Examiners' Report
June 2019

GCSE Physics 1PH0 2F

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Introduction

This Foundation tier examination is the second of two physics papers to be sat for this specification The question are set to test the student's knowledge, application and the ability to analyse information and draw conclusions having studied the eight topics which make up this part of the specification.

The topics covered by the specification are:-

- Topic 8 - Energy-forces doing work
- Topic 9 - Forces and their effects
- Topic 10 - Electricity and circuits
- Topic 11 - Static electricity
- Topic 12 - Magnetism and the motor effect
- Topic 13 - Electromagnetic induction
- Topic 14 - Particle model
- Topic 15 - Forces and matter

The assessment is through multiple choice questions, short answers, extended writing, calculations and analysis. The specification includes core practicals which should be included in the scheme of work and a number of suggested practicals which exemplify points in the specification to help students understanding of particular physical concepts. The skills students acquire through carrying out practical investigations will also be tested in the examination.

The practical skills tested in the examination included describing how an experiment is to be carried out. Some students found it difficult to describe the experiment in sufficient detail and would have benefited from drawing a diagram.

The work produced for the examination showed that most students could substitute into equations and evaluate but found it difficult to accurately recall equations. Having to recall the value of the gravitational field strength, g as 10N/kg and the 273 needed to convert from °C to Kelvin also caused difficulties for many students.

Some students also have difficulty in identifying the correct value for given symbols and should remember for reference that all equations are written in words and symbols on the equations page at the end of the paper.

Students are generally able to identify anomalous results from a graph and put in the curve of best fit but are unable to describe how a graph will change if one set of values is altered.

Generally, there is a poor understanding of the movement of charged particles which cause static electricity and of how the build up of static charge can be prevented.

Question 1 (a)

This question tests that students know the charge that is carried by atomic particles and the position of the particle within the atom. Students have to draw a straight line from the particle to the correct description The majority of students were able to link:-

Proton ---------- positive charge inside the nucleus

Electron --------- negative charge outside the nucleus

Neutron ---------- no charge inside the nucleus

Question 1 (b)

This question is about the conservation of current at a junction.

The diagram shows 6.0 A entering a junction of wires through wire F. Wire G then takes 3.5 A leaving the student to calculate the current in wire H.

6.0-3.5 = 2-5.

Giving the answer 2.5 A.

Question 1 (c)

Students have to calculate the charge that flows through a wire in 50s when the current is 0.9 A.

The equation is given for the value of charge to be calculated but students also have to give the unit of charge.

The majority of students could substitute and evaluate the charge to be 45 numerically but very few were able to give the correct unit for charge this being the coulomb.

Ocassionally students read 0.9 A as 9 A and obtained an answer of 450 this was allowed one mark for the evaluation.

This response gains 2 marks.

(c) A wire in a circuit carries a current of 0.9 A.
Calculate the quantity of charge that flows through the wire in 50 s.

State the unit of charge with your answer.

Use the equation

charge = current × time

(3)

current = 0.9
time = 50s

0.9 x 50 =

quantity of charge = 45 unit W

ResultsPlus
Examiner Comments

The substitution and evaluation are correct but the unit given is W; this is the symbol for watt and the correct unit is coulomb which has the symbol C.

ResultsPlus
Examiner Tip

Learn the units that are given for each quantity in this case charge.

This response gains three marks.

$0.9 \times 50 = 45$

quantity of charge = 45 unit C

ResultsPlus
Examiner Comments

The evaluation and unit C; the symbol for coulomb is correct.

ResultsPlus
Examiner Tip

Show working for each calculation and learn unit of charge.

Question 2 (b)

The question refers to a helium filled balloon which is released into the atmosphere. Students are asked to explain what happens to the size of the balloon as it rises through the atmosphere.

This was a three mark question, one mark for knowing the balloon expanded and two marks for the explanation which should mention how the atmosphere changes as with increasing height above the Earth and how this effects the pressure on the balloon or the difference in pressure between the inside and outside of the balloon.

Very few students were able to gain all three marks.

This response scores two marks.

(b) A balloon is filled with helium when it is on the ground.

The balloon is released and it rises through the atmosphere.

Explain what happens to the size of the balloon as it rises through the atmosphere.

(3)

The balloon will get bigger because there is less air acting on the balloon because the air gets thinner and therefore the air can expand inside the balloon.

ResultsPlus
Examiner Comments

The student states correctly that the balloon gets larger and gives the reason that the air gets thinner, but does not refer to a pressure difference to gain the third mark.

ResultsPlus
Examiner Tip

The question has three marks available therefore three separate points need to be made to get all three marks.

Question 2 (c)

The majority of students were able to gain the full three marks for this calculation.

This response scores one mark.

(c) Figure 4 shows a container of length 6.0 m and width 2.0 m resting on a floor.
The weight of the container is 15 000 N.

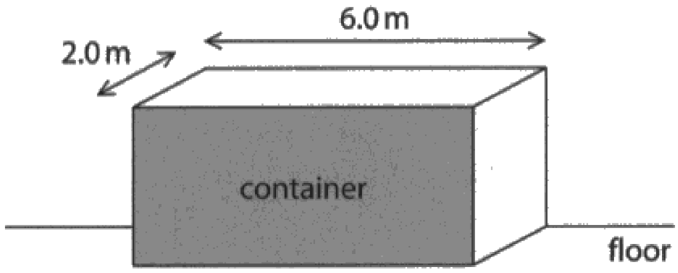


Figure 4

Calculate the pressure that the container exerts on the floor.

Use the equation

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

(3)

$$\frac{15000}{144} = 104.16$$

pressure of the container on the floor = 104.16 Pa

ResultsPlus
Examiner Comments

The student has given an incorrect value for the area and has not shown how this area was worked out . However the force has been substituted correctly as is seen in the working.

ResultsPlus
Examiner Tip

Show your working to get as many marks as possible.

This response gained three marks.

Pressure = $\frac{15\,000}{12}$ m

= 1250

area = l x w = 2.0 x 6.0 = 12

pressure of the container on the floor = 1250 Pa

ResultsPlus
Examiner Comments

The example shows the calculation of the area which was obtained from the values given on the diagram. The working is shown with the correct area being used for the substitution and the pressure is then evaluated.

ResultsPlus
Examiner Tip

Show all your working; just an answer will get full marks if correct but no marks if you get it wrong.

Question 3 (b)

Students were asked to describe an experiment to show the shape of a magnetic field produced by a current in a wire. The apparatus to be used was given in the question.

It was obvious from the responses that many students had not done the experiment or seen it demonstrated.

The mark scheme allowed for students to describe a variety of experiments in which wires, power packs, stiff card and iron fillings had been used.

This response scores all four marks.

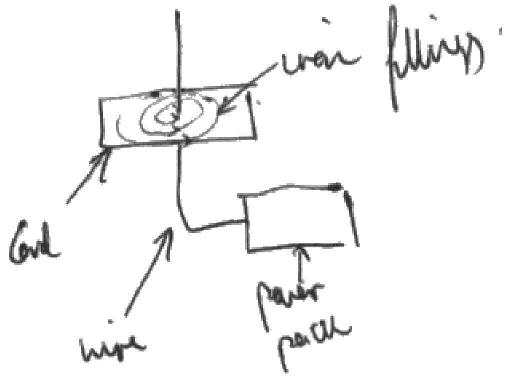
(b) A student has

- a power pack
- a long piece of wire
- a stiff card
- iron filings

Describe how the student could use this equipment to show the shape of the magnetic field produced by a current in the wire.

You may draw a diagram to help with your answer.

(4)



• Pass the long piece of wire through a hole in the stiff Card.
• The wire is connected to the power pack which will give it a magnetic charge.
• Drop the iron fillings on the card and they will rearrange themselves into the pattern of the magnetic field

ResultsPlus
Examiner Comments

The labelled diagram shows a wire through a piece of card (MP1), iron filings on the card (MP2),the wire connected to a power pack (MP3), a pattern of iron filings (MP6).

All four marks can be obtained from the diagram even though the diagram does not show a complete circuit. Full marks are gained without the need to look at the written work although this correctly supports the diagram.

ResultsPlus
Examiner Tip

Draw a labelled diagram for the experiments that you carry out and learn the experiments that you have done as part of your revision.

This response scores two marks.

You may draw a diagram to help with your answer.

(4)

Attach the piece of wire to the power pack.
Put the iron filings around the wire.

ResultsPlus
Examiner Comments

The student has not drawn a diagram but has gained a mark for 'attach the piece of wire to the power pack'(MP3) and 'put the iron filings around the wire((MP2).

Although it is not certain that the student was describing the specific experiment that was required the apparatus given in the question has been used appropriately.

ResultsPlus
Examiner Tip

Use the apparatus given in the question to describe a relevant experiment.

Question 3 (c)

This question requires students to add to a diagram to show the magnetic field lines between the two magnetic poles facing each other.

The field is uniform therefore the lines should be straight, an equal distance apart and extend from one pole to the other without any gaps.

The arrows on the field lines should show the direction north pole to south pole.

This response scores 3 marks.

(c) Figure 5 shows two magnetic poles facing each other.

The magnetic field between the poles is uniform.

On Figure 5, draw the magnetic field lines between the two poles and show the direction of this magnetic field.

(3)

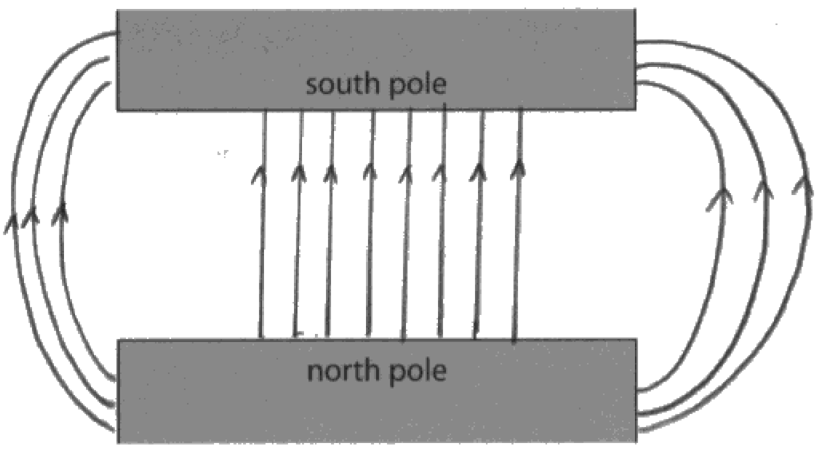


Figure 5

ResultsPlus
Examiner Comments

The lines between the magnetic poles are straight and equal distance apart and the arrows go from north to south pole. The lines outside the magnets are correct but are ignored as the question asked for the field lines between the poles.

ResultsPlus
Examiner Tip

Remember uniform fields have field lines which are equal distances apart and that magnetic fields lines go from north pole to south pole.

This response does not score a mark.

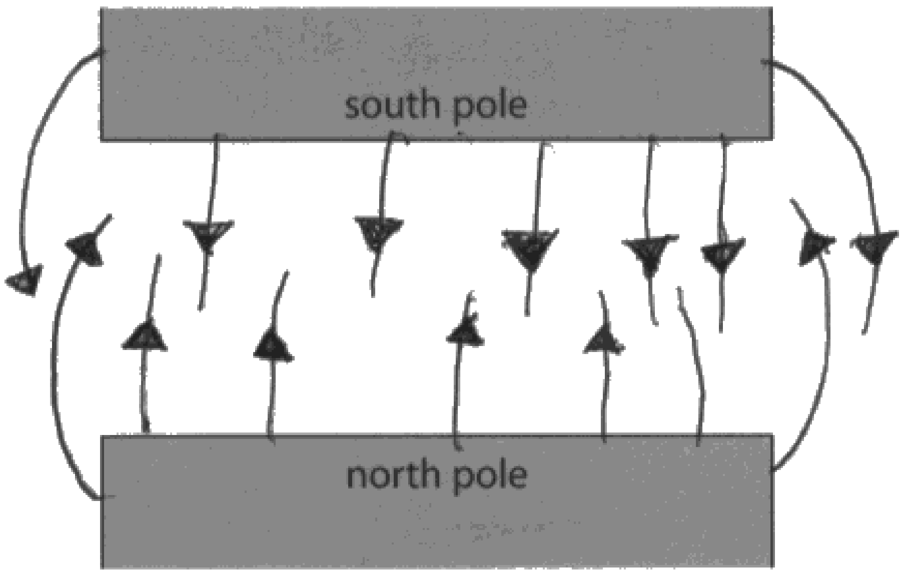


Figure 5

ResultsPlus
Examiner Comments

The lines only extend half way between the poles and therefore cannot be regarded as field lines and the arrows go in both directions.

ResultsPlus
Examiner Tip

Remember field lines go from one pole to the other without gaps.

Question 4 (b)

The majority of students were unable to convert from °C to Kelvin being unable to remember the conversion factor of the addition of 273.

A rare example of a correct answer.

(b) A digital thermometer gives a temperature reading of 23 °C.

Calculate the value of this temperature in kelvin. 273

(1)

273 + 23 = 296

ResultsPlus

Examiner Comments

Adding 273 to the value of 23°C converts the temperature to a value of 296K on the Kelvin scale of temperature,

ResultsPlus

Examiner Tip

Remember the conversion from °C to Kelvin requires the addition of 273.

Question 4 (c) (iii)

Very few students were able to describe how the graph in 4(c)(i) - 4(c)(ii) would change if the experiment was repeated with the same mass of gas at a higher temperature.

The answer that 'the line would be higher and of a similar shape' was rarely seen. Those students that did gain 2 marks described how the pressure would be higher for each of the volumes. This answer was allowed for in additional guidance.

This response gained two marks by referring to the volume remaining the same but the pressure values getting higher. This was allowed for in additional guidance.

(iii) Describe how the graph in Figure 7 would change if the student repeated the experiment with the same mass of gas, at a higher constant temperature.

(2)

the volume in ml would still be the same but the pressure would have higher numbers, along the Y axis if the constant temperature was higher.

ResultsPlus
Examiner Comments

The question asked how the graph would change and it would be best to describe the graph as being the same shape as the original but above it or higher.

ResultsPlus
Examiner Tip

Remember to describe any change between the two graphs. The second one is either higher or lower and it is the same shape or the gradient is steeper or less steep rather than using values from the axes.

Question 4 (c) (i) - (ii)

The question showed a series of points plotted on graph paper and asked students to identify the anomalous point and then draw the curve of best fit for the points shown.

The response gains one mark for ringing the anomaly and one mark for drawing the curve of best fit

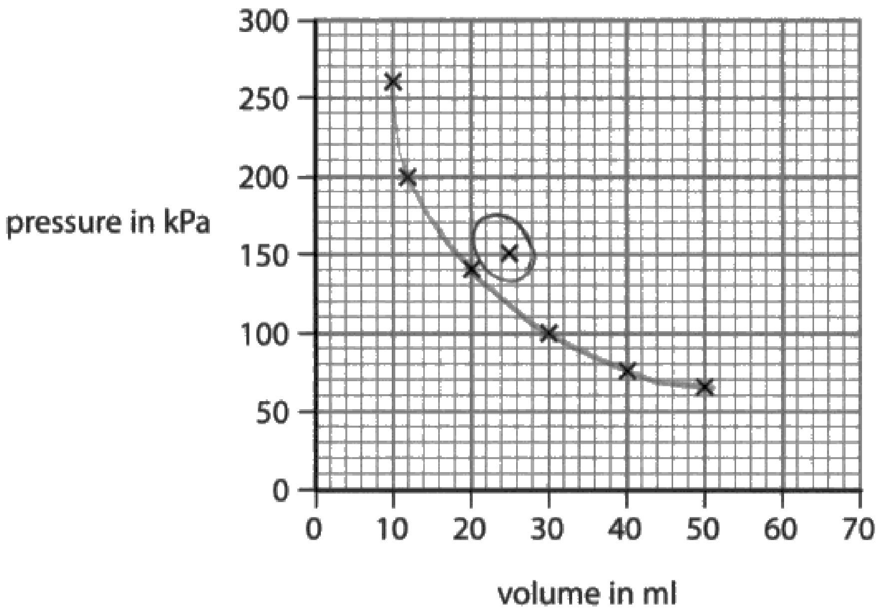


Figure 7

(i) Identify the anomalous result plotted on Figure 7 by drawing a circle on Figure 7 around the anomalous point.

(1)

(ii) Draw the curve of best fit on Figure 7.

(1)

ResultsPlus
Examiner Comments

The anomaly is clearly ringed and all other points must be included in the curve of best fit.

ResultsPlus
Examiner Tip

Remember not to include the anomaly when drawing the curve of best fit.

Question 4 (d)

More than half of students were unable to gain marks for this calculation.

The values of V_1, P_1 and V_2 are given and only require to be substituted into the equation for at least one mark to be awarded. The rearrangement to find P_2 was challenging for most students but once this had been achieved then students could evaluate correctly.

This response gains one mark for correctly substituting and evaluating one side of the equation.

(d) Figure 8 shows a small container of carbon dioxide at high pressure.

The pressure, P_1, in the container is 8.00 MPa.

The volume, V_1, of the container is 14.5 cm³.

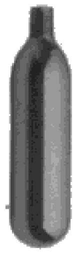


Figure 8

The container is pierced and all of the carbon dioxide goes into a large balloon.

The volume of gas, V_2, in the large balloon is 1160 cm³.

Calculate the pressure, P_2, in the large balloon.

Use the equation

$$P_1V_1 = P_2V_2$$

(3)

~~TE~~ $8.00 \times 14.5 = 116$

$1160 \div 116 = 10$

pressure in the large balloon = 10 MPa

ResultsPlus
Examiner Comments

If the substitution had been written out in full then it would have been more likely that the rearrangement would have been done correctly.

ResultsPlus
Examiner Tip

Substitute all the values and leave the unknown quantity in the equation and then do the rearrangement.

This response scores three marks.

$8.00 \times 14.5 = P_2 \times 1160$

$\downarrow$

116

$\frac{116}{1160} = 0.1$

pressure in the large balloon = 0.1 MPa

ResultsPlus
Examiner Comments

The student has substituted into the equation leaving the unknown quantity in the equation.

8.00 x 14.5 has been evaluated and then divided by 1160 to give the correct answer of 0.1 MPa.

ResultsPlus
Examiner Tip

Substitute all values into the equation including the unknown quantity and practice rearranging equations.

Question 5 (a)

The spring shown in the diagram has an upward force acting on it at the top. The force is represented in magnitude and direction by the arrowed line.

If an object is stationary then the forces acting on it must be balanced. Therefore the upward force at the top of the spring must be balanced by a downward force at the bottom of the spring. Forces are represented by arrowed lines and if the forces are equal the arrowed lines should be the same length and acting at the bottom of the spring.

The diagram shows the second force represented by an arrow acting from the bottom of the spring. The arrow is not the same length as the top arrow but it is a downwards arrow acting from the correct position and gains two marks.

5 (a) Figure 9 shows a 10 N weight hanging from a spring.

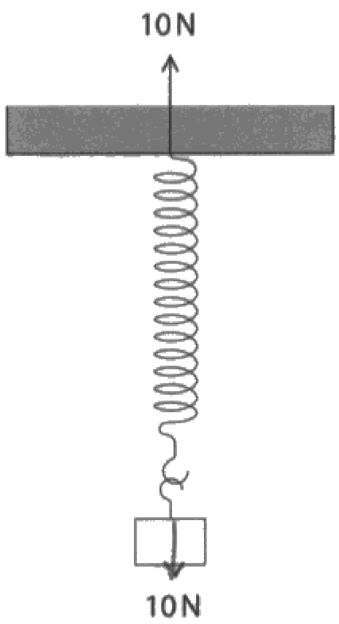


Figure 9

One of the forces acting to stretch the spring is shown in Figure 9.

Complete Figure 9 by adding an arrow to show the other force acting to stretch the spring.

(2)

ResultsPlus
Examiner Comments

The direction of the second force acting on the spring is shown by the downward arrowed line. The arrowed line could either be the same length as the upward arrowed line or as in this case it is from the bottom of the spring.

ResultsPlus
Examiner Tip

Use a ruler to draw lines representing forces and indicate the direction with an arrow and if the forces are balanced keep the upward and downward lines the same length.

Question 5 (b) (i)

The calculation required the values of force and extension to be substituted into a given equation. The equation then has to be rearranged to find the value of k, the spring constant.

This response scores no marks.

(b) A weight of 4.0 N is used to extend a spring.
The extension of the spring is 0.06 m.

(i) Calculate the spring constant, *k*, of the spring.

Use the equation

$$F = k \times x$$

(3)

$4 \times 0.06 = 0.24$

spring constant = 0.24 N/m

ResultsPlus
Examiner Comments

The substitution is incorrect it should be

4.0 = kx 0.06

4.0 is the divided by 0.06 to give the value of the spring constant.

ResultsPlus
Examiner Tip

Substitute all the terms in the equation, replace symbols that are given a value with that value and leave the unknown quantity in the equation.

This response scores two marks.

(i) Calculate the spring constant, *k*, of the spring.

Use the equation

$$F = k \times x$$

(3)

$$k = \frac{F}{x}$$

$$k = \frac{0.4}{0.06} = 6.6$$

spring constant = 6.6 N/m

ResultsPlus
Examiner Comments

The rearrangement is done algebraically and is correct but o.4 has been substituted rather than 4.0. giving a power of ten error

ResultsPlus
Examiner Tip

Check values substituted are correct.

This response gains 3 marks.

(i) Calculate the spring constant, k, of the spring.

Use the equation

$$F = k \times x$$

(3)

$$k = \frac{x}{F} \qquad \frac{4}{0.06}$$

spring constant = $66.\dot{6}$ N/m

ResultsPlus
Examiner Comments

The rearrangement is completed before the substitution but it is correct and gives the evaluation 66.6N/m.

ResultsPlus
Examiner Tip

If rearranging equations is difficult learn to make the correct substitution to get a mark.

Question 5 (b) (ii)

The question required some practical knowledge about finding the extension of a spring .

More than half of students could not state the measurements that they had made to find the extension of a spring.

A significant number of students knew that the measurements were made with a ruler but did not state what was being measured and so did not score any marks.

This response gains one mark.

(ii) State what measurements should be made to determine the extension of the spring produced by the 4.0 N weight.

(2)

~~Y~~ You should measure the spring length.

ResultsPlus
Examiner Comments

Only one length is measured and to find the extension measurements of length before and after weights are added need to be taken.

ResultsPlus
Examiner Tip

Read the question carefully and make sure you give enough detail.

This response scores two marks.

initial length of spring
and length after spring extended.

ResultsPlus
Examiner Comments

The initial length and length after extension are measured.

ResultsPlus
Examiner Tip

There is no need to repeat that measurements are made as this is in the stem of the question.

Question 5 (c)

This is another calculation where the equation is given. The spring constant k is 250N/m and the extension for the spring x is 0.30m. In addition to completing the evaluation the unit of work done was required.

Students had to note that the extension had to be squared and there is a 1/2 in the equation.

This response scored one mark for the correct unit, J or joule.

(c) Another spring has a spring constant of 250 N/m.

Calculate the work done in stretching the spring by 0.30 m.

State the unit.

Use the equation

$$E = \tfrac{1}{2} \times k \times x^2$$

(3)

$$E = \frac{1}{2} \times 250 \times 30 = 3750$$

$0.30m = 30cm$

work done in stretching the spring = ~~5~~3750 unit J

ResultsPlus
Examiner Comments

The substitution is incorrect because the 0.30m has been converted to cm. The unit for k is N/m therefore the extension should be used in metres, this is the unit of length that is used to calculate energy in joules.

ResultsPlus
Examiner Tip

Remember when newtons are used for force then metres should be used for length.

This response scores two marks.

$$\frac{1}{2} \times 250 \times 0.30$$

$$= 37.5$$

work done in stretching the spring = 37.5 unit J

ResultsPlus
Examiner Comments

The student has not included the square in the substitution and therefore the evaluation is incorrect.

However as the square is in brackets in the mark scheme one mark is given for the substitution. The unit is also correct.

ResultsPlus
Examiner Tip

Look for squares in the equations and substitute correctly.

This response score 3 marks.

(3)

$E = \frac{1}{2} \times 230 \times 0.30^2$

$= 11.25$

work done in stretching the spring = 11.25 unit J

ResultsPlus
Examiner Comments

Correct substitution, evaluation and unit.

ResultsPlus
Examiner Tip

Always show your working.

Question 6 (b) (i) - (ii)

Using the information on the diagrams in 6(b). Students should have been able to find the mass of liquid added to the measuring cylinder and the volume of the liquid. Almost all students were able to give at least one of the values correctly.

Question 6 (b) (iv)

Students found giving improvements to the investigation quite challenging with more than half unable to gain a mark.

There are a large number of possible improvements for this experiment such as:-

- using apparatus that reads to more decimal places
- setting the zero
- using smaller divisions on apparatus
- using a larger volume or liquid.

There are also the general improvements of 'repeat and average'.

This response gains 2 marks.

(iv) State **two** improvements the student could make to this investigation.

(2)

1 Use a more accurate measuring cylinder e.g. instead of going up in 10's do 2 cm each

2 Set the ~~p~~ balance to 0 ~~one~~ once ~~pt~~ the student has placed the measuring cylinder to get a more accurate reading

ResultsPlus
Examiner Comments

The student has given two separate improvements.

The first to improve the accuracy of the measuring cylinder and this is explained as 'instead of going up in 10's go up in 2cm'.

The second improvement is 'Set the balance to zero'.

ResultsPlus
Examiner Tip

When you have completed an experiment and written it up make a list of possible improvements, developments and extensions which you can use for revision.

Question 6 (c) (i)

This is a calculation of energy needed to raise the temperature of 1.5 kg of water. The majority of students were able to successfully complete this evaluation although some students did not recognise the use of ΔQ (deltaQ) as the increase in energy and Δθ as the increase in temperature.

The equation and what each of the symbols mean is given on the equations page at the end of the examination paper.

This response scored 2 marks.

(c) (i) Figure 11 shows an electric kettle.

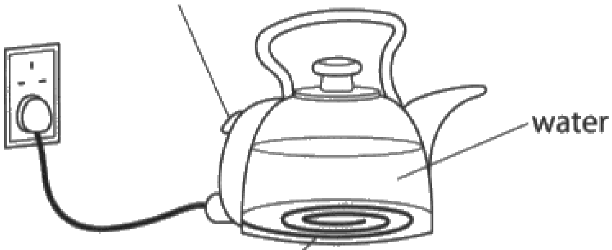


Figure 11

The kettle contains 1.5 kg of water.

The kettle is switched on.

Calculate the energy needed to raise the temperature of the water by 50 °C.

Specific heat capacity of water = 4200 J/kg °C

Use the equation

$$\Delta Q = m \times c \times \Delta\theta$$

(2)

1.5 x 50 x 4200 =

315000

energy needed = 315000 J

ResultsPlus
Examiner Comments

The student has substituted correctly into the equation and evaluated.

ResultsPlus
Examiner Tip

Remember the equations that you are not required to recall are given on the equations page at the end of the paper and each symbol used is given its meaning so you can check what the symbols mean and substitute correctly.

Question 6 (c) (ii)

In this calculation the equation is given and a substitution and rearrangement are needed to evaluate the time.

This response scores one mark.

(ii) The amount of energy, *E*, needed to bring the water to boiling point is 670 000 J.

The kettle has a power of 3500 W.

Calculate the time, *t*, it takes to bring the water to boiling point.

Use the equation

$$P = \frac{E}{t}$$

(3)

$$3500 = \frac{670\ 000}{t}$$

$$3\ 500 \times 670\ 000 = 2345000000$$

time to bring the water to boiling point = 2345000000 s

ResultsPlus
Examiner Comments

The substitution into the equation is correct and scores 1 mark but the rearrangement is wrong and therefore no further marks are awarded.

ResultsPlus
Examiner Tip

Always show the substitution to get the first mark.

This response scores two marks.

$$3500 = \frac{670000}{?}$$

$$\frac{67000}{3500} = 19.14$$

time to bring the water to boiling point = 19.14 s

ResultsPlus
Examiner Comments

The student has shown the correct substitution and rearrangement but the evaluation should be 191.4s. The power of ten error came from transcripting 670000 in the top line to 67000 in the rearrangement.

ResultsPlus
Examiner Tip

Take care to transcribe values correctly from one line of the calculation to the next.

Question 7 (a) (i)

The question tested that students were able to explain charging by friction through the transfer of electrons.

Many students were able to gain one mark for stating that the rod must be rubbed with the cloth or there must be friction between the rod and the cloth. However many students did not recognise that electrons are negatively charged and can only be negatively charged and it was the removal of the negatively charged electrons from the rod that made the rod positively charged.

This response scored the full three marks.

7 (a) A student uses a cloth to give a plastic rod a positive charge.

(i) Explain how the rod becomes positively charged.

(3)

When the rod is rubbed with the cloth, the rod's electrons go onto the cloth, making it positively charged and the cloth negatively charged.

ResultsPlus
Examiner Comments

The student states that the rod has to be rubbed by the cloth and that this causes the electrons on the rod to be moved to the cloth. The cloth is then negatively charged and the rod is positively charged having lost its negatively charged electrons to the cloth.

ResultsPlus
Examiner Tip

Remember that it is only electrons that can be transferred by rubbing and that electrons are negatively charged.

This response scores one mark.

The student would have held the rod with the cloth and rubbed it frantically to transfer ~~t~~ positive electrons over to the cloth. The friction would transfer over a positive charge and the cloth would now be negative.

ResultsPlus
Examiner Comments

The student gains a mark for knowing that the rod has to be rubbed with the cloth and realises that electrons have to be transferred but has referred to the electrons as having a positive charge; this is a fundamental error and no further marks can be awarded.

ResultsPlus
Examiner Tip

The electrons can only have a negative charge and it is the removal of the electrons which makes an object positive.

Question 7 (b)

Very few students were able to score three marks on this question.

If marks were scored it was students knew that the ground was positively charged by induction because of the charged cloud overhead. This was either written in the answer or shown on the diagram.

Generally students were not able to gain the third mark as they could not explain how the oppositely charged ground and cloud caused electrons to travel to the ground.

Question 7 (c)

This is an extended writing question in which students were asked to explain how transferring fuel to an aircraft can be dangerous and how the use of metal wires makes the process safer.

This followed from the previous parts of this question as students should have been guided to answers which were related to static electricity, the danger being the build up of a static charge when the fuel flows through the fuel pipe and the metal wires, making it safer by conducting the charge to earth.

However, many students referred to the metal wires as conductors of heat rather than electricity and were only able to gain Level 1 from generalised statements such as the fuel is flammable or there could be a spark.

This response is Level 1, 2 marks.

*(c) Figure 14 shows fuel being transferred to an aeroplane.

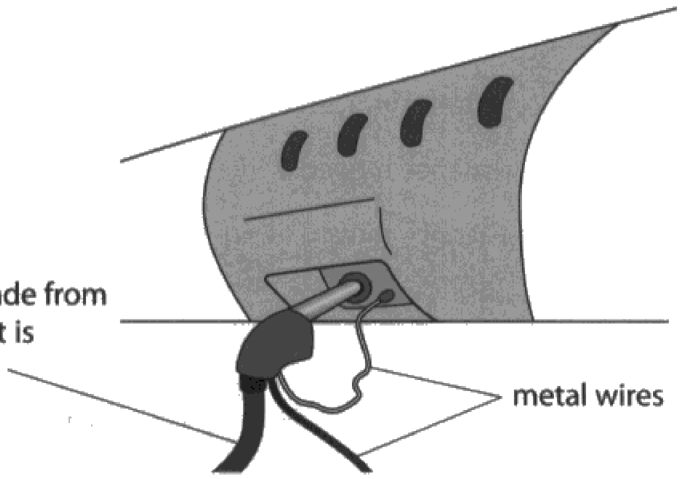


Figure 14

Explain why transferring fuel can be dangerous and how the use of metal wires makes the process much safer.

(6)

transferring fuel to an aeroplane is dangerous because of how flammable it is. Using metal wires decreases the chances of it leaking. Transferring fuel to an aeroplane is dangerous also because it can cause an electric shock. Using the metal wires as an insulator is good because it protects against getting an electric shock. Transferring fuel is dangerous because it can be explosive, metal wires make it safer because it gives more protection.

ResultsPlus
Examiner Comments

The students has given several true generalised statements amongst some incorrect physics.

True statements:-

- fuel is flammable
- process can cause an electric shock
- fuel can be explosive

None of the statements is explained and therefore only a Level 1 can be awarded.

ResultsPlus
Examiner Tip

Th is is the last part of a question which has been all about static electricity therefore it would be reasonable to expect and start thinking about static electricity in the last part of the question.

This response gains Level 2, 4 marks.

The insulated material on the fuel pipe means if an elcl-rical current the pipe will not conduct it and reduce the harm to anyone

The metal wire will guide the current into the ground therefore stopping it from eleclrituting any person.

ResultsPlus
Examiner Comments

The student is concerned with the prevention of electric shock rather than sparks but this is valid reasoning. The second paragraph which states that the metal wire will take the current to the ground to prevent electric shocks gives sufficient for Level 2.

ResultsPlus
Examiner Tip

Remember if you are asked to 'explain' there should be some linking of facts giving a reason.

This response is Level 3, 6 marks.

Transfering fuel can be dangerous as it causes a buildup of static charge from the pipe to the tank as the electrons are transfered through the insulated pipe to the tank which is negatively charged- causing static build up. This can cause sparks and as fuel is flammable, this could cause an explosion also.

Metal wires are useful as an earthing method to reduce the static charge as it transfers the electrons down to the ground which prevents this buildup of charge, the metal wire must be attached to the tank of the aeroplane and the ground to do this.

ResultsPlus
Examiner Comments

The student refers to the build up of charge which may cause a spark and then how this can be prevented by the metal wires taking the charge to earth and so preventing the build up of static charge.

ResultsPlus
Examiner Tip

The question has two parts: 'how can the transfer of fuel be dangerous' and 'how does using the metal wires make it safer'.

Try to answer both parts.

Question 8 (b) (i)

This question gives the equation to find the change in gravitational potential energy but does not give the value of g the gravitational field strength 10N/kg which students should be able to recall.

This response scores no marks.

(b) A ball has a mass of 0.046 kg.

(i) Calculate the change in gravitational potential energy when the ball is lifted through a vertical height of 2.05 m.

Use the equation

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

(2)

$0.046 \times 2.05 = 0.0943$

change in gravitational potential energy = 0.0943 J

ResultsPlus
Examiner Comments

The student has substituted the mass of the ball and the vertical height but missed out g.

ResultsPlus
Examiner Tip

Remember g is 10N/kg

This response gains two marks.

$0.046 \times 10 \times 2.05$

$=$

change in gravitational potential energy = 0.943 J

ResultsPlus
Examiner Comments

Substitution is shown and included the correct value for g and the evaluation is correct.

ResultsPlus
Examiner Tip

Always show your working.

Question 8 (b) (ii)

Students have to recall the equation for determining the kinetic energy of a ball of mass 0.046 kg moving at a speed of 3.5m/s. A large number of students left this blank as they could not recall the equation.

Those students that were able to recall the equation were generally able to substitute and evaluate correctly. Occasionally students would convert the mass from kilograms to grams. To calculate energy in joules mass must be given in kilograms, the answer of 0.00028 using grams gained 2 marks out of three because of a power of ten error.

This response gained 3 marks.

(ii) The ball is released.

Calculate the kinetic energy of the ball when the speed of the ball is 3.5 m/s.

(3)

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

$\frac{1}{2} \times 0.046 \times 3.5^2 = 0.28175$

kinetic energy of the ball = 0.28175 J

ResultsPlus
Examiner Comments

The relevant part of the equation is written correctly but the equation written properly should be,

K.E. =½ x m x v^2

The correct values are substituted and the evaluation is correct.

ResultsPlus
Examiner Tip

Practice writing out the equations that you may be asked to recall together with the meaning of the symbols used

Question 8 (b) (iii)

The majority of students were able to use the graph to estimate the height of the ball reached after the first bounce.

The tolerance allowed was 0.9m + or - 0.05m that is, 0.85m to 0.95m inclusive.

Question 8 (b) (iv)

About half of the students were able to gain a mark for the response to this question.

The first mark was for realising that the ball did not bounce back to the height it was dropped from because it had lost energy and the second mark was for explaining where the energy had gone.

This response scores no marks.

(iv) Explain why the ball does not bounce back to its starting height of 2.05 m.

(2)

cause as the ball bounce, it looses it's speed and gravity pulls it down.

ResultsPlus
Examiner Comments

There were many misconceptions about why the ball did not bounce back to its original height; the pull of gravity being a common wrong answer.

ResultsPlus
Examiner Tip

The start of this question is about the gravitational potential energy of the ball and the kinetic energy. Therefore this should help to guide you towards an answer involving energy.

Question 8 (c)

Looking at the points plotted on the graph students were asked to describe how the maximum height reached changes with the bounce number.

Many students were able to describe correctly that the maximum bounce height decreased as the bounce number increased and this gained one mark.

The second mark describing the change as non-linear was given less often.

This response scores two marks.

(c) A student plots a graph showing the height at the start and the maximum height reached after each bounce.

Figure 16 shows the student's graph.

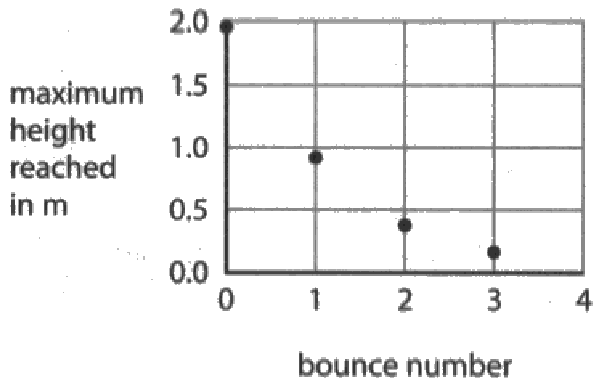


Figure 16

Describe how the maximum height reached changes with the bounce number in Figure 16.

(2)

Each time the ball bounces the maximum height reached halfes.

ResultsPlus
Examiner Comments

The approximate halving of the maximum bounce height describes not only that the height deceases with each bounce but also that the change is non-linear and gets 2 marks.

ResultsPlus
Examiner Tip

Look for a particular relationship between the variables plotted or non-linearity to gain the second mark.

Question 9 (b) (i)

Most students were able to give the correct answer of 19 ohms either by calculation or by looking at the values given in the table

Question 9 (b) (ii)

The question gave a possible conclusion that could be drawn from the table which was produced for the experiment.

The conclusion given was:-

'The resistance of the lamp is directly proportional to the potential difference.'

There were some student that did not attempt this question and many students were unable to gain marks either because they looked potential difference and current in the table instead of the resistance, were unsure of the meaning of directly proportional or did not compare potential difference and resistance as both increasing.

Question 9 (c)

This is an extended writing question. The diagram shows a battery connected to a lamp and students are asked to explain, in terms of movement of charge, how energy is transferred from the battery through the lamp to the surroundings.

Most students were able to score some marks on this question, usually by referring to energy from the filament lamp being dissipated as light or thermal energy. There were fewer responses explained that the particles moving in the wires were electrons.

This response is Level 3, 6 marks.

***(c) Figure 18 shows a battery connected to a filament lamp.**

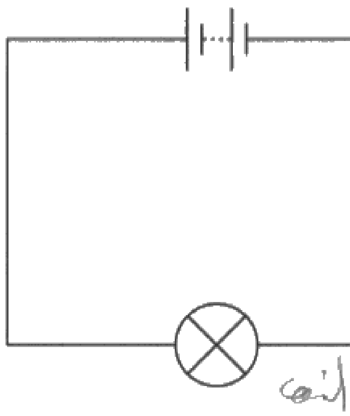


Figure 18

Explain, in terms of the movement of charged particles, how energy is transferred from the battery, through the lamp, to the surroundings.

(6)

The battery sends electrons down the wires from the positive to the negative. These wires are connected to the lamp therefore the electrons will pass through it. The filament lamp contains metal to conduct the electricity. It is then lit up by the coil. The lamp doesn't only produce light but it also produces heat to the surroundings.

ResultsPlus
Examiner Comments

The first line refers to electrons being sent down wires: this is an example of linked facts about particles and without anything else would gain Level 2, 4 marks. The last two lines then refer to light and heat being produced by the lamp and going to the surroundings. This answer demonstrates the use of relevant physics which is presented as a clear and logical explanation.

ResultsPlus
Examiner Tip

The answer does not have to be long but it must express accurate physics in a clear and logical form.

This response is Level 2, 4 marks.

*(c) Figure 18 shows a battery connected to a filament lamp.

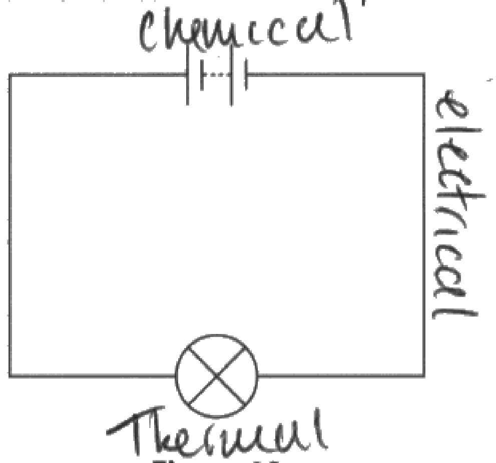


Figure 18

Explain, in terms of the movement of charged particles, how energy is transferred from the battery, through the lamp, to the surroundings.

(6)

The energy starts off as a chemical store within the battery. The energy is then ~~[illegible]~~ ~~[illegible]~~ converted into electrical energy as it travels the circuit. This can cause little amounts to be converted to a thermal store where it dissapates into the surroundings. Most electrical travels to the lamp where it is mostly turnt to thermal this is where most of the thermal dissapates to the surroundings

ResultsPlus
Examiner Comments

The student has given the energy changes from the chemical energy stored in the battery to the light and heat dissipated to the surroundings. However there is no mention of the movement of particles which is needed to award Level 3.

ResultsPlus

Examiner Tip

Read the question carefully and make sure you include all the points given in the answer.

Question 10 (b) (i)

The majority of students were not able to score on this question.

Moments (force x distance from pivot) had to be calculated for the girl about the pivot and the rock about the pivot.

Many students did not realise that a calculation of moments was needed and just considered the difference between the weight of the rock and the downward force provided by the girl. This did not score a mark.

This response scores one mark.

(b) Figure 20 shows a person trying to lift a large rock using a metal bar.

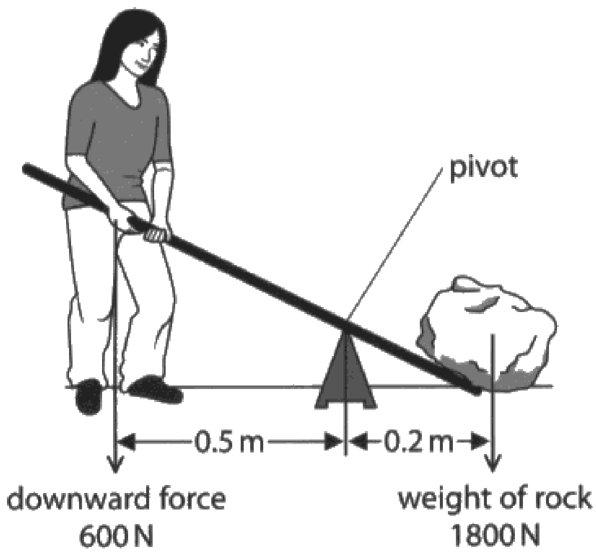


Figure 20

The rock weighs 1800 N.

The person can only produce a downwards force of 600 N.

The person cannot lift the rock.

(i) Explain, using calculations, why the person cannot lift the rock.

(3)

0.5 x 600 = 300 N/m

0.2 x 1800 = 360 N/m

the rock has the greatest downwards force that the person cannot balance

ResultsPlus
Examiner Comments

To score the first mark the student needed to use the equation for moments or give the unit of moment (Nm) after the calculation. This answer did not score the first marking point.

Both calculations were completed correctly giving the second marking point.

There is no mention of moments so the third marking point cannot be awarded.

ResultsPlus
Examiner Tip

Learn the principle of moments and how to apply it to practical situations.

Question 10 (b) (ii)

This question also required an understanding of moments and many students did not score a mark.

Most students wanted to move the pivot to the centre rather than increasing the moment supplied by the person or decreasing the moment given by the rock.

This response gained a mark.

(ii) Explain **one** change to the arrangement that will make it possible for this person to lift the rock.

(2)

There would need to be two more people who produce the same downward force to be able to lift the rock.

ResultsPlus
Examiner Comments

Increasing the force pushing down by using more people is the common sense answer which is correct. There is no second mark awarded as the effect on the moment of the force is not explained.

ResultsPlus
Examiner Tip

Look to apply common sense and then explain it using the physics.

Question 10 (c) (i)

About half of the students were able to complete this calcuation and give the correct answer that the small gear wheel turned 8 times in each second.

If students showed their working then one mark could be scored for giving the correct gear ratio.

This response scores two marks.

(c) Figure 21 shows a bicycle.

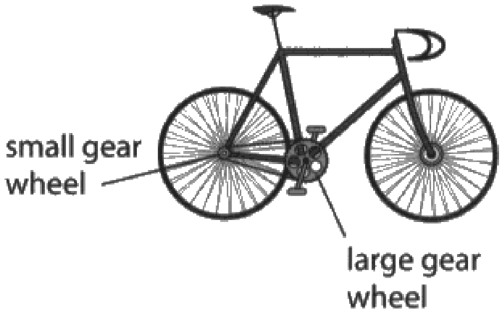


Figure 21

(i) The rider uses the pedals to make the large gear wheel turn.

The large gear wheel moves the chain.
The chain turns the small gear wheel.

The large gear wheel has 48 teeth.

The small gear wheel has 12 teeth.

The large gear wheel turns 2 times each second.

Calculate the number of times that the small gear wheel turns each second.

(2)

$48 \div 12 = 4$

$2 \times 4 = 8$

= 8 turns each second.

8 turns each second

ResultsPlus
Examiner Comments

The students has shown their working and given the correct answer.

ResultsPlus
Examiner Tip

Work through a calculation in a logical order.

This response scores one mark.

Calculate the number of times that the small gear wheel turns each second.

(2)

48 ÷ 12 = 4

4 .... turns each second

ResultsPlus
Examiner Comments

Although the answer is incorrect, a mark is awarded for the correct gear ratio which is seen in the working.

ResultsPlus
Examiner Tip

Always show your working.

Question 10 (c) (ii)

About half the students could score one mark for this question but a response that scored two was rarely seen.

The question requires an explanation of efficiency and therefore students need to consider the definition of efficiency and relate this to the application given in the question.

This response scores one mark.

(ii) Oil is applied to the wheel of a bicycle at the point shown in Figure 22.

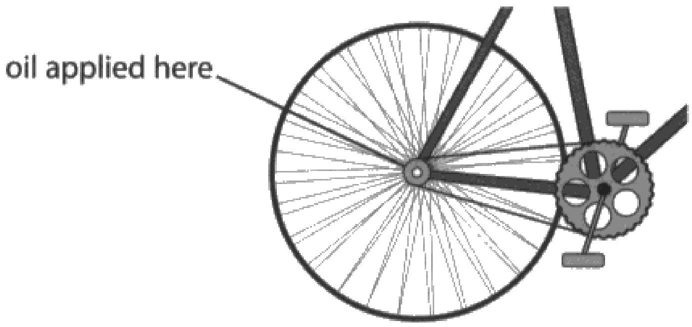


Figure 22

Explain how the oil improves the efficiency of the bicycle.

(3)

Oil improves the effiency of the bicycle as it lubricates the chains This prevents any friction meaning the bike can travel quicker and faser. Oil also prevents rust meaning the bike is kept in better condition for longer.

ResultsPlus
Examiner Comments

Oil lubricates or reduces friction gives the first mark but there is no reference to energy input and or useful energy output to explain efficiency.

ResultsPlus
Examiner Tip

Remember efficiency needs to be explained in terms of energy input and output.

Paper Summary

Student performance on this paper could be improved by:-

- Always showing working for calculations
- Substituting values into equations and including the unknown quantity
- Practice rearranging equations
- Using labelled diagrams to help describe experiments
- Listing improvements, developments and extensions for experiments that have been carried out
- Learning units for quantities given on the equations page of the paper
- Learning how to check for direct proportionality
- Learning and repeatedly writing out recall equations
- Learn how to convert from ºC to Kelvin.

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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