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Examiners' Report
June 2015

GCSE Physics 5PH2F 01

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Introduction

This unit is divided into six topics and candidates' knowledge and understanding of all six topics is tested in the examination.

A variety of question types were used, such as objective questions, short answer questions worth one or two marks each and longer questions worth three or four marks each. The two six mark questions were used to test quality of written communication.

It was particularly pleasing to note the much improved performance on such questions on this P2 paper compared to that on earlier series of examinations. Candidates usually wrote more, and more sensibly, in this series.

The overall impression was that the majority of candidates had been well prepared for this examination.

Successful candidates were:

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

Less successful candidates:

- had gaps in their knowledge
- did not read the questions carefully, and gave answers that were related to the topic being tested, but did not answer the question
- did not understand the meaning of key scientific words and phrases
- found difficulty in applying their knowledge to new situations
- did not show the stages in their working
- did not think through their answers before writing

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

Question 1 (a)

Most candidates scored well on this question.

Investigating motion

1 Some students investigate the speed of cars.
They measure the time it takes each car to travel a distance of 80 m.

(a) State **two** measuring instruments the students should use.

(2)

1 ~~A speed stopwatch~~ Stopwatch

2 Timer

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Examiner Comments

A significant number of candidates gave two instruments from the same marking point. 1 mark.

Investigating motion

1 Some students investigate the speed of cars.
They measure the time it takes each car to travel a distance of 80 m.

(a) State **two** measuring instruments the students should use.

(2)

1 STop watch

2 Tape measure

ResultsPlus
Examiner Comments

One of the many responses that scored full marks.

Investigating motion

1 Some students investigate the speed of cars.
They measure the time it takes each car to travel a distance of 80 m.

(a) State **two** measuring instruments the students should use.

(2)

1 Speedometer

2 STOP watch

ResultsPlus
Examiner Comments

Many candidates gave the names of equipment that would work out the speed directly such as 'speed camera' or 'speedometer'. 1 mark.

Question 1 (b) (i)

The majority of candidates gained this mark. The most common error was to give the colour of the fastest car, presumably because it had the shortest time to travel the 80 metres rather than the longest time.

Question 1 (b) (ii - iii)

The majority of candidates correctly calculated the speed of the black car, but found estimating the speed in miles per hour too difficult.

(ii) Calculate the speed of the black car.

(2)

speed of the black car = 18.6 m/s

(iii) 20 miles per hour is approximately 9 m/s.

Estimate the speed, in miles per hour, of the black car.

(1)

speed of the black car = ~~40~~ 41.2 miles per hour

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Examiner Comments

One of the responses that scored full marks without showing any working.

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Examiner Tip

Always write down clearly all the steps used in arriving at a final answer.

(ii) Calculate the speed of the black car.

(2)

speed = distance / time

80 ÷ 4.35

speed of the black car = 18.6 m/s

(iii) 20 miles per hour is approximately 9 m/s.

Estimate the speed, in miles per hour, of the black car.

(1)

speed of the black car = 40 miles per hour

ResultsPlus
Examiner Comments

A fully correct response with clearly set out working.

(ii) Calculate the speed of the black car.

(2)

speed of the black car = 9 m/s

(iii) 20 miles per hour is approximately 9 m/s.

Estimate the speed, in miles per hour, of the black car.

(1)

speed of the black car = 20 miles per hour

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Examiner Comments

This candidate scored one mark for a correct estimate in miles per hour of the wrong speed. If the candidate had included working they might have scored two out of the three marks.

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Examiner Tip

Always include working. There is usually plenty of time allowed to answer all the questions fully.

Question 1 (c)

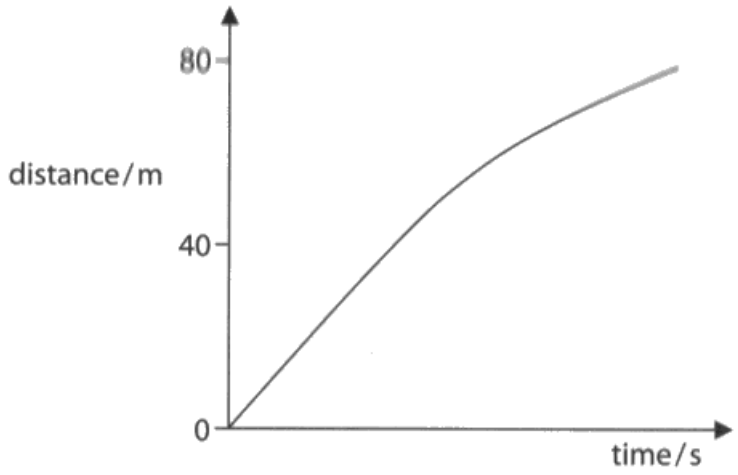
Many candidates failed to answer this correctly due to the following points;

i) Not recognising that a diagonal line on a distance time graph = constant speed and instead interpreting this section as acceleration.

ii) If candidate did correctly identify the first section as constant/ steady speed – many went on to describe the second section (less steep line) as acceleration not deceleration.

iii) Many candidates simply described the pattern of the graph rather than using specific terms e.g. as time increased, the distance increased.

(c) The distance-time graph for another car is shown below.



Describe what the graph shows about the speed of the car as it travels the 80 m.

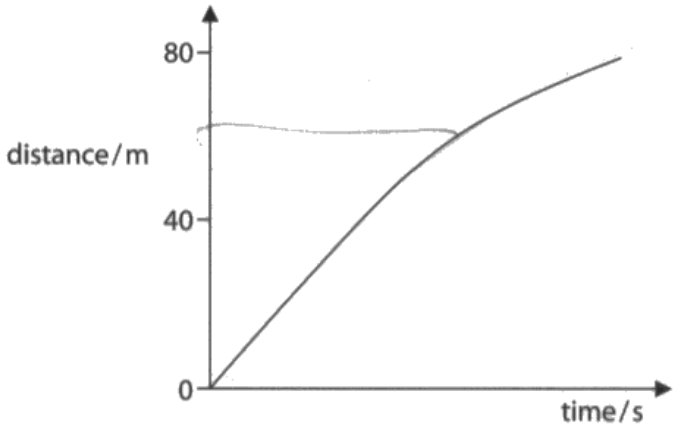
(2)

As the distance is increasing So so is the time.

ResultsPlus
Examiner Comments

Vague descriptions of the graph. 0 marks.

(c) The distance-time graph for another car is shown below.



Describe what the graph shows about the speed of the car as it travels the 80 m.

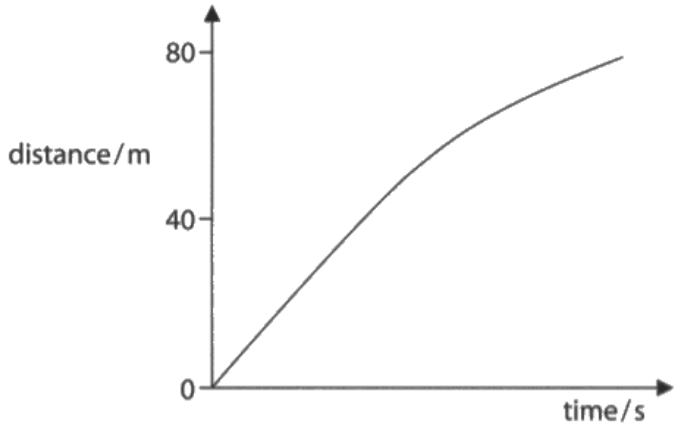
(2)

~~at the start he is going about 1m/s~~
At the start he travels at a constant speed then about 60m he slows down.

ResultsPlus
Examiner Comments

One of the responses that scored both marks for this question.

(c) The distance-time graph for another car is shown below.



Describe what the graph shows about the speed of the car as it travels the 80 m.

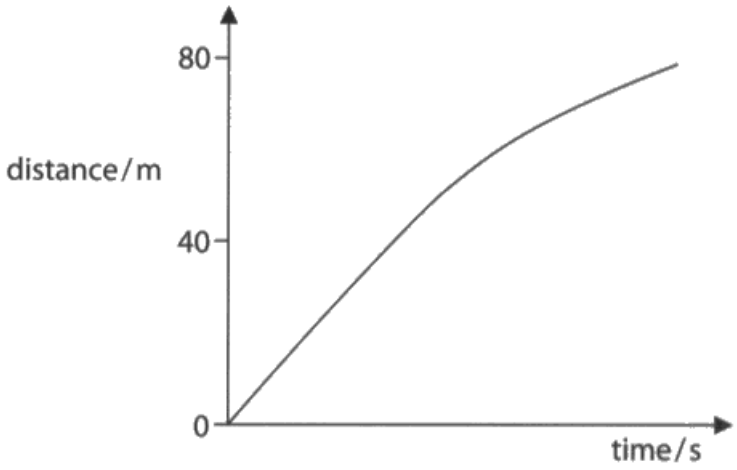
(2)

the further the car goes, the faster the car goes.
the car speeds up as it ~~goes~~ travels a further distance

ResultsPlus
Examiner Comments

This type of response from candidates was very common. 0 marks.

(c) The distance-time graph for another car is shown below.



Describe what the graph shows about the speed of the car as it travels the 80 m.

(2)

The speed stayed constant for more than half of the distance and got quicker towards the end.

ResultsPlus
Examiner Comments

Many candidates thought that the decrease in gradient represented an acceleration of the car. This candidate scored one mark for the first part of their response.

ResultsPlus
Examiner Tip

Always write clearly and concisely.

Question 2 (a) (ii)

Most candidates were aware that a movement of charges occurs, but to score both marks candidates needed to identify which charges moved and the direction in which they moved.

(ii) Explain how the plastic rod becomes negatively charged.

(2)

The positive charges from the plastic rod goes into the cloth and makes the rod negatively charged.

ResultsPlus
Examiner Comments

It is incorrect in this (and any question about electrostatics and insulators) to have positive charges moving as the protons are in the nuclei of the atoms which are in fixed positions.

This candidate scored no marks.

ResultsPlus
Examiner Tip

When explaining how an object becomes electrically charged always talk about electrons moving from one surface to another.

(ii) Explain how the plastic rod becomes negatively charged.

(2)

The plastic rod becomes negatively charged because electrons ~~are being~~ from the cloth are going into the plastic rod, giving the plastic rod more electrons, thus giving a negative charge.

ResultsPlus
Examiner Comments

An example of a response that scored full marks.

Question 2 (a) (iv)

The only way that the water will not bend is for there to be no attraction or repulsion between the rod and the water. For this to be the case, the charge of the rod must be neutral i.e. the rod must have lost its charge. Some candidates were incorrect in thinking that for it not to attract, the rod must now be positive; this is incorrect as there would still be a force between the water and the rod.

(iv) The student puts the plastic rod into the stream of water and pulls it out.

Now, when he holds the plastic rod near the stream of water, the stream of water does not bend.

Suggest why the stream of water does not bend.

(1)

Because the water has earthed the charge ~~around~~ so the rod has no charge.

ResultsPlus
Examiner Comments

An example of a correct response that clearly states the rod is no longer charged.

(iv) The student puts the plastic rod into the stream of water and pulls it out.

Now, when he holds the plastic rod near the stream of water, the stream of water does not bend.

Suggest why the stream of water does not bend.

(1)

because the ~~negative~~ positive charge from the water has transferred to the rod

ResultsPlus
Examiner Comments

A common error was to talk about positive charges moving. Even if the candidate went on to say the rod became neutral no marks would be scored.

Question 2 (b)

Use of charge = current x time is required for this question.

However, to achieve full marks, candidates needed to remember to convert the time into seconds.

(b) A torch has a battery and a bulb.

The current in its circuit is 0.08 A.

Calculate the amount of charge passing a point in this circuit in 2 minutes.

(3)

charge = current x time

= 0.08 x 120

= 9.6

charge = 9.6 coulombs

ResultsPlus
Examiner Comments

An example of a well set out response. This candidate followed good practice and scored full marks.

ResultsPlus
Examiner Tip

Write down the correct equation and substitute the values correctly and this will gain one mark even if the answer is not correct.

(b) A torch has a battery and a bulb.

The current in its circuit is 0.08 A.

Calculate the amount of charge passing a point in this circuit in 2 minutes.

(3)

charge = Current x time

0.08 x 2 = 0.16

charge = 0.16 coulombs

ResultsPlus
Examiner Comments

This is an example of a very commonly seen response. The candidate has forgotten to convert the time into seconds. This well set out response scores two out of the three marks available.

(b) A torch has a battery and a bulb.

The current in its circuit is 0.08 A.

Calculate the amount of charge passing a point in this circuit in 2 minutes.

(3)

0.08 × 2 = 0.14

charge = 0.14 coulombs

ResultsPlus
Examiner Comments

This candidate has made an error in evaluating the calculation. However, this response scores one mark as the working clearly shows the correct substitution.

ResultsPlus
Examiner Tip

Write down the correct equation and substitute the values correctly and this will gain one mark even if the answer is not correct.

Question 3 (b)

Many candidates scored very well on this question. The easiest way to score full marks in this question was to write down the number of protons = 36 and to calculate the number of neutrons i.e. 89-36 = 53 neutrons. Weaker candidates often misread the question and tried to give the structure of the atom including the electron configuration.

(b) An isotope of krypton, krypton-89, is produced in the nuclear reactor.
A nucleus of this isotope can be represented as

$$^{89}_{36}Kr$$

Describe the structure of a nucleus of krypton-89.

(4)

It has 89 Protons and 36 neutrons. It has a big surface area. It is flamable. It is dangerous and radioactive.

ResultsPlus
Examiner Comments

This type of response was fairly common. Despite the confusion about nucleon and proton numbers this response scored 2 marks for correctly stating the names of two particles in the nucleus.

(b) An isotope of krypton, krypton-89, is produced in the nuclear reactor.
A nucleus of this isotope can be represented as

$$^{89}_{36}Kr$$

Describe the structure of a nucleus of krypton-89.

(4)

It has 36 protons and 53 neutrons. It has 36 electrons on the outter shells. The protons and neutrons together are 89.

ResultsPlus
Examiner Comments

An example of one of the many responses that scored full marks.

Question 3 (c)

Many candidates seemed unaware of the difference between the terms nucleus and atom or molecule. It is important to emphasise that nuclear reactions such as nuclear fission involve the nucleus.

(c) Use words from the box to complete the following sentence.

The words may be used once, more than once, or not at all.

(2)

alpha	atom	beta
molecule	neutron	nucleus

During nuclear fission, a uranium-235 nucleus splits

when it absorbs a slow moving neutron.

ResultsPlus
Examiner Comments

One of the many responses that scored both marks.

(c) Use words from the box to complete the following sentence.

The words may be used once, more than once, or not at all.

(2)

alpha	atom	beta
molecule	neutron	nucleus

During nuclear fission, a uranium-235 atom splits

when it absorbs a slow moving neutron.

ResultsPlus
Examiner Comments

One of the most common errors was to have atom instead of nucleus in the first space. 1 mark.

Question 3 (d)

Many candidates were able to answer this question by stating that the control rods are lowered into the reactor to absorb excess neutrons.

However, there was a significant number of candidates that confused the role of a moderator and the control rods. References to the role of the moderator did not score.

(d) There are many control rods in a nuclear reactor.

Explain how control rods are used to reduce the number of nuclear reactions in the reactor.

(2)

They cool down the nuclear reactor.

ResultsPlus
Examiner Comments

This type of response was quite commonly seen from weaker candidates. 0 marks.

(d) There are many control rods in a nuclear reactor.

Explain how control rods are used to reduce the number of nuclear reactions in the reactor.

(2)

Control rods absorb neutrons. ~~so~~ TO control the reactions the rods are lowered to reduce the amount of fission going on.

ResultsPlus
Examiner Comments

An example of a response that scored full marks. Lowering the control rods was accepted as meaning the rods were moved further into the reactor core.

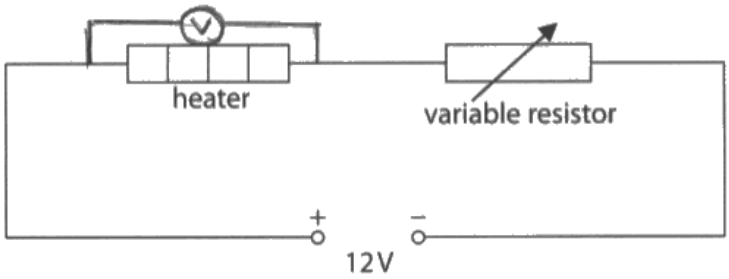
Question 4 (a) (i)

To measure the potential difference across the heater, a voltmeter is needed in parallel with the heater. Marks were awarded for the correct position in the circuit and the correct symbol for a voltmeter. The most common mistake was putting the voltmeter in series with the heater rather than in parallel.

Controlling and using electric current

4 (a) A technician investigates the potential difference (voltage) across an electrical heater.

This circuit diagram shows the circuit the technician uses.



(i) Add a voltmeter to the circuit which will measure the potential difference (voltage) across the heater.

ResultsPlus
Examiner Comments

An example of a well drawn response that scored both marks.

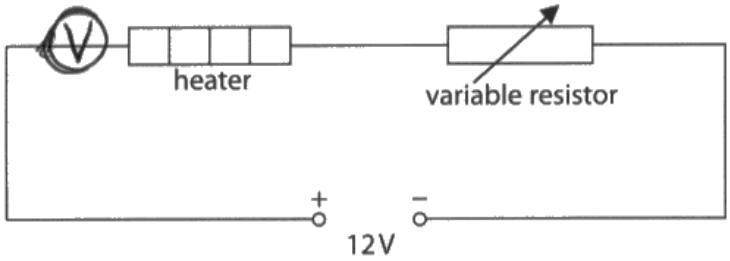
ResultsPlus
Examiner Tip

Always take care when drawing circuit symbols. Use of a ruler for drawing connecting wires is recommended.

Controlling and using electric current

4 (a) A technician investigates the potential difference (voltage) across an electrical heater.

This circuit diagram shows the circuit the technician uses.



(i) Add a voltmeter to the circuit which will measure the potential difference (voltage) across the heater.

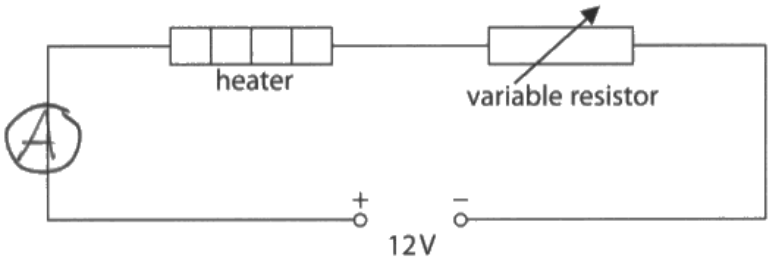
ResultsPlus
Examiner Comments

This is an example of the most commonly seen error. The voltmeter is connected in series with the heater. This response scores one mark for the correct voltmeter symbol. The wire going through the symbol was ignored as candidates could not remove this line.

Controlling and using electric current

4 (a) A technician investigates the potential difference (voltage) across an electrical heater.

This circuit diagram shows the circuit the technician uses.



(i) Add a voltmeter to the circuit which will measure the potential difference (voltage) across the heater.

(2)

ResultsPlus
Examiner Comments

This candidate has added an ammeter instead of a voltmeter. This is the answer to a different question and does not score any marks.

Question 4 (a) (ii)

Most candidates were completely successful with making a correct substitution into V=IR and then evaluating to give 8.4 V.

(ii) The resistance of the heater is 15 Ω.

The current in the heater is 0.56 A.

Calculate the potential difference (voltage) across the heater.

(2)

Potential difference = current x resistance
0.56 x 15 =

potential difference = 8.4 V

ResultsPlus
Examiner Comments

A well set out example. One of the many seen for this question. 2 marks.

(ii) The resistance of the heater is 15 Ω.

The current in the heater is 0.56 A.

Calculate the potential difference (voltage) across the heater.

(2)

C x R

0.56 x 15 = 0.4

potential difference = 0.4 V

ResultsPlus
Examiner Comments

This candidate has made an error during evaluation. However, as the correct substitution is clearly shown in the working the response scored one mark.

Question 4 (a) (iii)

To score full marks candidates needed to use the equation E = VIt, substitute the given values and evaluate to give the answer as 72 J. Most candidates calculated this correctly. Candidates generally lost credit for failing to multiply by time (i.e. V x I not V x I x t) or for substituting 30s as a value of 0.30. Even though the voltage is clearly given in this question as 6V, a number of candidates attempted to use 8.4V from a previous part of the question.

(iii) The technician changes the value of the variable resistor.

She measures the new voltage across the heater and the new current in it.

Here are her results:

voltage = 6.0 V current = 0.40 A.

Calculate the amount of electrical energy transferred in 30 s by the heater.

(2)

current x pd x time

0.40 x 6.0 x 30 s

energy transferred = 72 J

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Examiner Comments

A clearly set out example of one of the many responses that scored full marks.

Question 4 (a) (iv)

The most common way of scoring marks in this question was to establish where the energy was wasted and what form it is wasted. For example, 'energy transferred to the resistor was wasted as heat' would score both marks.

Most candidates found this question quite difficult as vague references to energy wasted as heat were insufficient due to the heater in the circuit.

(iv) The total energy supplied by the battery in 30 s is 144 J.

Explain why your answer in (iii) is not the same as the total energy supplied by the battery.

(2)

not all of the energy gets used up or transferred from the battery. Some can be wasted due to heat or sound.

ResultsPlus
Examiner Comments

One of the many responses that failed to score. The heater is designed to transfer energy to the surroundings as thermal energy and so vague references to 'energy is wasted as heat' were insufficient for a mark.

(iv) The total energy supplied by the battery in 30 s is 144 J.

Explain why your answer in (iii) is not the same as the total energy supplied by the battery.

(2)

Some energy is wasted through heat energy from the wires.

ResultsPlus
Examiner Comments

This response scored both marks. The candidate clearly identifies the wires as the place where energy is wasted and 'through heat energy' was an acceptable form.

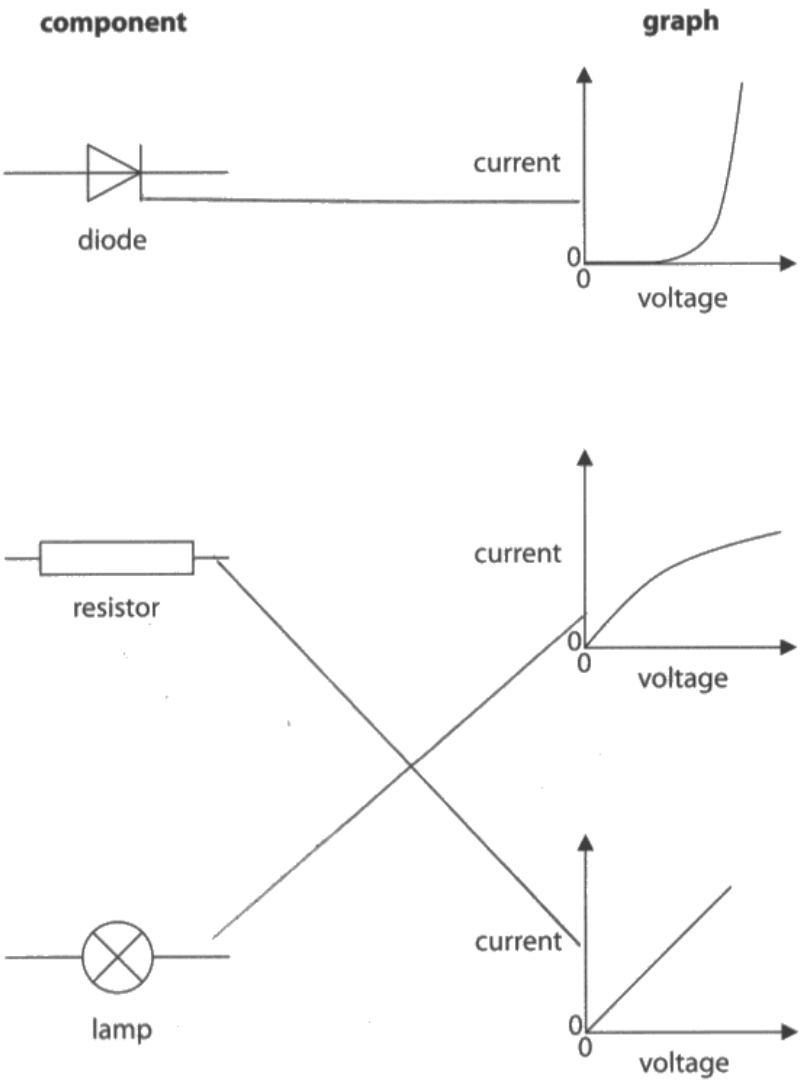
Question 4 (b)

Many candidates found this question surprisingly difficult, possibly due to the fact that all of the graphs showed a line with a positive gradient, the only difference between the graphs being how the gradient changed. Candidates could just learn the shapes of standard graphs or could use the fact that the higher the gradient the lower the resistance to deduce which graph is which.

(b) The graphs show how the current in a component changes with the voltage applied across the component.

Draw a line from each component to its correct graph.

(2)



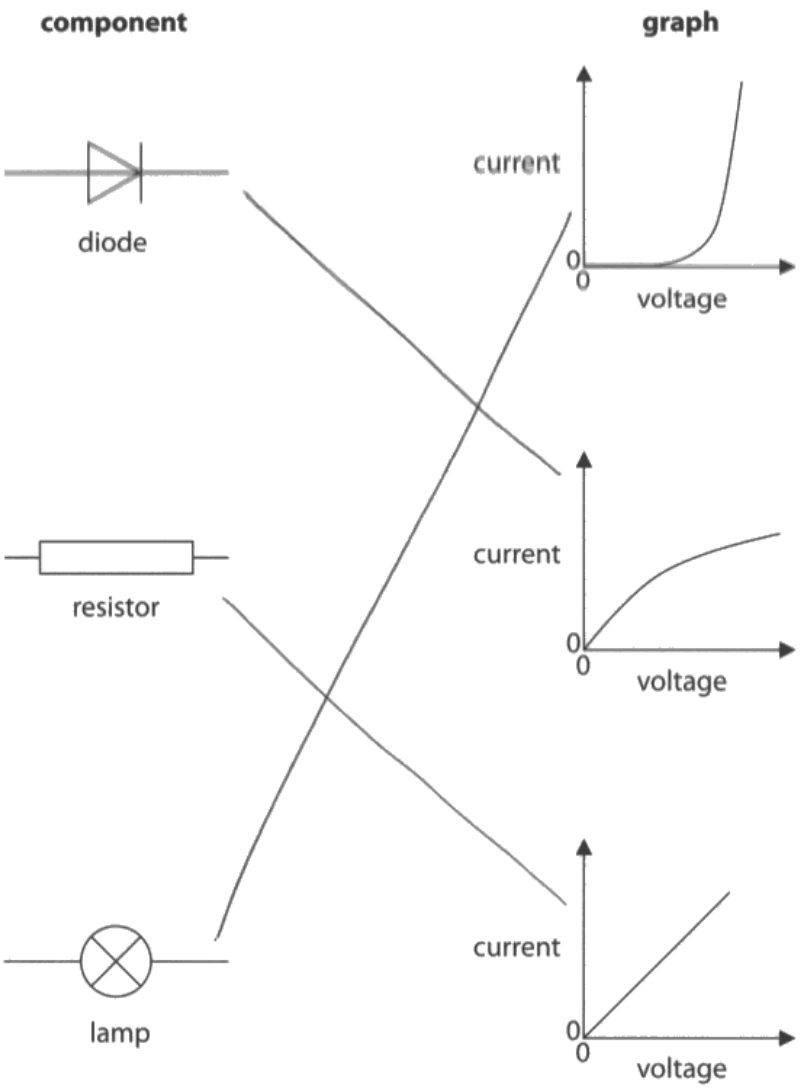
ResultsPlus
Examiner Comments

One of the many responses that scored both marks.

(b) The graphs show how the current in a component changes with the voltage applied across the component.

Draw a line from each component to its correct graph.

(2)



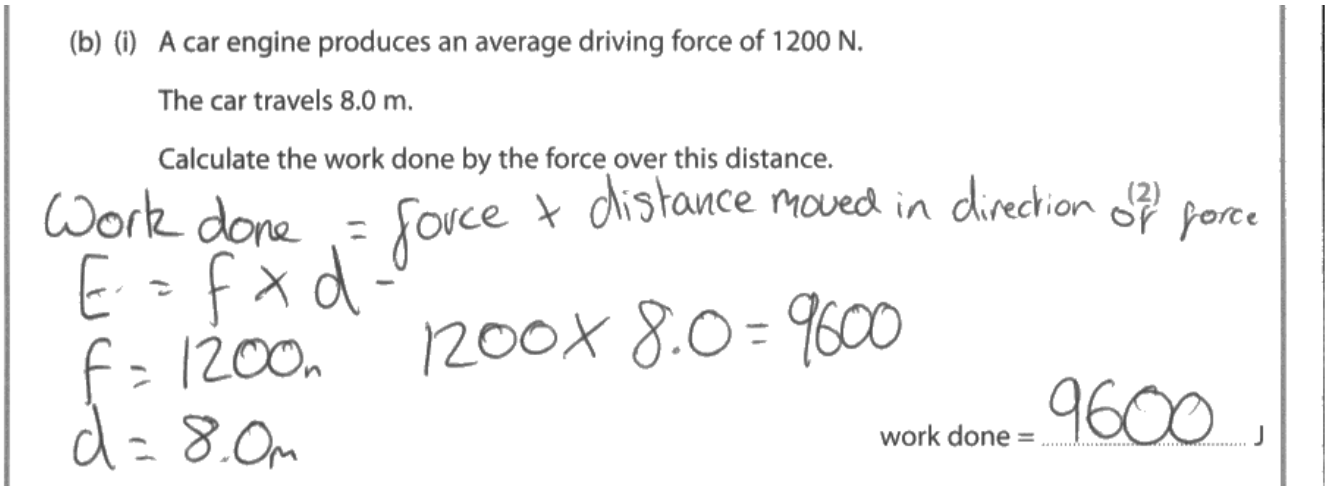
ResultsPlus

Examiner Comments

Most candidates correctly linked the resistor to its correct graph, but confused the diode and lamp graphs. This response scored one mark.

Question 5 (b) (i)

The majority of candidates correctly used the equation work = force x distance, substituted the correct values and evaluated to give 1200 x 8.0 = 9600 J. The most common error was an incorrect answer from multiplying the numbers.



(b) (i) A car engine produces an average driving force of 1200 N.

The car travels 8.0 m.

Calculate the work done by the force over this distance.

(2)

Work done = force x distance moved in direction of force

E = f x d

f = 1200 N

d = 8.0 m

1200 x 8.0 = 9600

work done = 9600 J

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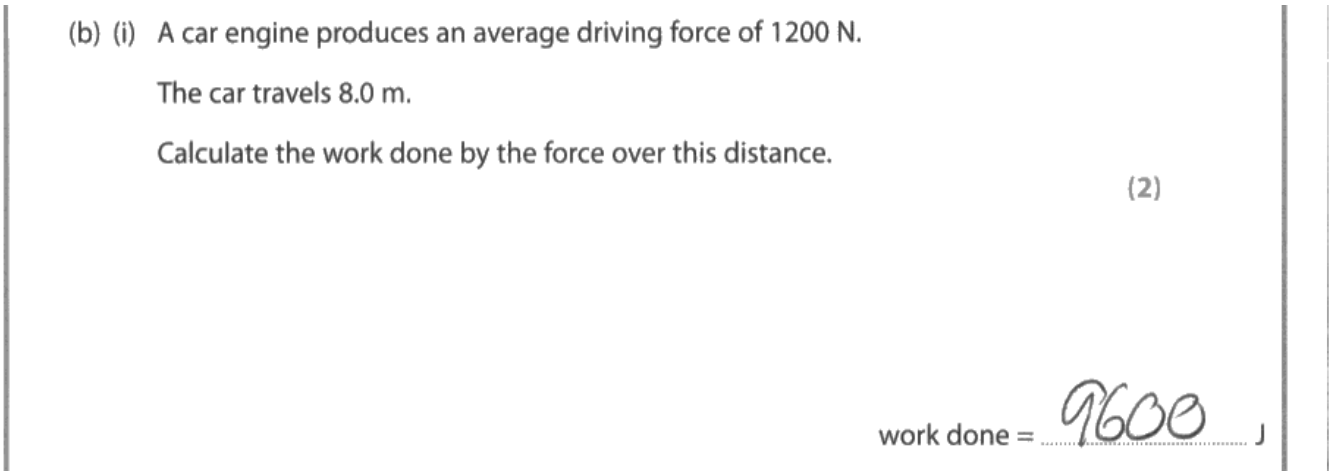
Examiner Comments

One of the many well set out responses that gained full marks.



(b) (i) A car engine produces an average driving force of 1200 N.

The car travels 8.0 m.

Calculate the work done by the force over this distance.

(2)

work done = 9600 J

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Examiner Comments

A correct response with no working also gained full marks.

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Examiner Tip

It is always better to show how you arrived at your answer.

You may be able to get a mark if your answer is wrong and the examiner can see that you used the correct method.

(b) (i) A car engine produces an average driving force of 1200 N.

The car travels 8.0 m.

Calculate the work done by the force over this distance.

(2)

1200
x 8.0
9200

work done = 82 J

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Examiner Comments

This response scored one mark. The candidate's working clearly shows that a force is being multiplied by a distance. Without the working an answer of 82 J would have scored zero.

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Examiner Tip

Candidates should always show their working. If they get the answer correct with no working then they will get full marks but if their answer is wrong with no working they will get zero.

Question 5 (b) (ii)

Candidates needed to use the equation ½ m v^2, substitute the correct values and then evaluate to give the final answer of 437 500 J.

A common mistake was to miss out the squared sign or candidates forgetting to halve their value.

For some candidates, it might be easier to think of this equation as (v^2 x m) then divide by 2.

(ii) The car has a mass of 1400 kg and travels at a velocity of 25 m/s.

Calculate the kinetic energy of the car.

(3)

$\frac{1}{2}$ x mass x velocity^2

= 0.5 x 1400 x 25^2 = 437500

kinetic energy = 437500 J

ResultsPlus
Examiner Comments

One of the many well set out and correctly evaluated responses that gained full marks.

(ii) The car has a mass of 1400 kg and travels at a velocity of 25 m/s.

Calculate the kinetic energy of the car.

(3)

kinetic energy = $\frac{1}{2}$ x mass x velocity^2

= $\frac{1}{2}$ x 1400 x 25^2

=

kinetic energy = 17,500 J

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Examiner Comments

This response shows one of the most common errors. The candidate has substituted the correct values, but has failed to square 25 during evaluation. This response scored one mark.

ResultsPlus
Examiner Tip

When evaluating complicated expressions it is advisable to put in an extra line of working. In this case to show 25 squared.

e.g. kinetic energy = 1/2 x 1400 x 625

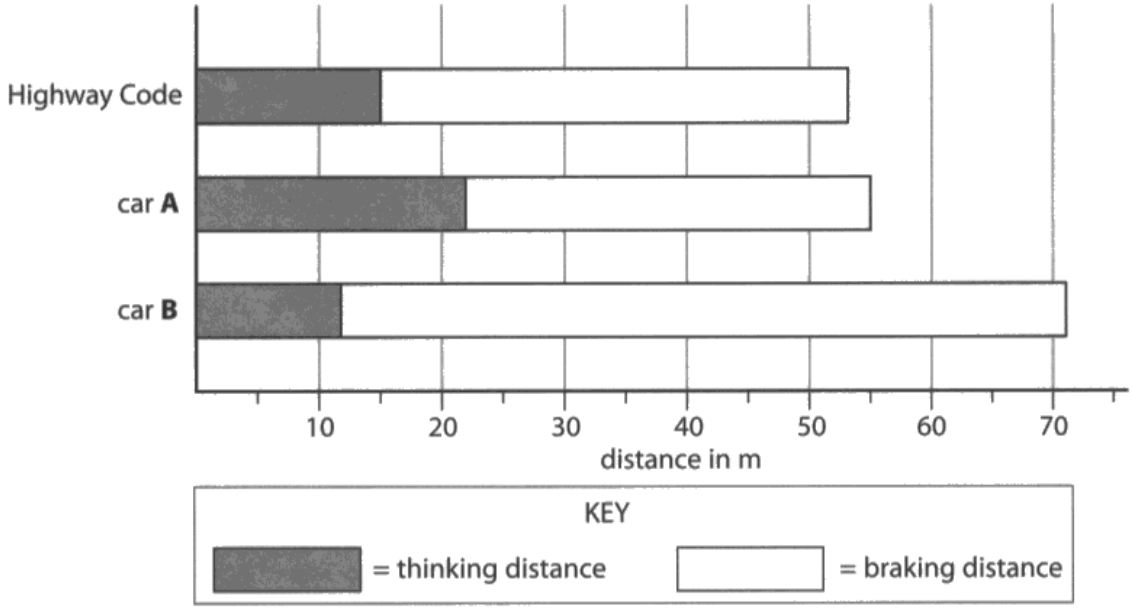
Question 5 (c)

To score highly on this 6 mark question, candidates needed to use what they knew about thinking distances, braking distances and overall stopping distances and apply it to the information given in the question.

One way to tackle this question was to make a correct statement or comparison about the thinking distance and do the same for braking distance, of either car, and then link the statement to possible explanations.

*(c) The chart shows the thinking, braking and stopping distances for an average car and driver stopping from 50 miles per hour as shown in the Highway Code.

It also shows the thinking, braking and stopping distances for drivers of cars **A** and **B**, both stopping from 50 miles per hour.



A and **B** are different cars on different roads.

Use the factors that can affect thinking and braking distances to explain the differences in stopping distances for cars **A** and **B**.

(6)

Car A could have been under the influence of a depressant drug, meaning their thinking distance was longer, as their reaction time was slower. However, their breaking time was good, meaning that the surface of the road could have been dry and easy to break on, meaning their overall stopping distance was better than car B.

Car B could have been under the influence of a stimulant, meaning their thinking distance was lower than car A, therefore they reacted quicker due to their reaction time being sped up. However the surface of the road could have been wet or icy, meaning their overall stopping distance was over 70m which is worse than car A, despite having quicker reactions

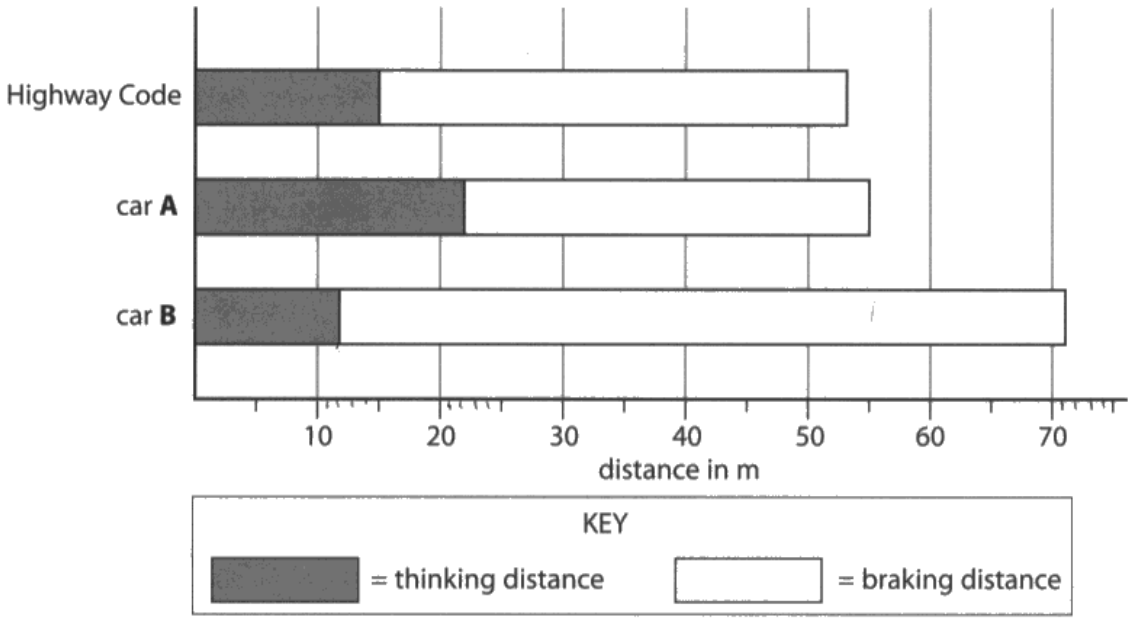
(Total for Question 5 = 12 marks)

ResultsPlus
Examiner Comments

An example of a response that scored 6 marks. It was very pleasing to see so many candidates producing answers of similar quality.

*(c) The chart shows the thinking, braking and stopping distances for an average car and driver stopping from 50 miles per hour as shown in the Highway Code.

It also shows the thinking, braking and stopping distances for drivers of cars **A** and **B**, both stopping from 50 miles per hour.



A and **B** are different cars on different roads.

Use the factors that can affect thinking and braking distances to explain the differences in stopping distances for cars **A** and **B**.

(6)

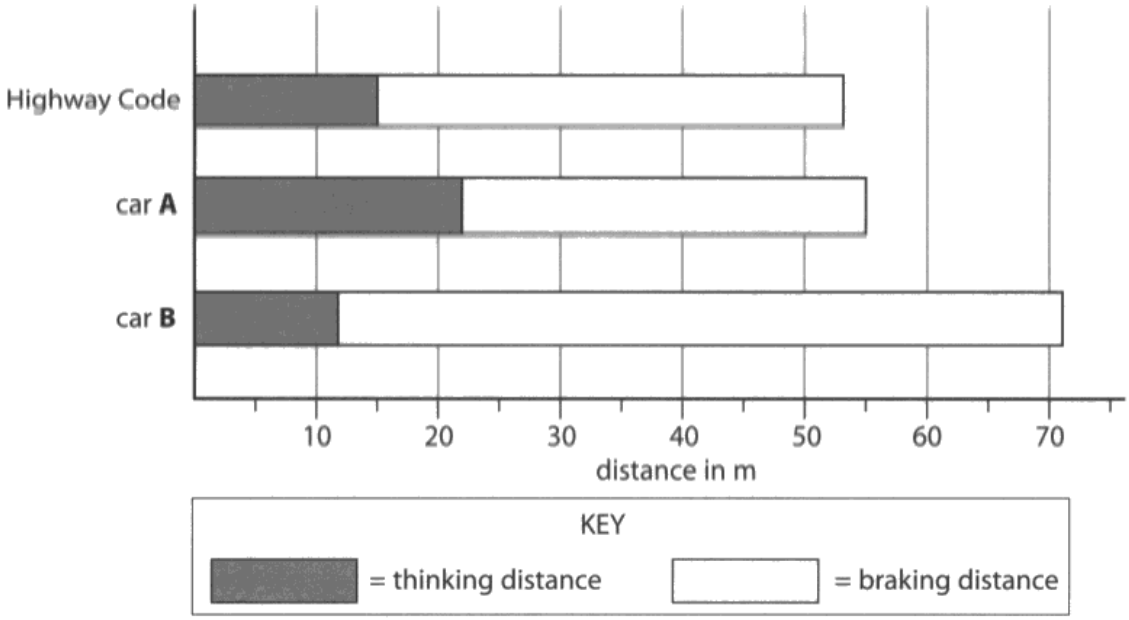
Car B hasn't got a longer thinking distance compared to Car A. However Car B does have a longer braking distance, meaning he has braked longer then A but car A has ~~~~ thought ~~~~ about it longer. It has taken car B 12m to be thinking distance and then took it 54 m to be brake. It took car A 22m to be think, and 33 m to be brake.

ResultsPlus
Examiner Comments

An example of a response that scored four marks. The candidate makes correct statements about the thinking and braking distance of the cars, but fails to link any of the statements to a possible explanation.

*(c) The chart shows the thinking, braking and stopping distances for an average car and driver stopping from 50 miles per hour as shown in the Highway Code.

It also shows the thinking, braking and stopping distances for drivers of cars **A** and **B**, both stopping from 50 miles per hour.



A and **B** are different cars on different roads.

Use the factors that can affect thinking and braking distances to explain the differences in stopping distances for cars **A** and **B**.

(6)

Affects Thinking
- Drinking alcohol or coffee
- Tiredness
- If you have taken drugs
- If your not in the right mind frame (Not focused)

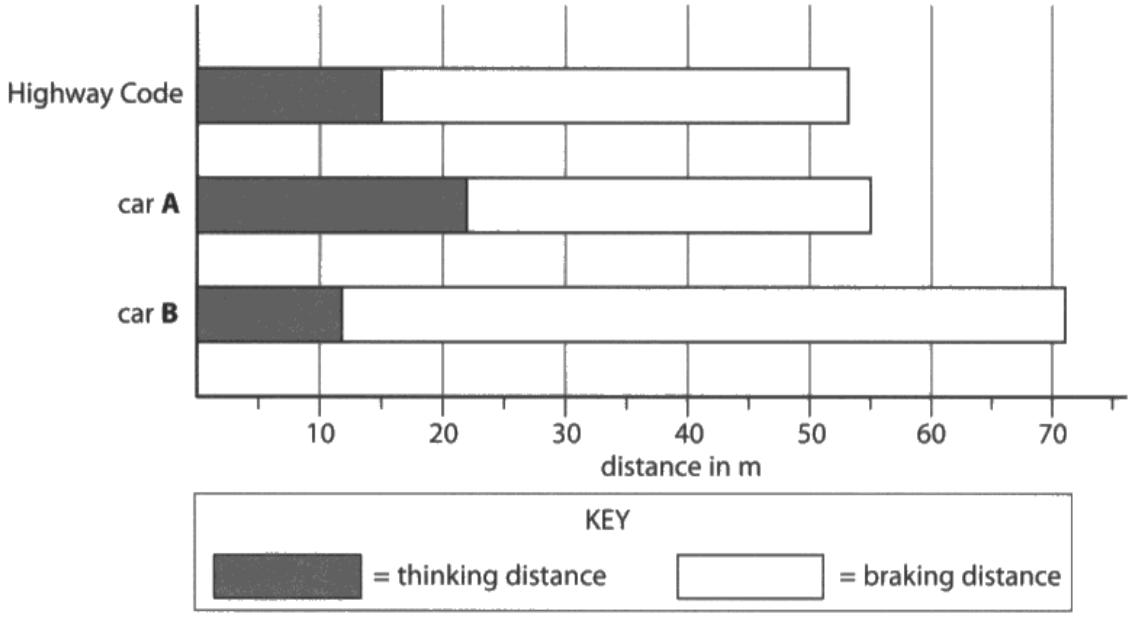
Affects Braking distance
- Weather
- Not knowing the area very well
- If it's dark
- What the road surface is like

ResultsPlus
Examiner Comments

This response was given two marks. The candidate merely lists some possible factors affecting thinking and braking distance. If the candidate had spent a little time analysing the charts and then linking the reasons to the thinking or braking distances for car A or car B they could have scored full marks.

*(c) The chart shows the thinking, braking and stopping distances for an average car and driver stopping from 50 miles per hour as shown in the Highway Code.

It also shows the thinking, braking and stopping distances for drivers of cars **A** and **B**, both stopping from 50 miles per hour.



A and **B** are different cars on different roads.

Use the factors that can affect thinking and braking distances to explain the differences in stopping distances for cars **A** and **B**.

(6)

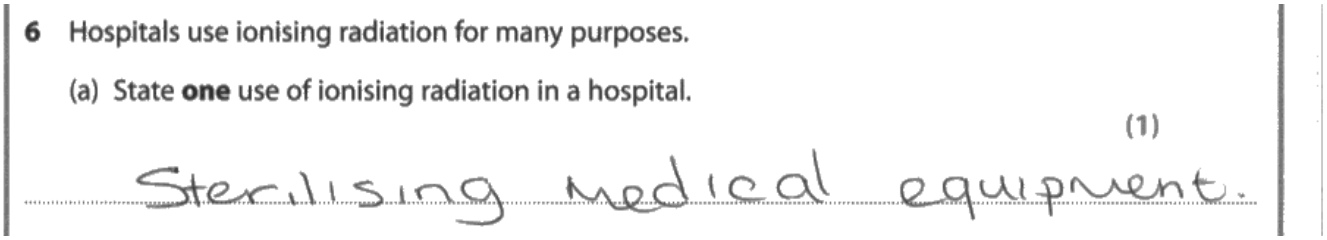
Car A had a high speed which had made it move twice faster than car B. However car B speed was not strong enough to beat car A. As the ~~A~~ Speed got faster it had increased the distance between the two car which had made car B slower than car A which was traveling faster with an high speed.

ResultsPlus
Examiner Comments

This response was given zero marks. The question states that both cars were travelling at 50 miles per hour and so differences in speed are not an acceptable reason for differences in thinking or braking distances.

Question 6 (a)

This question was generally well answered by most candidates. Candidates who failed to score usually gave vague responses such as ' to clean equipment' or 'to treat illnesses'. A number incorrectly gave chemotherapy as a use for ionising radiation.



6 Hospitals use ionising radiation for many purposes.

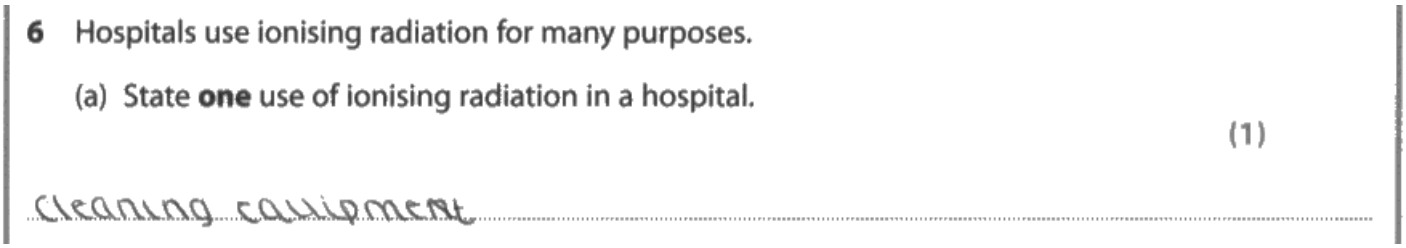
(a) State **one** use of ionising radiation in a hospital.

(1)

Sterilising medical equipment.

ResultsPlus
Examiner Comments

This is an example of a very commonly seen response. 1 mark.



6 Hospitals use ionising radiation for many purposes.

(a) State **one** use of ionising radiation in a hospital.

(1)

Cleaning equipment

ResultsPlus
Examiner Comments

This is an example of one of the responses that failed to score.

Question 6 (b)

Responses to this question were varied but showed a marked improvement when compared to similar items in previous series. Many candidates understood that halving was needed but chose the wrong information to use i.e. dividing the mass number of the sample (99) rather than original mass of the sample (40 mg). Credit was also lost by candidates not calculating the correct number of half-lives i.e. not realising *two* half-lives of 6 hours were needed for the twelve hour period, or by halving too many times. A number of candidates multiplied by two rather than dividing by four and so a commonly seen response was 80 mg.

(b) An isotope of technicium, technicium-99, has a half-life of 6 hours.

A hospital has a sample which contains 40 mg of technicium-99.

Calculate how much technicium-99 will be in this sample after 12 hours.

(2)

40 ÷ 2 = 20 = 6 hours

20 ÷ 2 = 10 = 6 hours

40.

amount remaining = 10 mg

ResultsPlus
Examiner Comments

One of the well set out responses that gained full marks.

(b) An isotope of technicium, technicium-99, has a half-life of 6 hours.

A hospital has a sample which contains 40 mg of technicium-99.

Calculate how much technicium-99 will be in this sample after 12 hours.

(2)

$\frac{40}{2} = 20$

amount remaining = 20 mg

ResultsPlus
Examiner Comments

A commonly seen response that gained one mark.

(b) An isotope of technicium, technicium-99, has a half-life of 6 hours.

A hospital has a sample which contains 40 mg of technicium-99.

Calculate how much technicium-99 will be in this sample after 12 hours.

(2)

amount remaining = 80 mg

ResultsPlus
Examiner Comments

One of the most commonly seen incorrect responses.

Question 6 (c) (i)

Most candidates gained at least one mark for this question, most being able to state that radiation caused mutations of cells or DNA or caused cancer. Many also indicated correctly that the badge was to prevent over-exposure. The most common error was to use vague phrases such as 'radiation is harmful' which by themselves are insufficient for the award of a mark.

(c) Every hospital radiographer who works with radiation wears a radiation badge.

The badge is used to monitor the amount of radiation the radiographer absorbs each month.

(i) Explain why it is important to monitor the amount of radiation a radiographer absorbs each month.

(2)

It is important to monitor this as, if they are exposed to too much radiation it can cause serious health issues that could be extremely fatal.

ResultsPlus
Examiner Comments

One of the many responses that scored one mark for the idea of over-exposure to ionising radiation but was too vague about the possible consequences.

(c) Every hospital radiographer who works with radiation wears a radiation badge.

The badge is used to monitor the amount of radiation the radiographer absorbs each month.

(i) Explain why it is important to monitor the amount of radiation a radiographer absorbs each month.

(2)

over exposing themselves could lead to radiation problems and cancerous cells developing. Monitoring the amount they receive helps protect them from getting into harm.

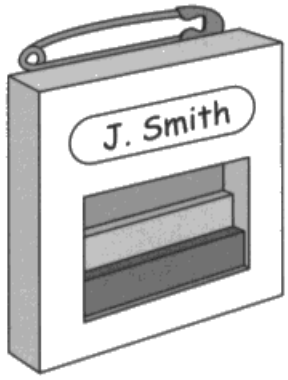
ResultsPlus
Examiner Comments

This is an example of a response that was sufficiently detailed to enable the award of both marks.

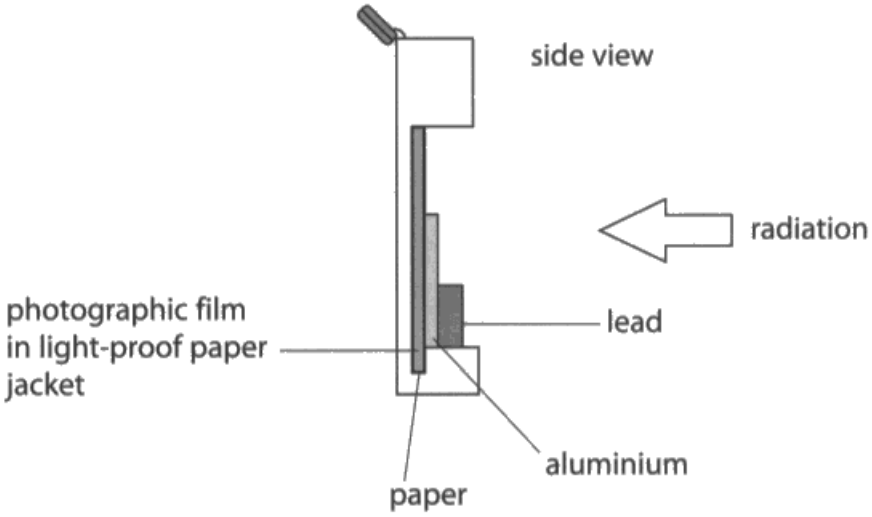
Question 6 (c) (iii)

There were many well thought out responses to this question. Many candidates were able to explain how the absorption of alpha, beta and gamma radiation was linked to the monitoring of exposure to ionising radiation. Very few candidates mentioned X-rays in their responses. A common error was to say that alpha went through paper and Beta went through aluminium, and a significant percentage of candidates confused the absorption of alpha with that for gamma radiation.

*(iii) The radiation badge contains a photographic film which is sensitive to radiation.



radiation badge



The radiation badge is sent to a laboratory after a month and the film is checked.

Explain how the badge shows the amount of different types of radiation that the radiographer has been exposed to.

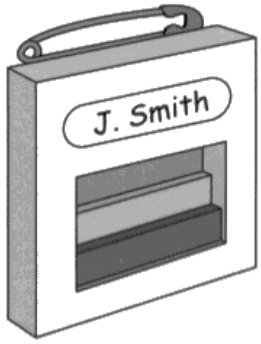
(6)

The badge shows the different types of radiation because firstly, the photographic film is sensitive to radiation, therefore it must tell what radiation has gone penetrated through. Also, Lead stops gamma rays from penetrating through, therefore they can check the amount of gamma rays. Aluminium stops beta particles from penetrating through, therefore they can check how much beta particles have gone through. paper stops alpha particles penetrating through, therefore they can check how much alpha particles with a geiger counter.

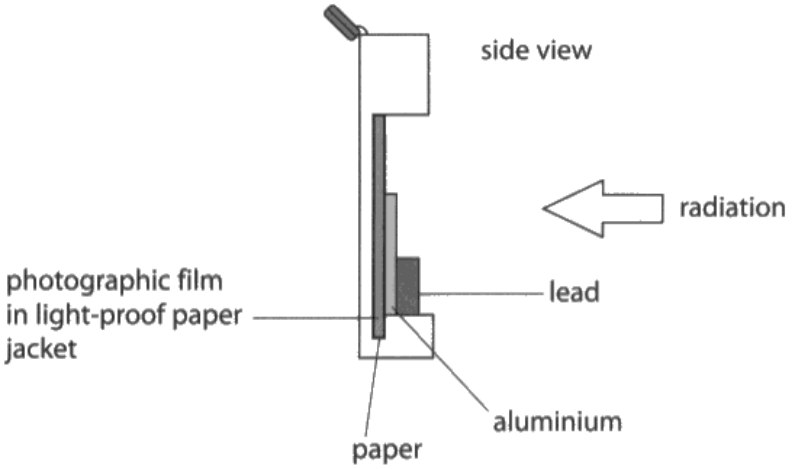
ResultsPlus
Examiner Comments

One of the many responses that scored six marks. It was pleasing to see so many well thought out responses to an unfamiliar context.

*(iii) The radiation badge contains a photographic film which is sensitive to radiation.



radiation badge



The radiation badge is sent to a laboratory after a month and the film is checked.

Explain how the badge shows the amount of different types of radiation that the radiographer has been exposed to.

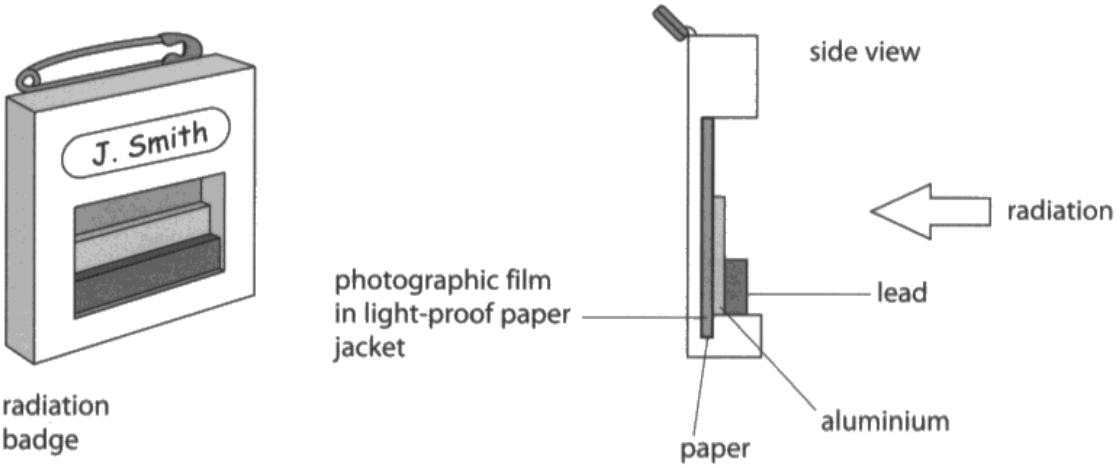
(6)

If will see the if alpha particles have gone through the paper. If Beta particles have gone through aluminium and if gamma has gone through lead. If will show this as the 3 parts in the badge will absorb the 3 radiation in it.

ResultsPlus
Examiner Comments

This response is an example of one scoring 4 marks. The candidate has the correct idea but incorrectly states that alpha particles will pass through paper and beta particles will pass through aluminium. However, there is enough correct material to match the criteria for 4 marks.

*(iii) The radiation badge contains a photographic film which is sensitive to radiation.



The radiation badge is sent to a laboratory after a month and the film is checked.

Explain how the badge shows the amount of different types of radiation that the radiographer has been exposed to.

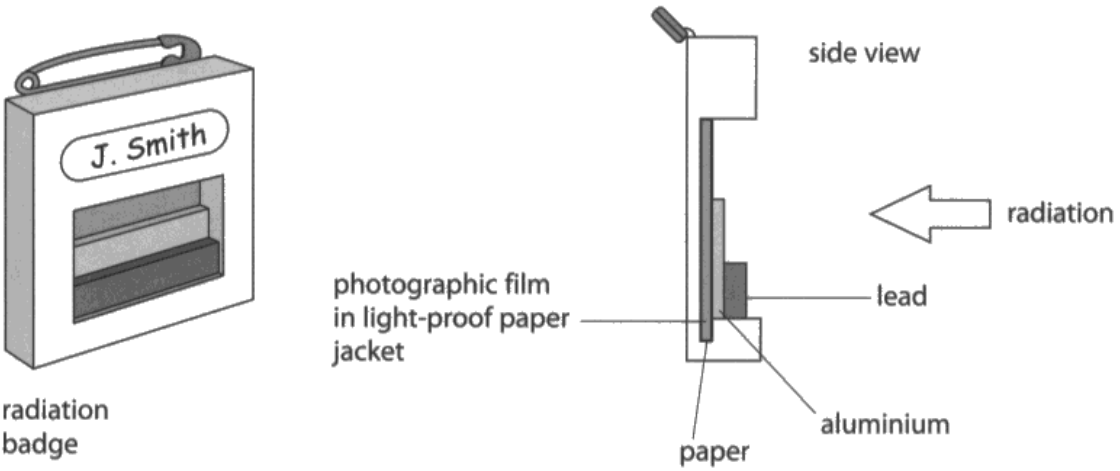
(6)

because if its gamma rays it will go through the lead, aluminum and paper yet radiowaves will only go thrown the paper. So they can inspect that and see which type of radiation it was.

ResultsPlus
Examiner Comments

An example of a response scoring two marks. The candidate has made a correct statement about one type of ionising radiation.

*(iii) The radiation badge contains a photographic film which is sensitive to radiation.



The radiation badge is sent to a laboratory after a month and the film is checked.

Explain how the badge shows the amount of different types of radiation that the radiographer has been exposed to.

(6)

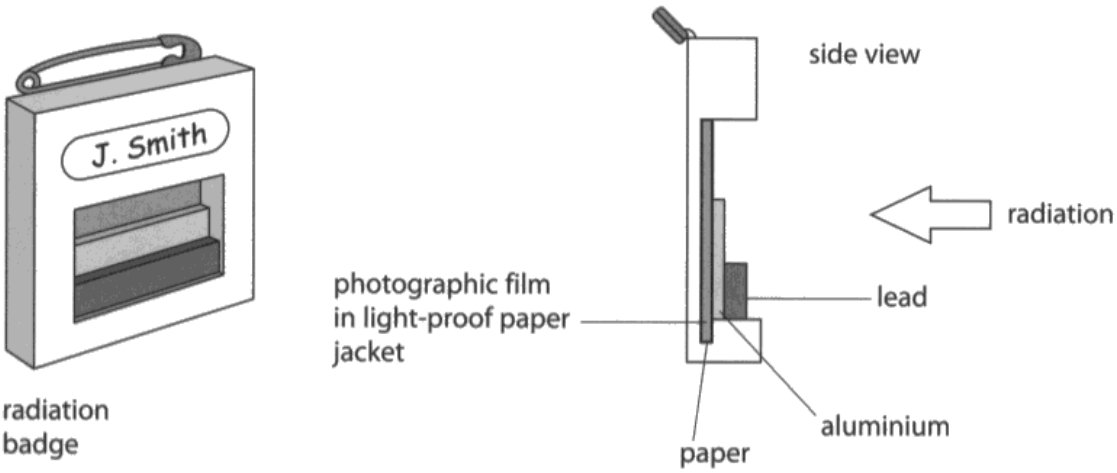
The paper the photographic film changes colour ~~depending~~ depending on how much radiation it is exposed to.

ResultsPlus

Examiner Comments

This response scored two marks. The candidate has made an acceptable statement about the film badge.

*(iii) The radiation badge contains a photographic film which is sensitive to radiation.



The radiation badge is sent to a laboratory after a month and the film is checked.

Explain how the badge shows the amount of different types of radiation that the radiographer has been exposed to.

(6)

The aluminium attracts radiation, alluminium is contained in the badge which will ~~attract the~~ help expose the amount of radiation taken in.

ResultsPlus
Examiner Comments

There was no rewardable material in this response.

Paper Summary

This year's paper allowed candidates of all abilities to access marks in all questions. Weaker candidates found difficulty with describe, explain and discuss questions, and with some of the calculations.

In order to improve performance, candidates should:

- memorise the basic facts as stated in the specification
- use technical terms wherever possible in descriptions and explanations
- give a reason as well as a statement when answering an 'explain' question
- practise applying their knowledge to new situations by attempting questions in support materials or exam papers from previous sessions
- read the question carefully and underline the key words
- have a calculator as this is an essential requirement for this examination
- use the marks at the end of a question as a guide to the form and content of their answer

Grade Boundaries

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

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

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