Pearson Edexcel

Examiners' Report
June 2022

GCSE Physics 1PH0 2F

ResultsPlus

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk.

Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

ResultsPlus

Giving you insight to inform next steps

ResultsPlus is Pearson's free online service giving instant and detailed analysis of your students' exam results.

- See students' scores for every exam question.
- Understand how your students' performance compares with class and national averages.
- Identify potential topics, skills and types of question where students may need to develop their learning further.

For more information on ResultsPlus, or to log in, visit www.edexcel.com/resultsplus. Your exams officer will be able to set up your ResultsPlus account in minutes via Edexcel Online.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk.

June 2022

Publications Code 1PH0_2F_2206_ER

Introduction

Questions were set to test candidates' knowledge, application and understanding from the following topics:

- Topic 1 – Key Concepts of Physics
- Topic 8 – Energy
- Topic 9 – Forces and their effects
- Topic 10 – Electricity and circuits
- Topic 11 – Static electricity
- Topic 12 – Magnetism and the motor effect
- Topic 14 – Particle mode
- Topic 15 – Forces and Matter

Within this 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. There was also the inclusion of questions designed at targeting candidates' knowledge and understanding of practical work. This included assessing their fundamental knowledge of core practicals specified in the specification, together with further application, especially where they were asked to propose improvements to a procedure. The assessment of candidates' mathematical skills involved the selection of equations from a list provided and became more demanding as the paper progressed. There were also two extended open response questions, worth six marks each.

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 misconceptions, with the aim of aiding future teaching of these topics.

Question 1 (b)(ii)

Most candidates were able to calculate the charge using the values and equation supplied. There was less success in recalling the unit of charge.

Question 2 (b)

Most candidates were able use the equation together with the values given. However, a great many gave a value in Ncm rather than converting this to Nm as required.

Question 2 (c)

This question required the candidates to determine the distances of the two forces from the pivot and then calculate the moment of each force. The two moments are of equal size and opposite direction and so, by the principle of moments, the ruler is balanced. It was sufficient, in this question, to simply show that the sizes were equal and a great many candidates were able to show this. Many candidates tried a qualitative approach using statements along the lines of Z is greater than Y but closer to the pivot. This, on its own, was not sufficient to show that it was indeed balanced.

(c) A 20 cm ruler has a pivot at its centre.

The ruler is balanced when no forces act on the ruler.

Figure 4 shows two forces, Y and Z, acting on the ruler.

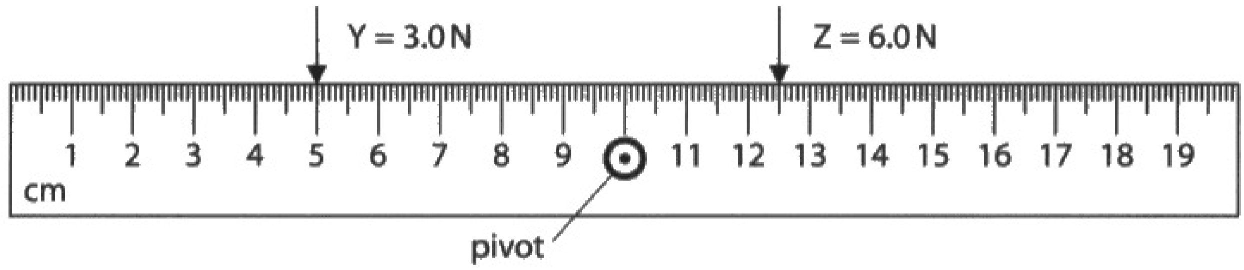


Figure 4

Use the principle of moments to show that the ruler in Figure 4 is balanced.

(2)

Moment Y = 15 (3 × 5)

moment Z = 15 (6 × 2.5)

Both are equal in moment.

ResultsPlus
Examiner Comments

1 mark for calculating both moments.

1 mark for stating that they are equal (size).

Question 2 (d)

Most candidates stated that the speed of rotation of P and R were equal. There was less agreement that the directions of rotation were also the same.

Question 3 (a)(i)

Examiners saw very few clear arrows with a line of action that was normal to the surface at point X. Even fewer had arrows that actually touched the point X.

Question 3 (a)(ii)

Stronger candidates could clearly write that the particles were in random motion and colliding with the sides of the container. A large number of candidates wrote about the gas trying to escape without mentioning particles.

(ii) Explain, in terms of particles, why the helium gas exerts a force on the sides of the container.

(2)

The particles in helium move very quickly and freely because it's a gas. Which causes the particles to hit the sides of the container. This causes pressure.

ResultsPlus
Examiner Comments

A clear answer that scored both marks.

Question 3 (b)

The effect of an increase in temperature was generally well described; either in terms of increase in (kinetic) energy or increase in speed of the particles; although this was often implied in responses that wrote about more frequent collisions.

(b) The container of helium is moved from a cold room to a warmer room.

State the effect of an increase in temperature on the helium gas particles inside the container.

(1)

The particles will move faster, so a bigger force is exerted.

ResultsPlus Examiner Comments

A mark for stating that the particles move faster.

(b) The container of helium is moved from a cold room to a warmer room.

State the effect of an increase in temperature on the helium gas particles inside the container.

(1)

the particles will have more energy

ResultsPlus Examiner Comments

A mark for referring to an increase in energy.

Question 3 (c)(i)

The calculation in this question was usually correct.

(c) A fixed mass of helium gas is compressed into a container, with no change in temperature.

The table in Figure 7 shows the pressure P_1 and volume V_1 before the gas is compressed, and the volume V_2 after the gas is compressed.

	pressure in kPa	volume in m^3
before the gas is compressed	$P_1 = 105$	$V_1 = 2.3$
after the gas is compressed	$P_2 =$	$V_2 = 0.20$

Figure 7

(i) Calculate the pressure P_2 after the gas is compressed.

(2)

Use the equation

$$P_2 = \frac{P_1 \times V_1}{V_2}$$

$$\frac{105 \times 2.3}{0.20} = 120.75$$

pressure P_2 = 120.75 kPa

ResultsPlus
Examiner Comments

A clearly laid out calculation that scored both marks.

Question 3 (c)(ii)

There were several, equally valid approaches to answering this question.

Some candidates correctly calculated the volume available per balloon by dividing 2.3 by 30 to arrive at a volume of 0.077 cubic metres, which was greater than the required volume of 0.07 and so the claim was valid.

Alternative approaches were to find the volume of 30 balloons or to find the number of balloons that could be filled with the available volume of gas.

The shop is correct as $0.07 \times 30 = 2.1 m^3$ and figure 7 shows at 105kPa that the volume can be 2.3 so the shop is correct as you could fill more than 30 balloons.

ResultsPlus
Examiner Comments

Successful candidates calculated the total volume of 30 balloons to be 2.1 cubic metres and then compared this with the 2.3 cubic metres available to conclude that the claim was valid.

Other candidates correctly calculated the number of balloons that could be filled by dividing 2.3 by 0.07 to arrive at an answer of (just over) 32, which again showed that the claim was valid.

When P_1 = 105, V_1 = 2.3 cm^3 therefore 2.3 cm^3 ÷ 0.07 = 32.8 so the helium gas will fill 32 balloons this shows that the shops claim is true as at least 30 balloons can be filled.

ResultsPlus
Examiner Comments

The value of 2.3 has been used in a calculation to find the total possible number of balloons and then compared the answer of 32 with the shop's claim of 30.

Full marks awarded.

Question 4 (a)(i)

The scenario showed a demonstration of electromagnetism that should have been very familiar to candidates.

Iron would be the most suitable material but examiners would also accept steel, cobalt or nickel alloys. However, there were a surprisingly large number of candidates that gave an answer of copper as a suitable material for the metal rod.

Question 4 (a)(ii)

Only a minority of candidates stated that the material must be able to be magnetised when there was a current in the coil and even fewer wrote that, in order for the iron filings to drop off when the switch was opened, this magnetism must be temporary.

A large number of candidates gave other physical or chemical properties such as electrical conductivity or "non reactive" as well as lost cost or ready availability.

Question 4 (b)(i)

Candidates are usually familiar with the use of a plotting compass to show that the Earth has a magnetic field that has a direction. There seems to be less understanding that this field has a magnitude as well as a direction.

This question and the following two questions assessed the ability of candidates to apply their understanding of magnetic fields using a device that was probably unfamiliar to them.

Examiners were looking for a reference to the Earth's magnetic field in part 4(b)(i). Many candidates recognised that there must be "a magnetic field everywhere" but fewer could state that the phone was showing the magnetic field of the Earth.

Many candidates wrote that there must be magnets near to the phone even though the question stated otherwise.

Question 4 (b)(ii)

Most candidates were able to identify the change in direction of the magnetic field. Slightly fewer candidates wrote that the strength of the field had increased.

Many candidates simply referred to the numbers being different without making it clear what changes in magnetic field were shown by different numbers.

(ii) State **two** changes in the magnetic field measured by the phone from Figure 10 to Figure 11.

(2)

1 where the centre was 0°, it's now 36°.

2 The strength of the magnetic field has changed to an even higher number

ResultsPlus
Examiner Comments

Two changes simply and correctly identified. Full marks awarded.

Question 4 (b)(iii)

This assessed the ability to plan an experiment. Examiners were looking for a least three of the following:

- Use familiar equipment (in this case a ruler to measure distance)
- Make an appropriate measurement; either of distance or of field strength as shown on the phone
- Vary the conditions; in this case changing the distance between the phone and the magnet
- Process the results in some way. Examiners would accept a variety of suitable suggestions

Many candidates were able to score at least 2 marks.

This scored 3 marks.

(iii) Describe how the student could use the mobile phone to investigate the strength of the magnetic field at different distances from the magnet.

(3)

By moving the magnet away from the phone further, for example 20cm. The student could then take the reading and divide it by the distance to find the strength per 1cm.

ResultsPlus
Examiner Comments

A mark for the idea of changing the distance by "moving the magnet away from the phone".

A mark for making a measurement: "take the reading".

A mark for processing the results: "divide by the distance to find the strength per 1cm".

There are several ways of showing how the results could be processed.

(iii) Describe how the student could use the mobile phone to investigate the strength of the magnetic field at different distances from the magnet.

(3)

put the magnet close to the phone and write the distance and the force shown. The place the magnet further away and record that result, keep doing that till the result doesnt change.

ResultsPlus
Examiner Comments

This answer has the idea of finding where the field falls to zero; ie when the result does not change.

Full marks awarded.

(iii) Describe how the student could use the mobile phone to investigate the strength of the magnetic field at different distances from the magnet.

(3)

Create a table with distance from phone and strength of magnet then measure strength of magnet at different length.

ResultsPlus
Examiner Comments

Another simple, but creditworthy suggestion of how the results could be processed: in this case "draw a table".

Question 5 (a)(ii)

The purpose of a fuse was often well described in terms of how it behaved when there was a fault. Weaker candidates could still score a mark by identifying the fuse even if their description of its purpose was not worthy of a mark. There are still very many candidates, however, who see the fuse as some kind of current regulator.

(ii) Describe the purpose of the component labelled X.

(2)

it melts if too much current flows through the circuit andacts as a safety measure - it is the fuse.

ResultsPlus
Examiner Comments

A simple description of the purpose of the fuse that scored full marks.

(ii) Describe the purpose of the component labelled X.

(2)

That is the fuse. It is a circuit breaker. If the water pump uses over 3A of electricity the fuse will break, stopping the circuit.

ResultsPlus
Examiner Comments

Another good answer that explains the purpose of the fuse.

Question 5 (b)

The calculation of power required conversion of time from 1 minute into 60 seconds. Candidates who did not carry out this conversion could still score 2 marks provided that the values of energy and voltage were used correctly.

(b) The 230V mains supply transfers 9000 J of energy to the pump motor in 1 minute.

Calculate the current in the pump motor.

Use the equation

$$I = \frac{E}{V \times t}$$

$$\frac{9000}{230 \times 60}$$

230

= 234.78

1m = 60secs

(3)

current = 234.78 A

ResultsPlus Examiner Comments

The candidate has shown a conversion: 1m = 60 secs and so scores the first mark.

The candidate has substituted the correct values into the equation and so scores the second mark.

Unfortunately, the evaluation was incorrect and so does not score the third mark.

ResultsPlus Examiner Tip

Always show you working. You can score marks even if your final answer is wrong.

Question 5 (c)(i)

Most candidates were clearly familiar with energy transfers and could write confidently about energy being “lost” or “wasted” or otherwise transferred to the surroundings. Very many candidates could use the diagram to identify the energy that was not transferred to the water and then calculate its value as 600J.

Question 5 (c)(ii)

Candidates were required to select the appropriate pair of values and use them in the equation that was given. Although vary many did this successfully there were a significant number that wrote the values in the correct position but then calculated the inverse by dividing the “large number” by the “smaller number” to arrive at an efficiency greater than 1. Partial credit was given in this case for selection of the two values from the three possible values.

Question 6 (b)(i)

The unit for work was generally not known.

Question 6 (b)(ii)

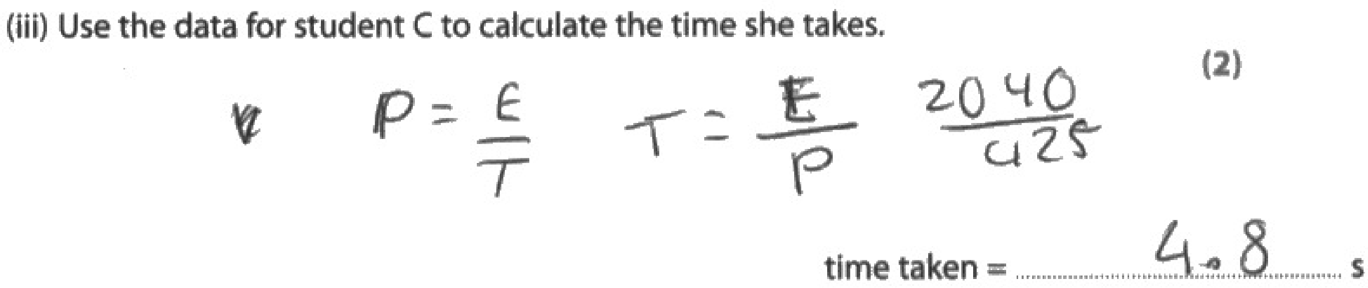
This required selection and use of the equation linking work done, force and distance. In this case the value of 490 is obtained by dividing 1960 by 4.0.

Some candidates, however, seemed to assume that the data had been arranged in descending order of weight and found a value halfway between the 550 and 510. Examiners did, on this occasion, condone this misunderstanding and gave partial credit for using the data in this way.

Question 6 (b)(iii)

The time taken is calculated by selection and use of the equation linking power, work done and time. Here a value of 4.8 s is obtained by dividing 2040 by 425.

The most common error was to multiply the two values rather than dividing.


(iii) Use the data for student C to calculate the time she takes.

(2)

$P = \frac{E}{T}$ $T = \frac{E}{P}$ $\frac{2040}{425}$

time taken = 4.8 s

ResultsPlus
Examiner Comments

A clearly laid out answer that scored full marks.

Question 6 (b)(iv)

Candidates were asked to find the average of three different values arising from an investigation. In this situation the most appropriate average is the arithmetic mean of the values (rather than a mode or a median).

Many candidates were able to find the arithmetic mean of the three power values to get an answer that rounded to 434 W. Partial credit was given to those who found the sum of the three values but were not able to use this to find the mean.

(iv) Use the data for all three students to calculate the average power of the students.

(2)

$$\frac{440+436+425}{3} = 108.41\dot{6}$$

average power = $108.41\dot{6}$ W

ResultsPlus
Examiner Comments

This response has the correct expression to find the average and so scored the first mark.

The final evaluation, however, was incorrect and did not score the second mark.

(iv) Use the data for all three students to calculate the average power of the students.

(2)

440 + 436 + 425 = 1301

1301 ÷ 3 = 433.66

average power = 433 W

ResultsPlus
Examiner Comments

A correct calculation.

The candidate has attempted to express the calculator value of 433.666 to 3 significant figures (the same precision as each of the three weight values).

This is very good practice. Unfortunately, the value was truncated by simply removing the decimal places. A correct rounding would be 434.

The examiner did not penalise this error in this question.

Question 6 (c)

A majority of candidates realised that the students' estimate of their own weight was a significant source of error that could be reduced by measuring the actual weight of each person.

(c) Identify a significant source of error in the investigation and state how this error can be reduced.

(2)

source of error

Estimating their weight

can be reduced by

Actually weigh themselves for more Accurate results.

ResultsPlus
Examiner Comments

Two simple statements that scored 2 marks.

A notable number of candidates thought that using a stopwatch to measure time was more significant and proposed the use of light gates. This solution is probably impractical as well as contributing much less to the accuracy of the results than making a measurement of weight.

(c) Identify a significant source of error in the investigation and state how this error can be reduced.

(2)

source of error

human reaction time when using stopwatch.

can be reduced by

using lightgates or another accurate method to accuratly track the time taken.

(Total for Question 6 = 10 marks)

ResultsPlus
Examiner Comments

Although a possible source of error, human reaction time is not the most significant in this case.

No marks awarded.

Question 7 (b)

Candidates were clearly very familiar with charging a plastic rod by friction.

Question 7 (c)(ii)

Most candidates could identify the difference in the shape of the two clouds but few could give a reason in terms of electrostatic repulsion between the charged droplets.

(ii) Figure 16 shows the shape of the clouds of droplets in the disinfectant from two sprayers.

cloud from sprayer 1 cloud from sprayer 2

Figure 16

Sprayer 1 gives a negative charge to each droplet.

Sprayer 2 does not give any charge to the droplets.

Explain the difference in the shape of the two clouds.

(2)

Sprayer 1's cloud spreads out further due to the electrons repelling each other

ResultsPlus
Examiner Comments

A clear and concise answer that scored both marks.

(ii) Figure 16 shows the shape of the clouds of droplets in the disinfectant from two sprayers.

cloud from sprayer 1 cloud from sprayer 2

Figure 16

Sprayer 1 gives a negative charge to each droplet.

Sprayer 2 does not give any charge to the droplets.

Explain the difference in the shape of the two clouds.

(2)

The cloud from sprayer 1 covers a large surface area than the cloud from sprayer 2.

ResultsPlus
Examiner Comments

A less complete answer that correctly describes the difference in the two clouds but does not give any explanation for this difference.

1 mark only.

Question 7 (c)(iii)

The stronger candidates wrote clearly about the droplets in the cloud being attracted to the hidden parts of the seat but most candidates simply wrote about the cloud spreading out over the seat.

Question 7 (d)

The scenario of refuelling an aeroplane is often cited as an example of the hazards of a build-up of electrostatic charge and some candidates were clearly familiar with this and how the danger is reduced. Examiners were firstly looking for an appreciation that electrostatic discharge can produce a spark that may possibly ignite the fuel and cause a major fire. Although the dangers of a fire were well understood, few candidates linked this to a spark caused by electrostatic discharge.

Secondly examiners were looking for a suggestion how this build up can be reduced; usually by an earth wire that can carry away the charge as it is produced by the fuel passing through the pipe or possibly, by reducing the rate of flow of the fuel. Such suggestions were not common and it was more usual to see general fire safety measures such as provision of fire extinguishers and staff training.

A level 3 answer did not have to be long provided that it described the risk and explained how the risk can be reduced.

The denger of having a electric charge ~~wite~~ near flemable fule is a bed ideer, because just one spark ~~[illegible]~~ could ~~ease~~ corse it to eggnight and explode.

So we expell the charge to the ground by having a earthe wire to provent the ~~bit~~ build up of electric charge.

ResultsPlus
Examiner Comments

A concise answer that correctly describes the risk of a spark igniting the fuel and causing an explosion. It then goes on to explain how an earth wire will prevent the build-up of static electric charge.

Level 3. 6 marks.

Many level 2 answers described the dangers but did not properly explain how the danger can be reduced.

The build up of static electricity can cause sparks on the plane and because fuel is very flammable it can then catch fire and burn the wings of the plane. because the pipes go through the plane into the wings the fire will travel through the plane and causes it to explode. what can reduce this is by cleaning out the fuel tanks and pipes in the plane to ensure that nothing can set a light when new fuel has been put in there. before a flight people also check the wings to make sure that nothing could cause a spark or produce flame when flying. The ~~electro~~ atoms on the plane can also vibrate more as the pressure of the atmosphere causes them to vibrate and become more active. this is what can cause most fires.

ResultsPlus
Examiner Comments

There is a good description of how a spark could ignite the fuel but, although the suggestions for reducing the danger may be sensible, they do not explain how the build-up of static electric charge can be reduced.

Level 2. 4 marks.

Other level 2 answers gave explanations about how charge build up can be reduced but did not describe how this build up could be dangerous.

Static electricity Creates a higher risk of the fuel setting on fire because of the excess energy.

If you grand the aeroplane allowing the build up off electric charge too fiow off the plane, it will reduce the danger.

ResultsPlus Examiner Comments

There is reference to the fuel setting on fire but not how a build-up of static electric charge can cause this. There should be some mention of a spark.

Level 2. 4 marks.

Question 8 (b)

It was generally appreciated that two lamps in series would each be less bright than a single lamp with the same power supply. Reasons were usually in terms of the power of the lamps being reduced or the voltage of the supply being shared between the two lamps. It was rare to see an answer that included a correct idea of resistance being increased and/or current being reduced when two lamps are connected in series.

(b) Another **identical** lamp is added to the circuit, as shown in Figure 20.

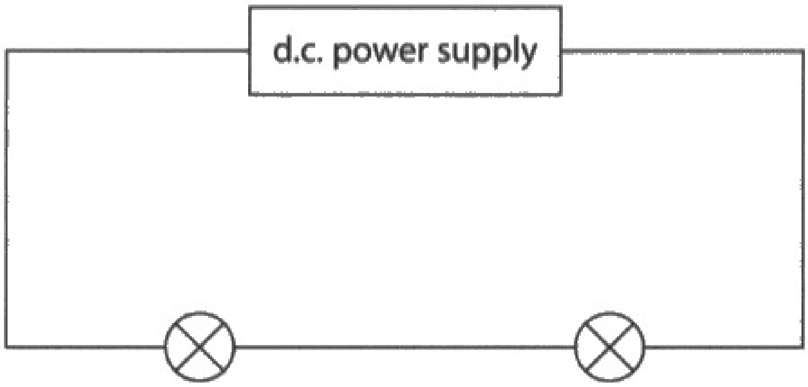


Figure 20

The power supply provides the same potential difference as it provided in the circuit in Figure 19.

State and explain the difference between the brightness of the lamp in Figure 19 and the brightness of a lamp in Figure 20.

(3)

The lamps in figure 20 will be more dim due to them needing to share the same potential difference

ResultsPlus
Examiner Comments

A mark for stating that the lamp would be dimmer and a mark for stating that now two lamps share the same potential difference.

However, this does not fully explain why the lamp is dimmer. A little more detail would be needed to score full marks. This might be comparing the current or power in the two circuits.

ResultsPlus
Examiner Tip

If there are three marks for a question, make sure that your answer contains three good points.

State and explain the difference between the brightness of the lamp in Figure 19 and the brightness of a lamp in Figure 20.

(3)

The lamp becomes less bright as the extra lamp increases the resistance, reducing the current

ResultsPlus
Examiner Comments

A simple correct statement that links the brightness of the lamp with increased resistance (in the circuit) and therefore a reduced current.

Full marks awarded.

Question 8 (c)

It appeared that many candidates failed to read the question properly and simply drew circuits that had a lamp and a power supply without any indication of a piece of resistance wire and very often without an ammeter or a voltmeter.

Although an ammeter was usually shown correctly connected in series, a voltmeter was very often, incorrectly, shown connected in series.

The requirement of trimming the 1 m wire to 50 cm seemed to escape most candidates.

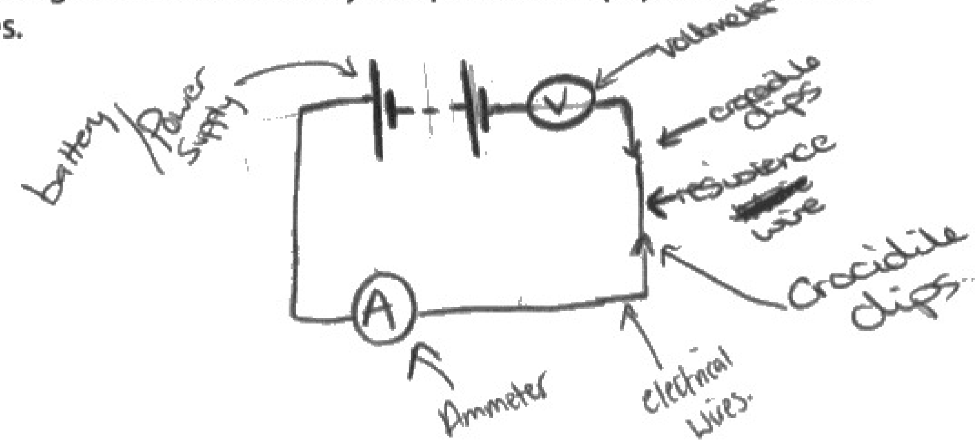
(c) A student is given a low voltage power supply and 1 m of resistance wire.

The student uses these and other pieces of equipment to measure the resistance of just 50 cm of the resistance wire.

Draw a diagram of the circuit that the student should use.

Your circuit diagram should identify the pieces of equipment that the student uses.

(3)



ResultsPlus
Examiner Comments

There is a mark for a drawing that includes a battery/power supply, an ammeter, a voltmeter and the piece of resistance wire.

There was a further mark for showing the ammeter in series with other components.

There was no mark for showing the voltmeter in series (rather than across a component).

The examiner gave a third mark for the indication of selecting part of the length of wire by using crocodile clips which was judged to be acceptable in this context.

3 marks out of 3.

Many drawings included a lamp. This does not form part of the investigation and was ignored by examiners when looking at which components had been included in the circuit.

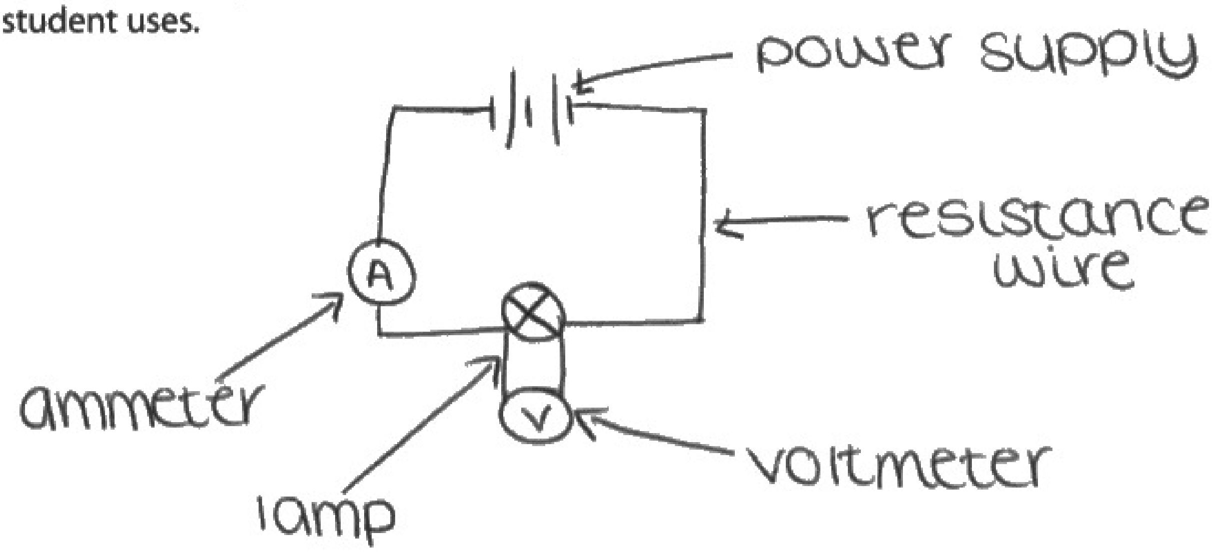
(c) A student is given a low voltage power supply and 1 m of resistance wire.

The student uses these and other pieces of equipment to measure the resistance of just 50 cm of the resistance wire.

Draw a diagram of the circuit that the student should use.

Your circuit diagram should identify the pieces of equipment that the student uses.

(3)



ResultsPlus
Examiner Comments

The drawing includes the power supply, ammeter, voltmeter and resistance wire and so scores the first mark.

The ammeter is in series with the rest of the circuit and so scores the second mark point.

The voltmeter is connected in parallel with a component for the third mark point. Although the lamp was ignored for the first mark point, it was allowed to be used to show correct connection of a voltmeter.

A total of 3 marks awarded.

Question 8 (d)

There were many clear and concise answers that described direct current as going in one direction and alternating current as changing direction.

Marks were usually lost by describing alternating current as going in many directions or simply changing, which does not necessarily imply a change in direction rather than a change in size.

(d) Describe the difference between direct current (d.c.) and alternating current (a.c.) in electrical circuits.

(2)

a direct ~~circ~~ current circuit is 1 large loop going in 1 direction but an alternating current can go back and forth

ResultsPlus
Examiner Comments

This has the correct idea of direct current in one direction only whereas an alternating current changes direction.

Examiners would accept "back and forth" in this context.

Question 9 (b)

This question concerned a core practical to investigate density. Most candidates evaluated mass as density multiplied by volume but there was very often uncertainty about which volume to use. Stronger candidates saw that when the iron was added, the water level rose by 40 cm^3 and that this would be the volume of the iron. Many simply used either the level of 490 cm^3 as shown on the diagram or 530 cm^3 as described in the question stem.

Examiners could give partial credit for rearranging the given equation and carrying out an evaluation even if an incorrect volume had been used.

It was pleasing to see that many candidates were able to take the calculator value and express this to 2 significant figures and credit was given for demonstrating this skill even if the evaluation had been incorrect.

(b) Figure 21 shows some water in a measuring cylinder and a lump of iron.

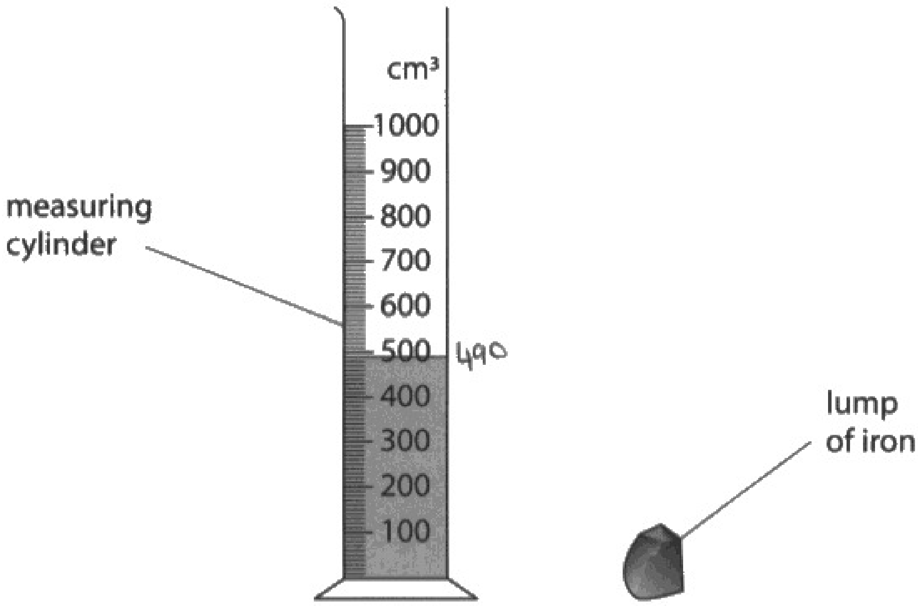


Figure 21

The lump of iron is lowered fully into the water.

The water level in the measuring cylinder rises to 530 cm^3.

The density of iron is 7.9 g/cm^3.

Calculate the mass of the lump of iron.

Use the equation

$$density = \frac{mass}{volume}$$

Give your answer to 2 significant figures.

(4)

530 - 490 = 40

7.9 x 40 = 316

density = 7.9

mass = ?

volume = 40

$7.9 = \frac{316}{40} = 7.9$

mass = 316.00 g

ResultsPlus Examiner Comments

The candidate has found the change in volume by subtracting the two water levels.

This value was then used in a rearranged equation to find the mass.

The final answer was to 3 significant figures rather than 2 significant figures as instructed and so scored 3 out of a possible 4 marks.

ResultsPlus Examiner Tip

The candidate has checked the answer by doing a reverse calculation to make sure that the calculated mass (316) divided by the volume (40) does indeed equal the density (7.9).

This is an excellent idea.

Question 9 (c)

Examiners were looking for an explanation that recognised that if wood had been used rather than iron, then the difference in volume shown on the measuring cylinder due to the rise in water level would not be the same as the volume of wood because the wood floats. Many candidates wrote that the wood would absorb some water and so give a false reading. Although the effect of this is likely to be very small, examiners gave credit for this explanation that displayed skills of reaching a conclusion via justification and reasoning.

(c) A piece of wood has a similar shape and volume to the lump of iron.

The density of the wood is 0.82 g/cm³.

The density of water is 1.00 g/cm³

Explain why the method used in part (b) cannot be used to determine the mass of the piece of wood.

(2)

The wood floats so it cannot be fully submerged.

ResultsPlus
Examiner Comments

This answer correctly states that wood would float and not be fully submerged. However, it does not fully explain why the method would be unsatisfactory.

1 mark out of a possible 2 marks.

(c) A piece of wood has a similar shape and volume to the lump of iron.

The density of the wood is 0.82 g / cm³.

The density of water is 1.00 g / cm³

Explain why the method used in part (b) cannot be used to determine the mass of the piece of wood.

(2)

The density of wood is lower than the density of water so the wood won't make a change in the water levels - would be inaccurate

ResultsPlus
Examiner Comments

A more complete answer that compares the densities of wood and water and explains why the method would not give an accurate measurement of the volume of the wood.

Question 9 (d)

This question required candidates to describe a core practical. A fully comprehensive and detailed description was neither expected nor required to reach level 3, but examiners were looking for:

- at least two items of equipment in addition to those mentioned in the stem of the question.
- at least two measurements that should be made.
- some additional detail that could include precautions taken to ensure accuracy or how the results are processed to determine the specific heat capacity of water.

Level 2 or level 1 could be reached by including some, but not all of the above.

Candidates were often able to mention at least one item of equipment; usually a thermometer, clock or measuring cylinder but very often failed to mention a power supply for the heater and meters that can be used to measure the amount of electrical energy transferred.

There were very often incomplete descriptions of measurements. It was common to see "measure the temperature of the water" without being clear whether this is the starting temperature or the temperature after or during heating. There was also only occasional reference to measuring the energy transferred.

Detail was often provided by mention of insulation or ensuring that the heater was fully immersed in the water. Stronger candidates included a reference to the equation even if there was less clarity about which measurements provided the values to be used.

- Wear safety goggles.
- Measure the start temperature of the water using the thermometer
- Also measure the volume of water.
- Turn on the low voltage heater
- Measure the temperature at different times using the stopwatch e.g. Every minute. × 10
- Create a table of results based on all the data you have recorded
- Compare how much the temperature has changed and the volume of water.
- Work out if the equation with your results

change in thermal energy = mass × specific heat capacity × change in temperature

or $\Delta Q = m \times c \times \Delta \theta$. To work out specific heat capacity of the water.

ResultsPlus
Examiner Comments

There is a labelled drawing that identifies two additional pieces of equipment (stopwatch and thermometer).

There are descriptions of at least two measurements (volume of water and starting temperature of the water).

There is also sufficient detail about how to process the results to achieve level 3 for 6 marks.

the Student would also need a thermometer so that they could keep track of the temprture and they will also need a batry Pack to use as a power Source for the heater. The heater will then need to be Pluged In And Placed Into the beaker after the Student has taking the waters Starting temprture

ResultsPlus
Examiner Comments

This answer gives two additional pieces of equipment, a thermometer and a power supply for the heater.

It also describes one measurement: "the waters starting temperature".

It does not describe another measurement, nor does it give any further details about the procedure or how the results can be processed and so is a level 2 response scoring 4 marks.

Question 10 (a)(i)

Most candidates were able to put the values of weight and area into the equation provided to calculate a pressure and gain at least partial credit.

The most common error was to not recognise that the weight would be distributed over four feet to produce an average pressure of 28 000 Pa.

(i) [redacted] the average pressure that the donkey exerts on the ground.

Use the equation

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

(2)

$0.022 \times 4 = 0.088$

$\frac{2500}{0.088} = 28409.1$

average pressure = 28409.1 Pa

ResultsPlus
Examiner Comments

A well laid out and fully correct calculation.

Question 10 (a)(ii)

Stronger candidates recognised that the area of a camel's hoof in contact with the ground was greater than the area of a donkey's hoof and therefore the pressure on the ground would be less. This would mean that the camel is less likely to sink into soft ground.

It was common to see mention of the relative surface area of the hooves but many answers confused weight (or force) with pressure and examiners saw many statements that "the pressure would be spread over a larger area".

Quite a few answers referred to the greater stability of a camel but failed to provide any justification of this. Such responses were not seen as creditworthy.

The camel and the donkey have the same mass.

Explain how a camel's hoof is a more suitable shape than a donkey's hoof for walking on soft ground.

(2)

The camel's hoof has a wider surface area therefore the weight is more spread out.

ResultsPlus
Examiner Comments

Examiners would accept "wider surface area" for one mark and "weight more spread out" for another mark.

2 marks out of 2.

The camel and the donkey have the same mass.

Explain how a camel's hoof is a more suitable shape than a donkey's hoof for walking on soft ground.

(2)

the camels hoof has a wider surface area therefore because of this the pressure is decreased and camels can walk easier on soft terrain/ground.

ResultsPlus
Examiner Comments

A correct link between greater area and therefore less pressure, scores full marks.

Pressure and force were often confused.

The camel hoof has a higher surface area therefore the pressure is spread out among the hoof which means less force along the soft ground.

ResultsPlus
Examiner Comments

There is a mark for mentioning the surface area but the statement about pressure being spread out means there is less force is incorrect.

1 mark only.

ResultsPlus
Examiner Tip

Make sure that you can use the words pressure and force correctly.

Question 10 (b)(i-ii)

Candidates did not need to be familiar with the equipment described in this question to be able to plot the graph and draw a line of best fit and examiners saw a great many completed graphs that were fully accurate.

It was pleasing to see that lines of best fit were well drawn and passed through, or close to, at least four points. There were very few attempts to draw a line passing through the false origin at the bottom of the y-axis.

Question 10 (b)(iv)

To find the pressure at the surface, a candidate needed to extend the line of best fit already drawn back to the y-axis and then read the value on that axis.

A well-drawn line of best fit would produce a value between 98.6 and 98.8, but examiners would also give a mark for a correctly read value from a less well drawn line of best fit.

Candidates who did extend their line of best fit usually scored a mark.

The most common error was to extend the line upwards and read the pressure at top of the line.

Figure 27 shows a graph with some of the results plotted, but two of the points are missing.

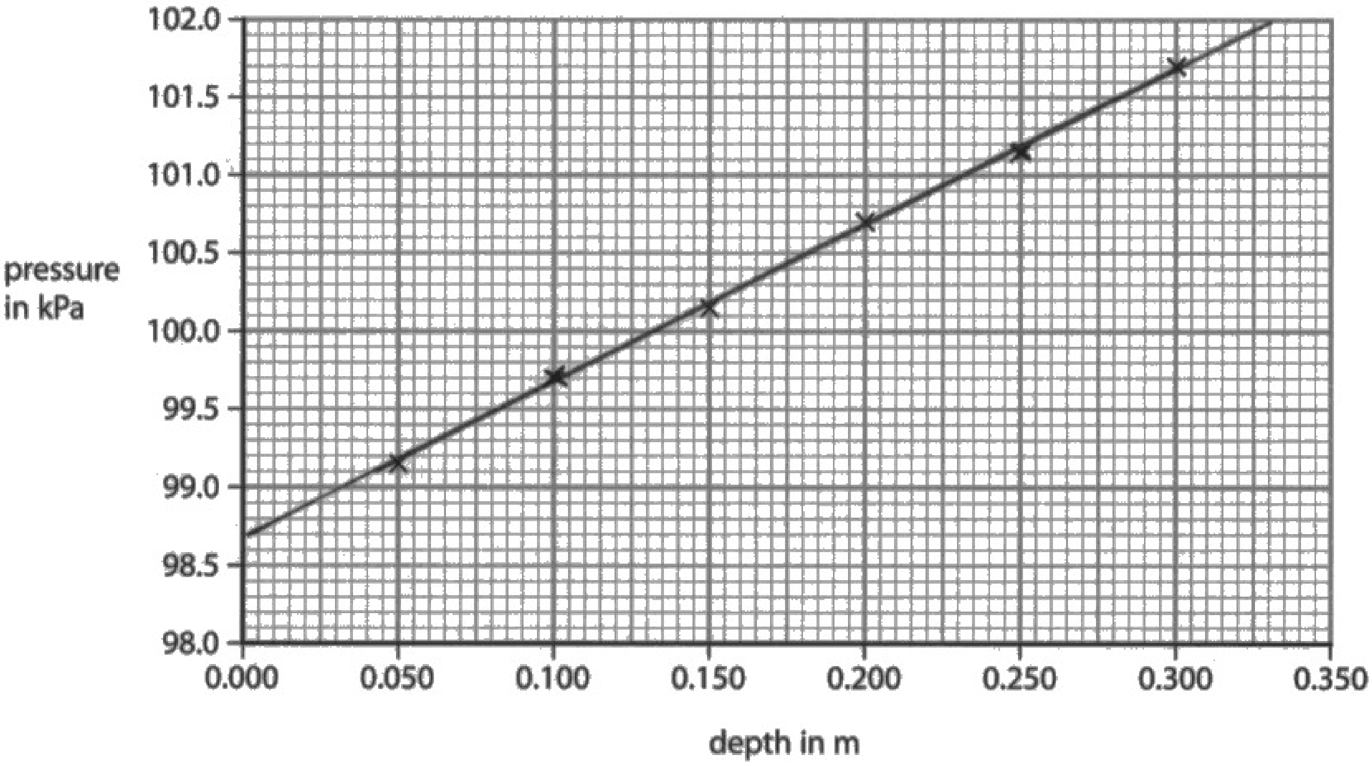


Figure 27

(iv) Use the graph in Figure 27 to predict the pressure at the surface of the water.

(1)

pressure at the surface of the water = 98.7 kPa

ResultsPlus
Examiner Comments

A well-drawn line that scored full marks in part 10(b)(i) and 10(b)(ii) and is extended back to the y-axis.

The candidate correctly read the value and scored the mark.

Question 10 (c)

Answers tended to refer to greater pressure with seawater and so scored at least one mark.

Fewer answers included a mention of the graph, such as it would have a steeper gradient.

(c) The student repeats the investigation in part (b) using seawater and draws a graph of the results.

The seawater is more dense than the water used in part (b).

Compare the graph for seawater with the graph in Figure 27.

(2)

as it is more dense the pressure would be alot higher.

ResultsPlus
Examiner Comments

There is one mark here for pressure (values) being a lot higher but no reference to the graph.

1 mark out of 2.

ResultsPlus
Examiner Tip

Remember if a question has two marks, then you need to make at least two correct statements.

(c) The student repeats the investigation in part (b) using seawater and draws a graph of the results.

The seawater is more dense than the water used in part (b).

Compare the graph for seawater with the graph in Figure 27.

(2)

The graph of seawater would have a ~~Steeper~~ Steeper gradient and a higher pressure under water.

ResultsPlus
Examiner Comments

A correct comparison of the gradients of the two graphs together with a statement that the pressure (values) would be higher.

2 marks.

Paper Summary

Based on their performance on this paper, candidates should:

- use the Advanced Information to focus their revision.
- engage with practical work during their course.
- be competent in quantitative work, especially in being able to select and rearrange equations and understand significant figures in the context of numerical values.
- recognise key command words such as “describe” and “explain” and construct their responses accordingly.
- be willing to apply physics principles to the novel situations presented to them.

Less successful candidates:

- had gaps in their knowledge of the topics of this paper.
- had gaps in their procedural knowledge, relating to their practical work.
- did not focus sufficiently on what the question was asking.
- found difficulty in applying their knowledge to new situations.

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

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London WC2R 0RL.