10\,N/kg = 0.42\,kg \times 11\,J \times \Delta h$

$10\,N/kg = 4.62$

$\Delta h = \frac{4.62}{10}$

$\Delta h = 0.462\,m$

height = 0.462 m

ResultsPlus
Examiner Comments

The algebra went awry with this candidate.

46.2 would have got one mark.

This deviates further so no mark is due.

ResultsPlus
Examiner Tip

Care is needed in calculations.

That substitution of 10 as the GPE, compounded with algebraic lacks, has led to this wrong outcome.

Question 6 (a)(ii)

Overall this scored better than Q06a(ii).

There were extra complications in having to search for the appropriate mass in the earlier part of the question, plus having to deal with v^2. Most managed that though.

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

(2)

Use the equation

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

$$KE = \frac{1}{2} \times 0.42\,kg \times 12^2$$

$$= 30.24\ J$$

kinetic energy = 30.42 J

ResultsPlus
Examiner Comments

This shows an exemplary answer. The working out is very clear and easy to follow.

ResultsPlus
Examiner Tip

Aim for this standard to achieve success.

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

(2)

Use the equation

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

$\frac{1}{2} \times 0.42 \times 12^2 = 3.024$

kinetic energy = 3.024 J

ResultsPlus
Examiner Comments

With only two marks available, this gets the substitution mark but falls down on the evaluation of the final answer.

ResultsPlus
Examiner Tip

Use your calculator carefully.

One way in which this answer could have been arrived at is typing 0.042 into the calculator instead of 0.42.

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

(2)

Use the equation

$\frac{1}{2} \times 0{\cdot}42 \times 12 =$

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

kinetic energy = 2·52 J

ResultsPlus
Examiner Comments

This was seen relatively frequently – forgetting to square the v.

ResultsPlus
Examiner Tip

Practising handling equations with squares in helps get into the habit of not falling into this trap.

Question 6 (a)(iii)

Candidates did not often stick to the remit of the question – '**when** the ball hits the wall'.

So there were lots of irrelevant reference to gravitational potential energy, which does not have a change during that occurrence.

Very few candidates referred to elastic potential energy.

The mark scheme was applied quite loosely, having no regard for any time order in the transfers (i.e. from and to). All we needed to see was any citing of any two of the four accepted stores/processes.

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

(2)

The ball is kicked this activates the kinetic energy that makes it go towards the wall when it bounces its elastic energy is needed to bocnce then gravity pulls it to the bottom

ResultsPlus
Examiner Comments

This candidate realises that elastic potential energy plays a role as (when) the ball hits the wall.

They gained a mark for mentioning kinetic energy as well.

ResultsPlus
Examiner Tip

Try and make sure you address the question at hand and are not tempted to quote tried and tested answers to other questions e.g. those involving transfers between gravitational potential energy and kinetic energy.

This question says **'when the ball hits the wall'**.

This candidate has taken notice of that.

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

(2)

The energy will transfer into Kinetic and Sound.

ResultsPlus
Examiner Comments

This scores mark points 1 and 3. Once again irrespective of context or order, so that accessibility to marks was enhanced.

Sound and heat figure in mark point 3 (additional guidance). They are one marking point.

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

(2)

The ball compresses against the wall and produces Sound and heat and the ball de-compresses and bounces back with less energy because of the waste energy

ResultsPlus
Examiner Comments

See above.

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

(2)

moves from chemical energy in the legs / muscles in the legs to kinetic energy when moving through the air.

ResultsPlus
Examiner Comments

Many candidates scored a mark through mentioning kinetic energy, in any context.

Question 6 (b)

This question asked candidates to explain trends in graphs for non-renewable and renewable energy resources over an eight year period.

Many level 1 answers were seen where candidates didn't effectively go beyond descriptions of the trends involved.

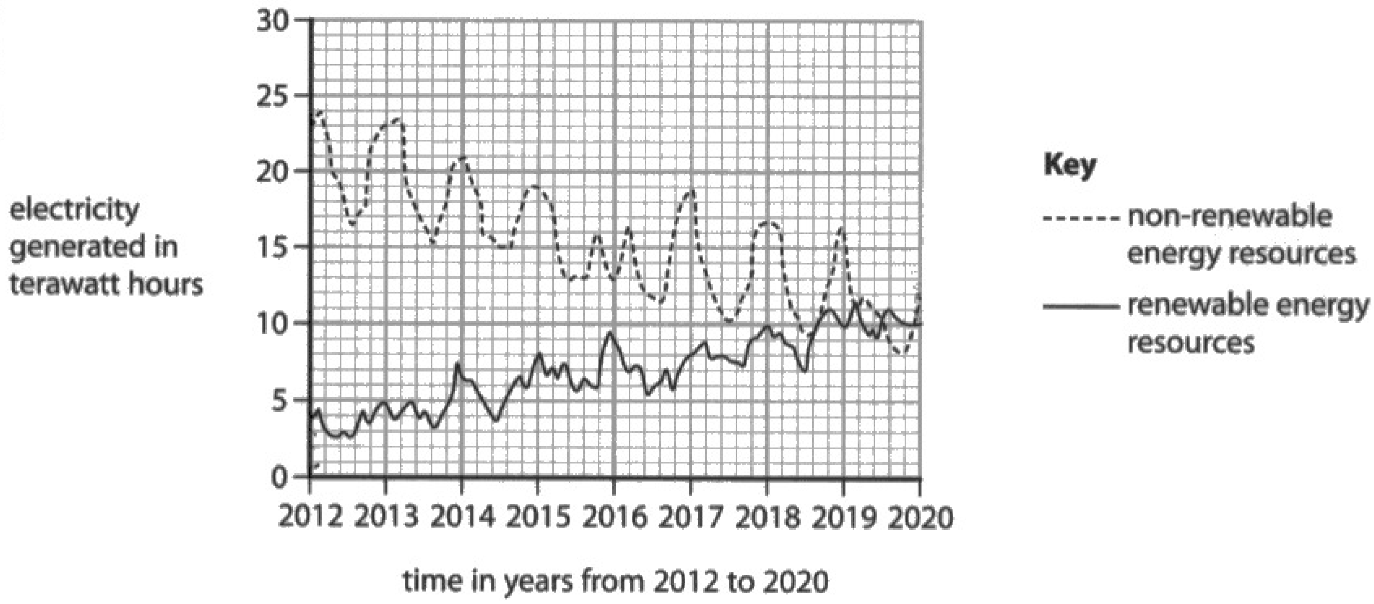
Explanations of those trends needed to be attempted for levels 2 and 3.

For level 2 limited explanations for either trend was needed.

For level 3 a minimum of a detailed explanation of one trend with some explanation of the other was needed.

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

The graph in Figure 11 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 11
- 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)

The amount of electricity generated has changed in 8 years by non-renewable decreasing from ~~2?~~ 23 to 11, due to the the electricity rate decreasing it leads to less people using it also because of the negative impacts such as fossil fuels, fossil fuels can run out and release carbon dioxide which affects the greenhouse gases and climate change. The change in use of non renewable increase as from 4 electricity generated to 10 in 8 years, more renewable energy resources have been introduced such as solar pannels by using the sun to provide energy due to reflection. these are better for the environment as they dont release any toxic gases and can be renewed by replacing them after a whille which saves energy and is alot cheeper. The trends show in figure 11 that non-renewable resources are becoming less popular and renewable resources increase activity rate however non-renewable is still used more in ~~2020~~ 2020 at a electricity rate of 12

(Total for Question 6 = 13 marks)

ResultsPlus
Examiner Comments

The trends are well described and there are details in both explanations of non-renewable and renewable resources. Details such as fossil fuels running out, the role of carbon dioxide in global warming and their influences on trends, are dealt with at a high level.

6 marks awarded.

ResultsPlus
Examiner Tip

Read what the question asks for – in this case **how** and **why** the amounts of electricity generated have changed. Just answering the how (descriptions) would not go far enough. Explanations are needed to go beyond level 1.

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

The graph in Figure 11 shows how the amount of electricity generated by these resources changed from 2012 to 2020.

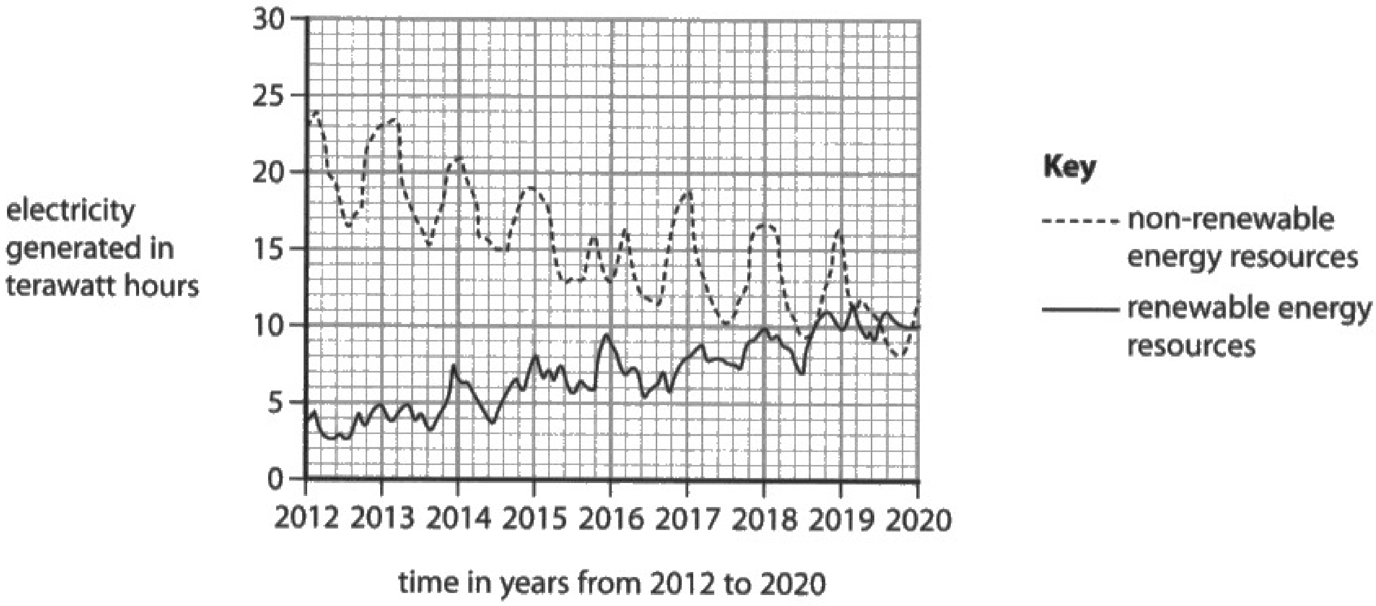


Figure 11

R = Increase
N-R = Decrease

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 11
- 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)

- The amount of electricity generated by renewable energy has increased due to the global issue of climate change
- Amount of electricity generated by non-renewable energy has ~~de~~ decreased as there are other cheaper and better for the environment options.
- Non-renewable ~~en~~ energy sources are bound to run out, alternatives need to be made.
- More people are ~~against~~ standing to prevent climate change in 2020 compared to 2012.
- In 2012, UK may not have had the ~~g~~ resources ~~as~~ to make ~~a~~ stable, renewable energy sources.
- Non-renewable energy sources may cause health issues. people wanted this to change.

ResultsPlus
Examiner Comments

This is another representative level 3 answer with detailed explanations, including an understanding of global warming and its consequences. The explanations also include an understanding of how society's view on this is changing and the impact of that in calls for change.

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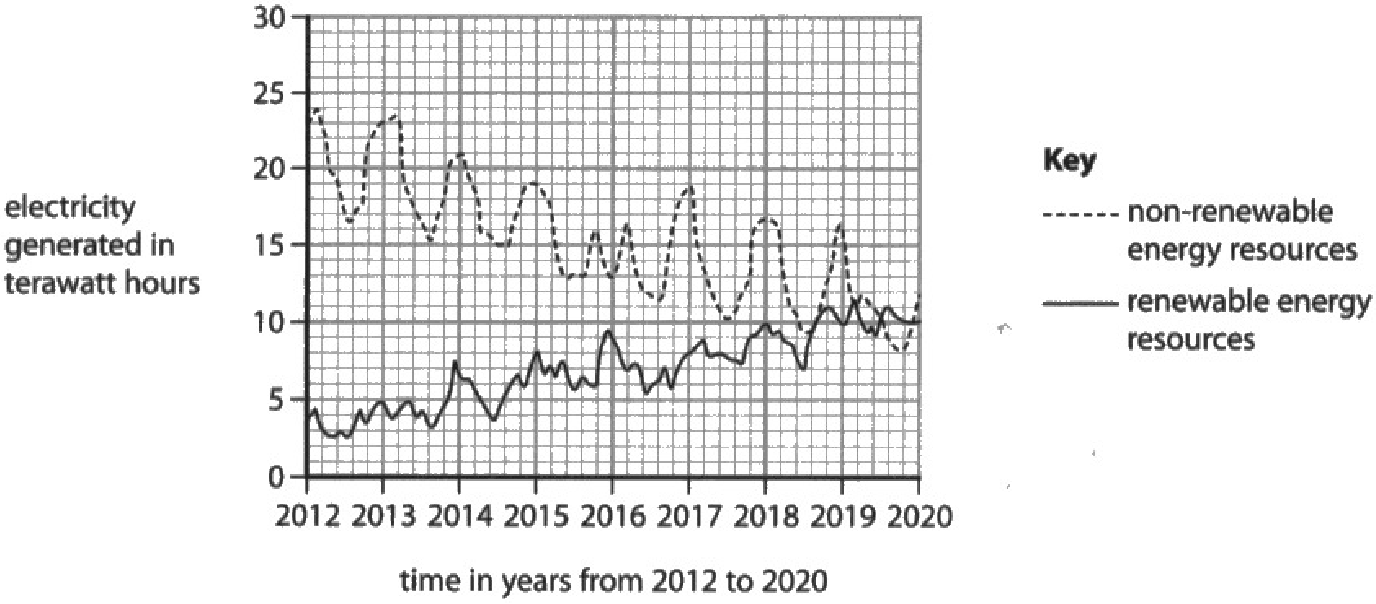

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(6)

The amount of electricity generated by renewable and non-renewable resources has changed because non-renewables are running out so there has been an increase in renewables as shown in figure 11 the change in amount of electricity generated by solar has ~~increase~~ increased as people have solar panels on roofs. Non-renewables have decreased as shown in the figure because since they are harder to get they have become more expensive for example gas so that is why the amount of electricity generated by renewable and non-renewables have changed between ~~3~~ 2012 to 2020.

ResultsPlus
Examiner Comments

This answer has a recognition of trends and limited explanations of both trends.

This corresponds with the level 2 descriptors.

4 marks awarded.

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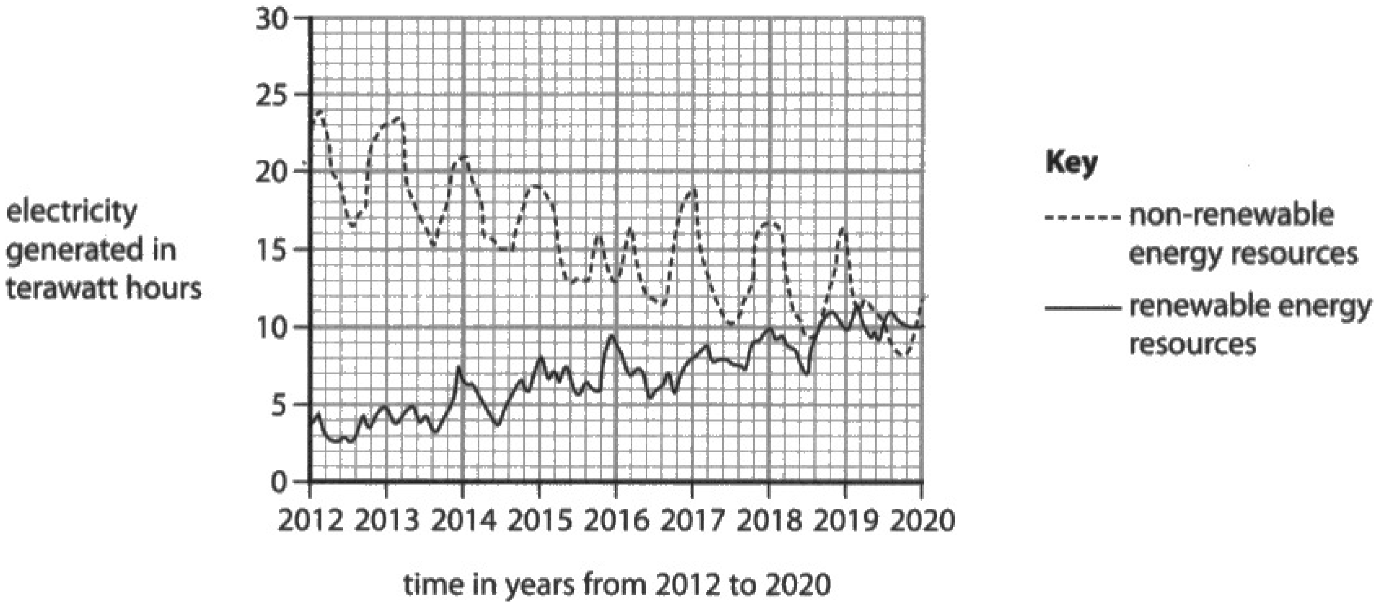

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(6)

In 2012 the energy generated in for non-renewable terawatt hours ~~is~~ is 23 and renewable energy was 4, then there was a big change the non-renewable energy decreased majorly in 2020 it was 12 this is becaus non-renewable energy like oil, fuel take ~~millions of~~ millions of years to be made, renewable increased to 10 this is because things like solar pannels can be reused as many times as you need.

ResultsPlus
Examiner Comments

The trends are described.

There are brief and quite limited explanations of why these trends have occurred in terms of the nature of fossil fuels and solar panels.

6 marks questions are judged holistically. An idea that 'solar panels can be reused' has crept in there; this could be better explained. However the levels are assessed looking for the positive things that are said.

This is not as good as the previous level 2 answer but still satisfies level 2 requirements.

Hence 4 marks.

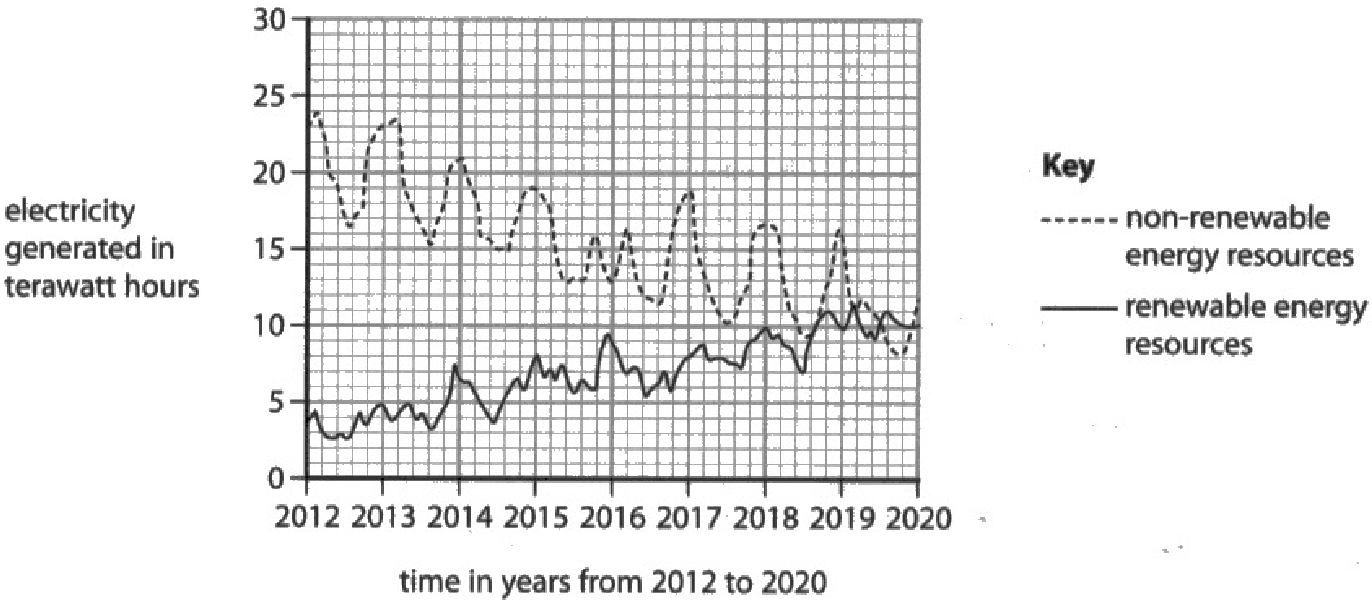
ResultsPlus
Examiner Tip

Always aim to **develop your answers** to demonstrate as much as possible your understanding.

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

back with more Power.

The graph in Figure 11 shows how the amount of electricity generated by these resources changed from 2012 to 2020.



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

(6)

~~Afor~~ ~~energy~~ ~~ren~~ Non-renewable energy resources ~~there~~ is slowly decreasing whereas renewable energy sources are increasing overtime.

ResultsPlus
Examiner Comments

The two trends are there, without explanation.

Level 1, 2 marks

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

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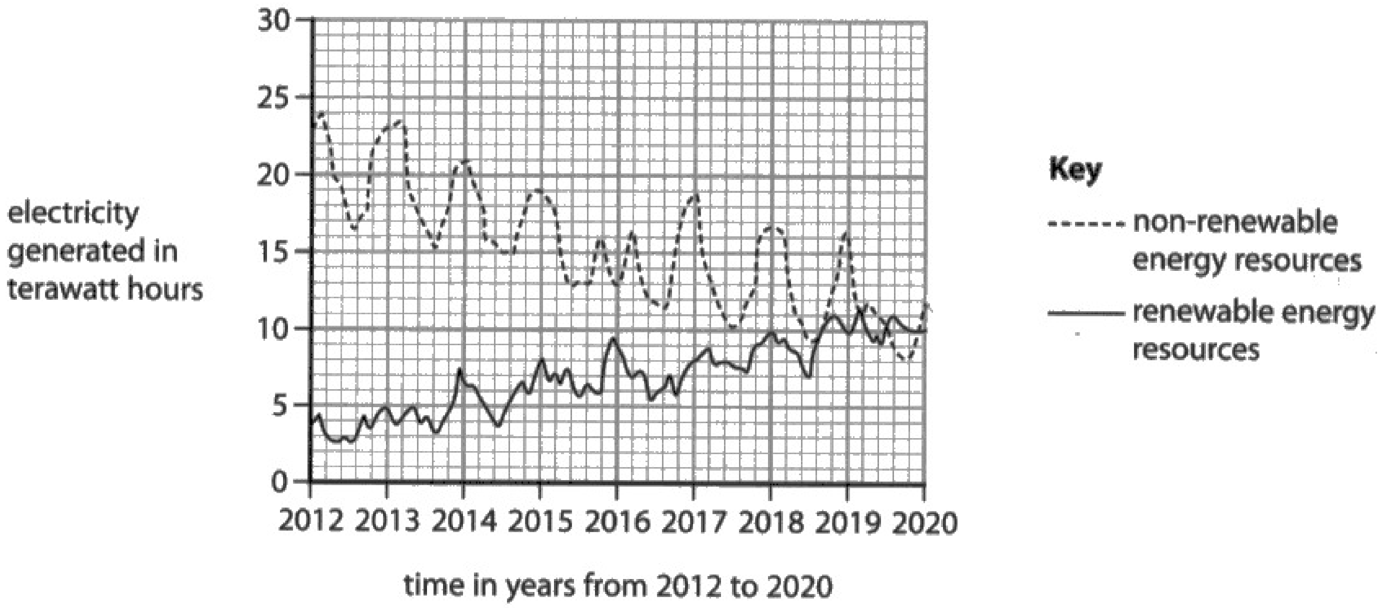

Explain how and why the amount of electricity generated by renewable and non-renewable energy resources has changed from 2012 to 2020.

Your answer should include

- the trends shown in Figure 11
- 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 is decreasing in a negative corralation whereas renewable are increasing. Renewable energy went from 4 electricity generated in terawatt hours to 10 from 2012 – 2020 however it peaked at 11.6 in 2019. non renewable energy went from 23 electricity generated in terawatt hours in 2012 down to 12.

ResultsPlus
Examiner Comments

The trends are there, quoting data to support.

Explanations of why these trends are occurring is lacking.

Some other candidates spent inordinate amounts of time describing the trends, but still not getting to answering 'why'.

Such answers could only get a maximum of 2 marks.

2 marks.

Paper Summary

Overall this exam gave ample opportunity for candidates to display their knowledge and understanding at grades 1-5.

Candidates have continued to do well with most calculation questions and these often formed a substantial part of candidates' accrued marks.

The assessment of practical skills showed some mixed outcomes. Question 4 practical items, about measuring frequency and wavelength, seemed out of the experience of most candidates, whilst question 5, falling cupcakes, yielded more achievement. There were many students, however, who did not provide a practical procedure asked for, but went off on a tangent talking theoretically as to how the number of cupcakes had a bearing upon the speed of fall. The standard of answers on practical questions was variable with some students showing good procedural knowledge, whilst for others there was a clear lack of familiarity shown.

Q06b, concerned graphs showing trends of non-renewable and renewable energies. It yielded few level 3 responses, and many didn't go beyond level 1, beyond which explanations were needed rather than simply describing trends. Within this there was opportunity for candidates to bring in environmental considerations into their explanations. Not many took the opportunity to do that, with many content at the 'describing trends' sage of level 1.

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

- Students should make the most of opportunities afforded in school laboratories where they become acquainted with practical work from the specification. This concerns both core practicals and the suggested practicals. It would benefit students to always question 'What is the purpose of this experiment?' making sure they are clear in their minds about it. After the event evaluations are also useful, especially when reflecting about how the experiment could have been improved.
- Straightforward substitutions into equations are well done by most candidates. Having to rearrange an equation proves to be a stumbling block for many. This may be overcome with more practice at this mathematical skill. Powers of ten issues prevented a number of students making progress with q03aii where a ratio of the size of an atom, compared with that of the nucleus, was asked for.
- In constructing explanations students need to take note of the marks allocated to a particular question and respond with a corresponding number of points in their answer. Attention needs to be made upon the command words used in a question. 'Explain' questions invariably need more than descriptions of the issue. This was notable in candidates' responses to Q06b.

Grade boundaries

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

https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

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