

Write your name here

Surname

Other names

Centre Number

Candidate Number

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Physics

Paper 2

Foundation Tier

Sample Assessment Material for first teaching September 2016

Time: 1 hour 45 minutes

Paper Reference

1PH0/2F

You must have:

Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- In questions marked with an asterisk (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

- 1 (a) (i) Complete each box in Figure 1 to show how particles are arranged in a solid, liquid and gas.

One particle in each box has been drawn for you.

(3)

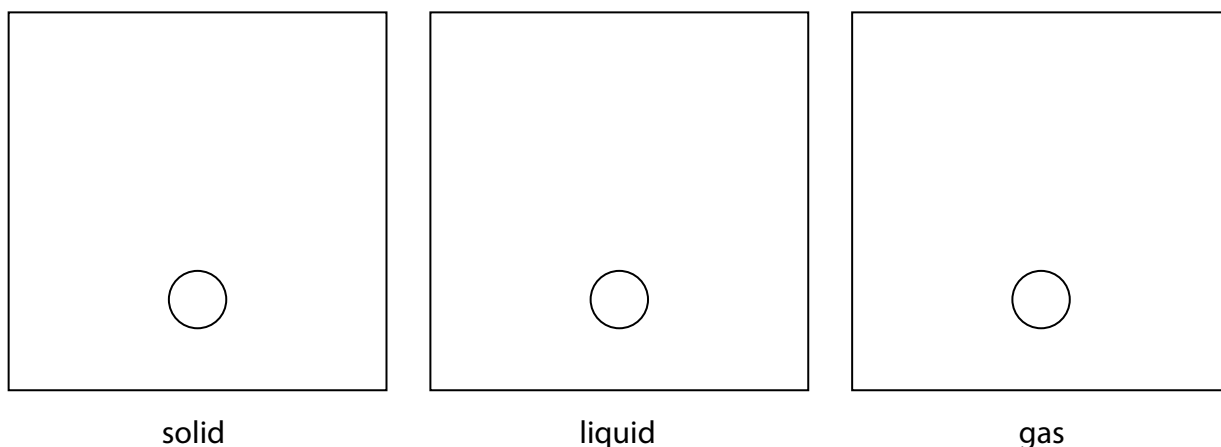


Figure 1

- (ii) Which row of the table is correct for water compared to steam?

(1)

	the density of water is	the water molecules are
<input type="checkbox"/> A	bigger	smaller
<input type="checkbox"/> B	smaller	bigger
<input type="checkbox"/> C	bigger	closer together
<input type="checkbox"/> D	smaller	further apart

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(b) A student investigates the density of a copper block and the density of a small stone, as shown in Figure 2.

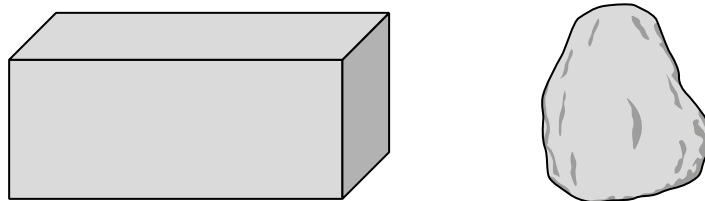


Figure 2

(i) The student calculates the volume of the block as 13 cm^3 .

She finds that the mass of the block is 100 g.

Calculate the density of the block.

Use the equation

$$\text{density} = \frac{\text{mass}}{\text{volume}} \tag{2}$$

density = g/cm^3

- (ii) The student found the volume of the copper block by multiplying the area of its base by its height.

The small stone does not have straight sides.

Describe how the student could measure the volume of the small stone.
You may use a diagram if it helps your answer.

(3)

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(Total for Question 1 = 9 marks)

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- 2 (a) Figure 3 shows a coil of wire called a solenoid.

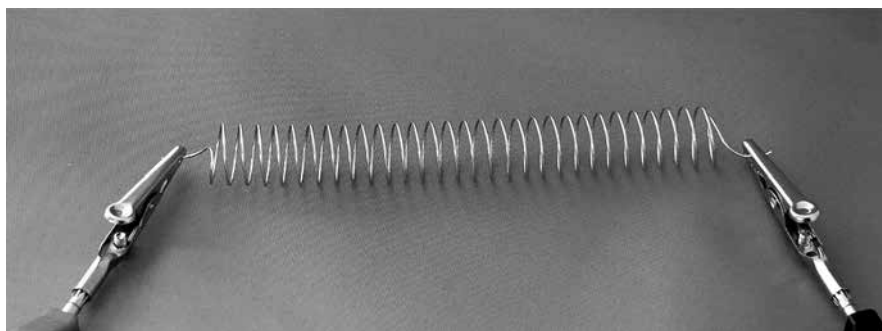


Figure 3

Figure 4 gives information about the magnetic field of a solenoid.

description of the magnetic field	part of magnetic field	
	inside the coil	outside the coil
strong	✓	✗
weak	✗	✓
uniform	✓	✗
non-uniform	✗	✓

Figure 4

- (i) Draw lines on Figure 5 to show the shape of the magnetic field **inside** the solenoid.

Use information from Figure 4.

(1)

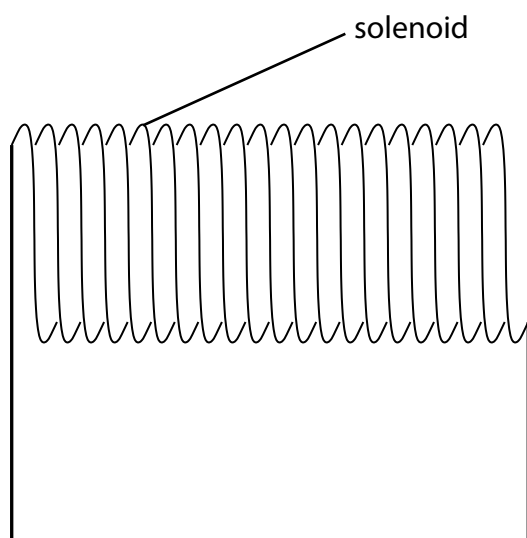


Figure 5

(ii) Describe how a student can determine the shape of the magnetic field around the solenoid.

(2)

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(b) A student investigates the magnetic properties of three rods. Each rod is made of one of the following materials:

- soft iron
- steel
- wood

The student places each rod in a solenoid that is connected to a direct current power supply.

The power supply is switched on for a short time.

The student tests the magnetic strength of each rod by seeing how many paper clips it can pick up as shown in Figure 6.

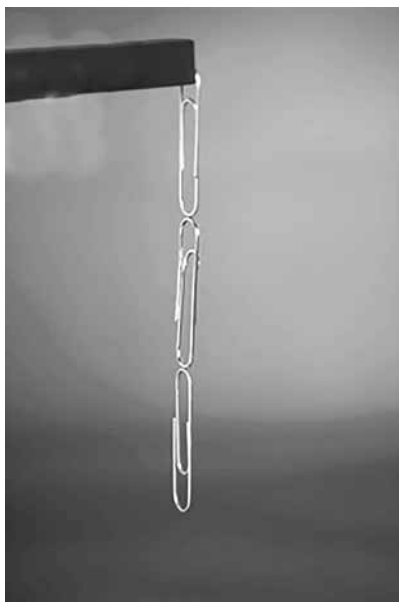


Figure 6

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The student's results are shown in Figure 7.

rod	number of paper clips picked up by rod			
	before rod is placed in solenoid	when there is current in solenoid	1 minute after current is switched off	10 minutes after current is switched off
A	0	0	0	0
B	0	6	1	0
C	0	8	7	7

Figure 7

Complete the table below to show which material (soft iron, steel or wood) each rod is made from, with the reason why.

Part of the table has been done for you.

Use information from Figure 7.

(3)

rod	material	reason
A		It is not magnetic because it does not pick up paper clips whether there is a current or not.
B		
C		

(Total for Question 2 = 6 marks)

3 An electric heater is used to heat some water.

Figure 8 shows the experimental setup used.

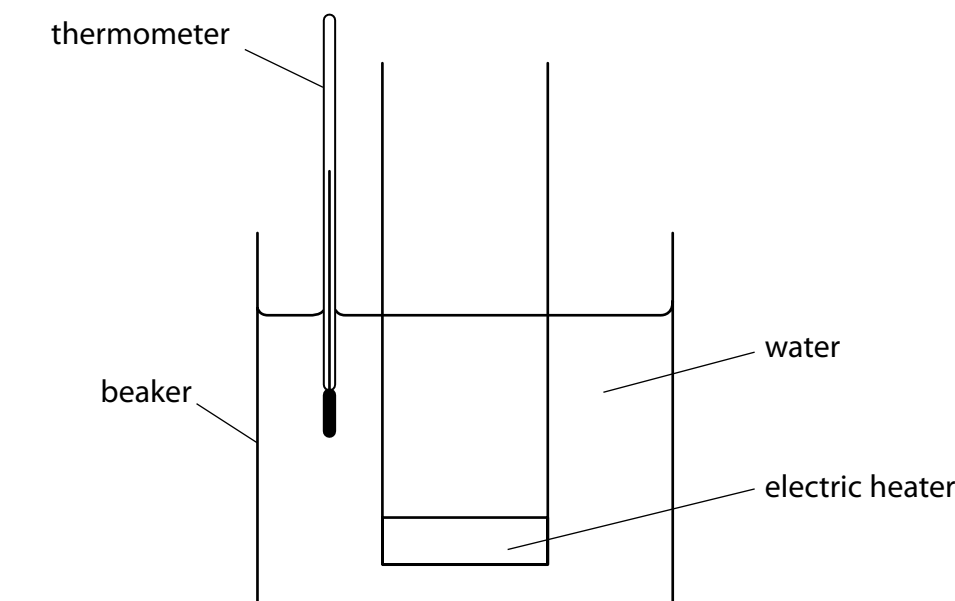


Figure 8

(a) Figure 9 shows the energy transferred by the electric heater in 1 second.

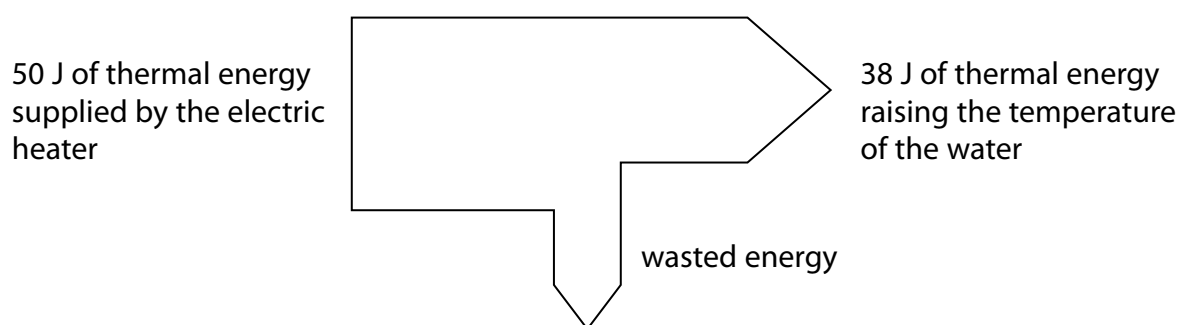


Figure 9

(i) How much energy is wasted each second?

(1)

- A 12 J
- B 38 J
- C 50 J
- D 88 J

(ii) Describe what happens to the wasted energy.

(2)

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(b) Explain **one** way the experiment can be improved to reduce the amount of wasted energy.

(2)

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(c) The initial mass of the water in the beaker is 0.72 kg.

The electric heater is switched on for some time and the water boils.

The mass of the water after the heater is switched off is 0.60 kg.

The thermal energy transferred to the water while it boils is 270 000 J.

Use an equation from the formula sheet to calculate the specific latent heat of the water.

(3)

specific latent heat = J/kg °C

(Total for Question 3 = 8 marks)

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4 A man pulls a suitcase with a horizontal force, F , as shown in Figure 10.

Two other forces acting on the suitcase are labelled P and Q .

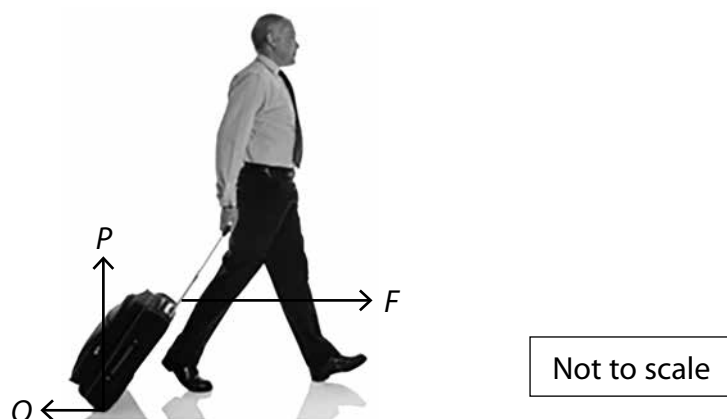


Figure 10

(a) (i) Which of these gives the correct names for the forces P and Q ?

(1)

		name of	
		force P	force Q
<input type="checkbox"/>	A	upthrust	reaction
<input type="checkbox"/>	B	reaction	friction
<input type="checkbox"/>	C	reaction	reaction
<input type="checkbox"/>	D	friction	upthrust

(ii) Draw an arrow on the diagram to represent the weight of the suitcase.

(1)

(b) The man pulls the suitcase for 80 m along a horizontal path.

The mass of the man and the suitcase is 85 kg.

The man does 1200 J of work on the suitcase as he pulls the suitcase along.

He walks with an average velocity of 1.5 m/s.

(i) Calculate the kinetic energy of the man and the suitcase.

(2)

kinetic energy = J

(ii) Calculate the horizontal force, F , that the man exerts on the suitcase.

Use the equation:

work done = force \times distance moved in the direction of the force

(2)

force = N

(c) The man runs up a set of stairs carrying his suitcase.

Explain whether he does more total work if he walks up the same stairs instead of running.

(2)

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(d) The man lifts his suitcase.

The increase in gravitational potential energy of the suitcase is 264 J.

The mass of the suitcase is 12 kg.

Calculate the vertical height the suitcase is raised.

(gravitational field strength, $g = 10 \text{ N/kg}$)

Use the equation:

change in gravitational potential energy = mass $\times g \times$ change in vertical height

(2)

height raised = m

(Total for Question 4 = 10 marks)

5 The efficiency of an electric motor is investigated as shown in Figure 11.

The motor lifts a mass at a constant speed.

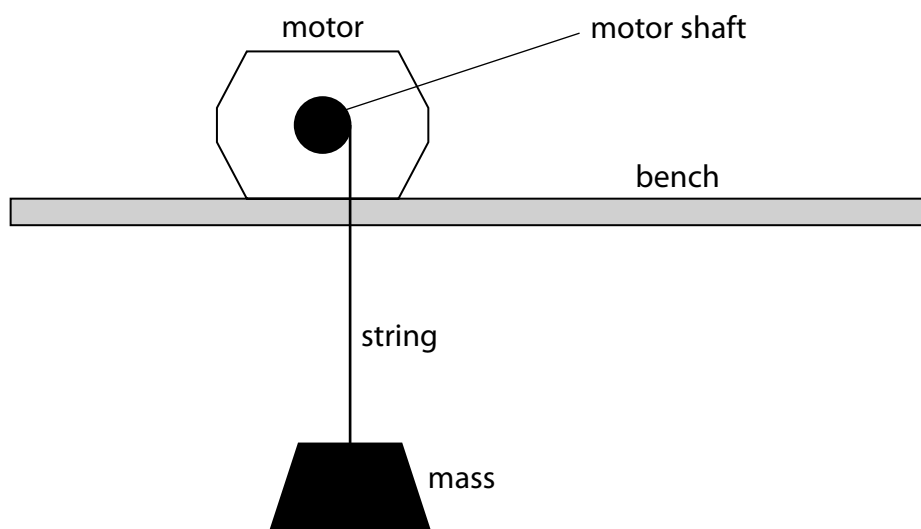


Figure 11

The results are shown in Figure 12.

current in motor	1.9 A
voltage across motor	10.0 V
time taken to lift mass	9.0 s

Figure 12

(a) (i) Which of these changes would improve the results?

(1)

- A Repeating the investigation with different masses
- B Repeating the readings and calculating averages
- C Using a motor that works with a higher voltage
- D Using a shorter piece of string to lift the mass

(ii) Which of these best shows the energy stores as the mass is lifted?

(1)

	kinetic energy of the mass	potential energy of the mass
<input type="checkbox"/> A	constant	increasing
<input type="checkbox"/> B	constant	decreasing
<input type="checkbox"/> C	decreasing	increasing
<input type="checkbox"/> D	decreasing	decreasing

(b) (i) Show that the total energy supplied to the motor in the 9 s is about 170 J.

(2)

(ii) During the 9 s the efficiency of the motor is 70%.

Calculate the amount of useful energy transferred in the 9 s.

Use the equation

$$\text{efficiency} = \frac{\text{useful energy transferred}}{\text{total energy supplied}}$$

(3)

useful energy = J

(c) Which row of the table is correct for the resistance of the motor?

(1)

	resistance of motor =	resistance of motor =
<input type="checkbox"/> A	$I \div V$	$I^2 \div P$
<input type="checkbox"/> B	$V \div I$	$P \div I^2$
<input type="checkbox"/> C	$V \div I$	$P \times I^2$
<input type="checkbox"/> D	$I \times V$	$P \div I^2$

(d) When the motor lifts the mass, the coil in the motor becomes warm.

Explain why the coil becomes warm.

(3)

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(Total for Question 5 = 11 marks)

6 (a) Figure 13 shows a tank for holding water.

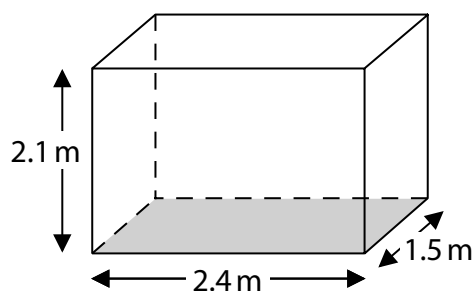


Figure 13

The tank has sides of 2.4 m, 2.1 m and 1.5 m.

The pressure at the bottom of the tank is 12 kPa.

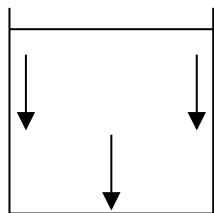
(i) State the equation relating pressure, force and area. (1)

(ii) Calculate the weight of water in the tank. (4)

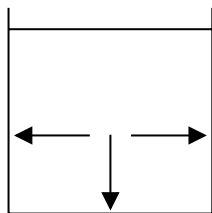
weight = N

(iii) Which diagram shows the direction of the forces from the water on the inside of the tank?

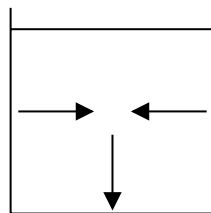
(1)



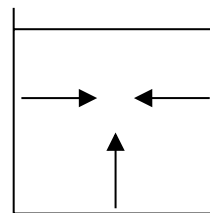
A



B



C



D

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(b) A student makes the following hypothesis:

'When I increase the pressure on a fixed mass of gas, the volume of the gas decreases.'

She has the equipment shown in Figure 14.

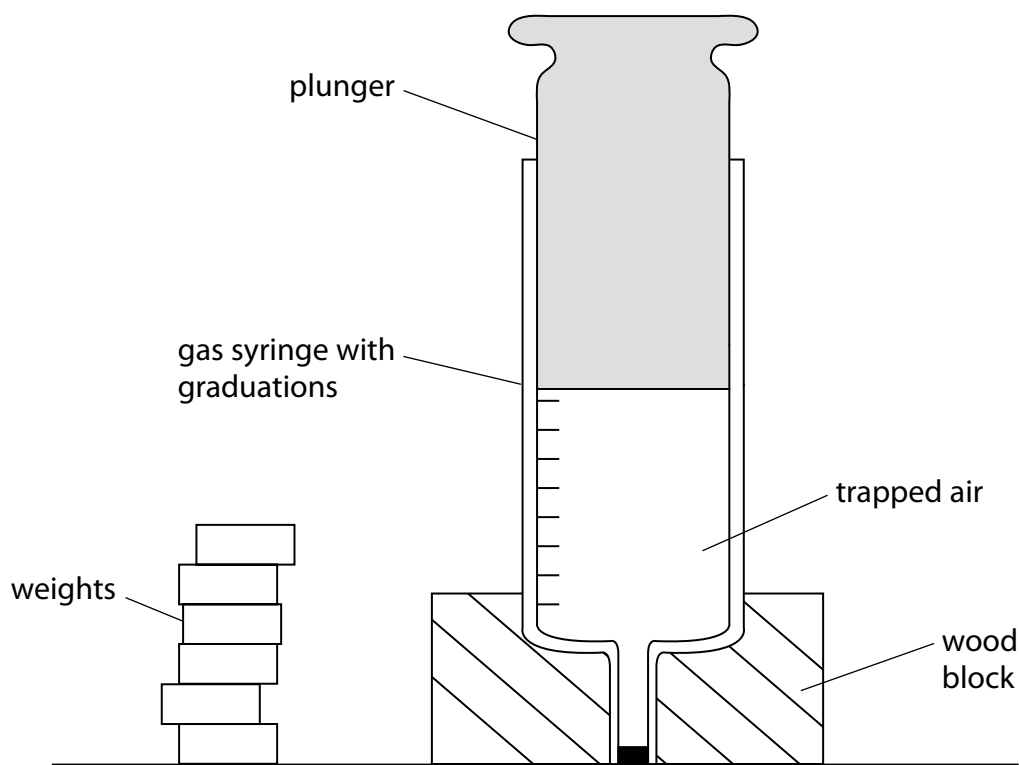


Figure 14

She measures the area of the plunger.

Devise a plan to test her hypothesis.

(4)

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(Total for Question 6 = 10 marks)

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7 (a) Balloon **P** hangs from an insulating thread.

A teacher gives the balloon a positive electric charge, as shown in Figure 15.

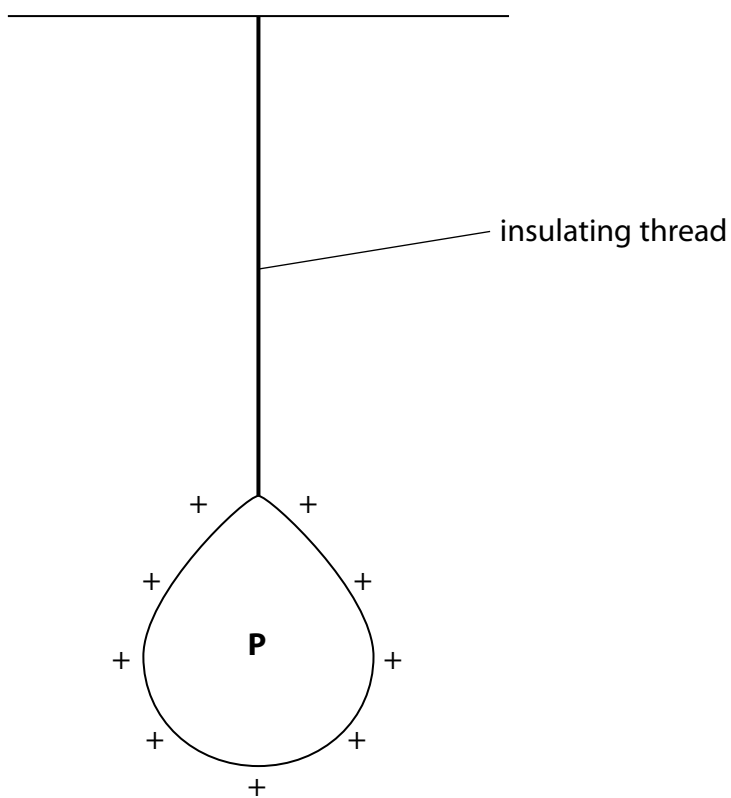


Figure 15

(i) When the balloon is charged like this, it has

(1)

- A gained electrons
- B lost electrons
- C gained protons
- D lost protons

(ii) Two more balloons, **Q** and **R**, are charged and placed either side of balloon **P**.

The balloons move to the positions shown in Figure 16.

Add the charges on balloons **Q** and **R** in Figure 16.

(2)

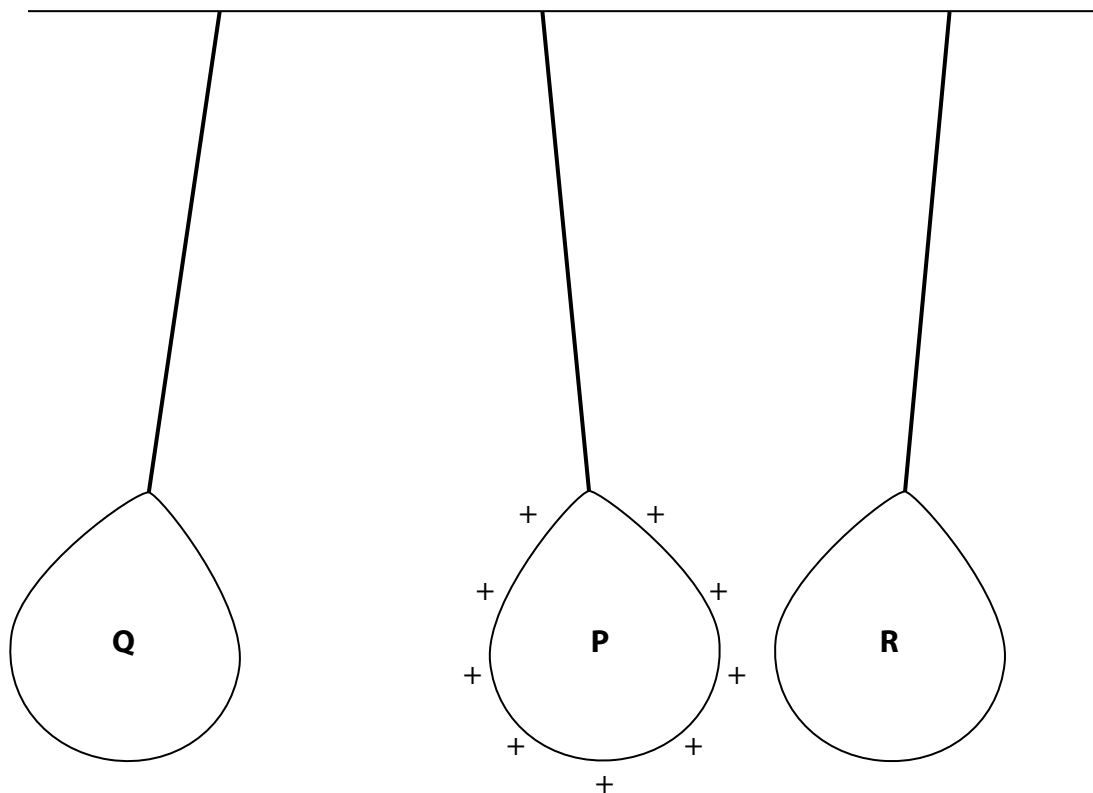


Figure 16

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(b) Figure 17 shows an airport worker refuelling an aircraft.



(Source: © Stanisław Tokarski/123RF)

Figure 17

- (i) As fuel moves through the pipe, it becomes positively charged.

Explain how the worker can prevent a build-up of charge when pumping fuel into the aircraft.

(3)

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(ii) Explain how an aircraft can become electrically charged as it flies through the air.

(2)

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(c) Fuel weighing 230 000 N is pumped into the aircraft.

This fuel moves upwards through a vertical height of 4.7 m.

The power developed by the pump is 1600 W.

Calculate the time needed to refuel the aircraft.

(3)

time = s

(Total for Question 7 = 11 marks)

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- 8 A student investigates how the resistance of a thermistor varies with temperature.
- (a) The student uses the equipment shown in Figure 18 to measure the temperature of the thermistor.

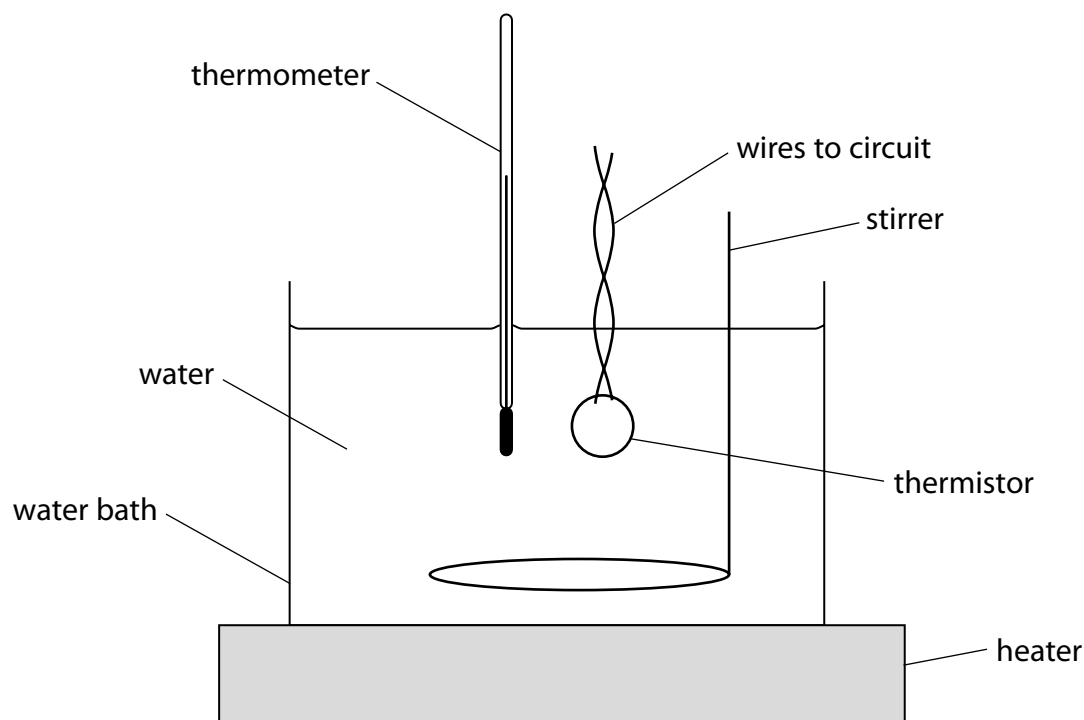


Figure 18

- (i) Give **one** reason for using a water bath.

(1)

- (ii) The equipment shown in Figure 18 is for investigations in the temperature range from 20°C to 100°C.

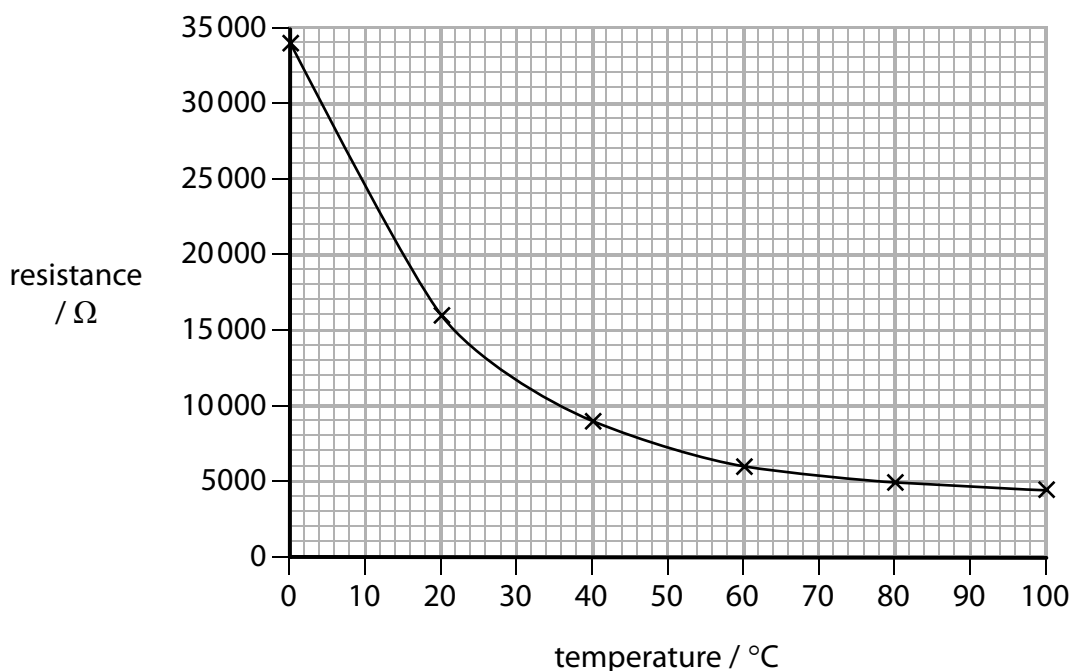
State **one** way the student could develop this experimental procedure to investigate temperatures outside this range.

(1)

(b) The student takes measurements for two other components, **A** and **B**.

The results for both these components are shown in Figure 19.

Component A



Component B

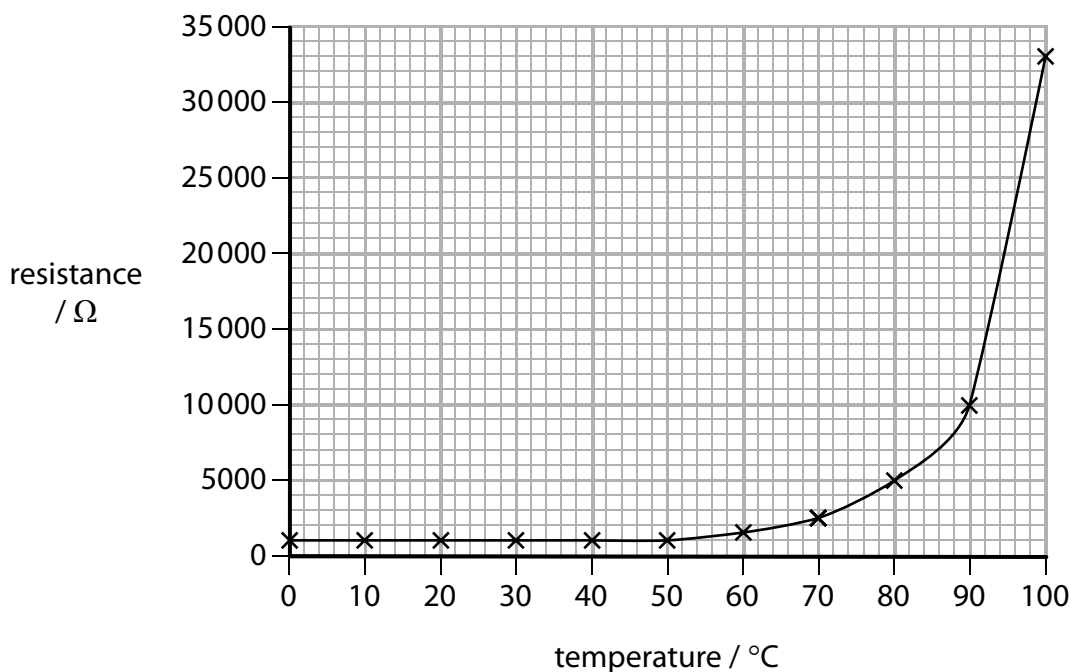


Figure 19

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- 9 A student uses a digital calliper to measure the length of a spring, as shown in Figure 20.

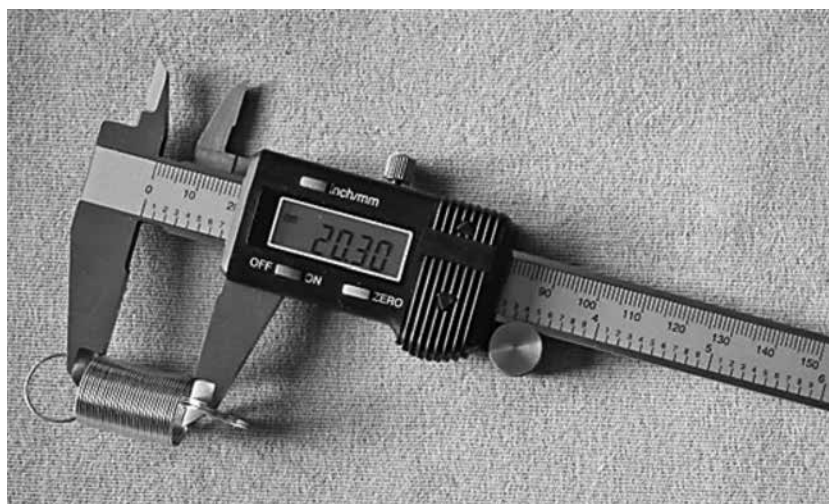


Figure 20

The spring is bendy and difficult to measure.

The student takes the six readings shown in Figure 21.



Figure 21

- (a) Calculate the average length of the spring.

(2)

average length = mm

- (b) The student investigates the stretching of a spring with the equipment shown in Figure 22.

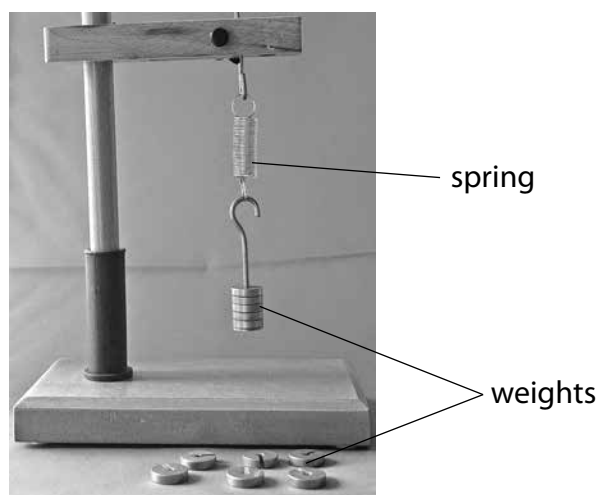


Figure 22

The student investigates the extension of the spring using six different weights.

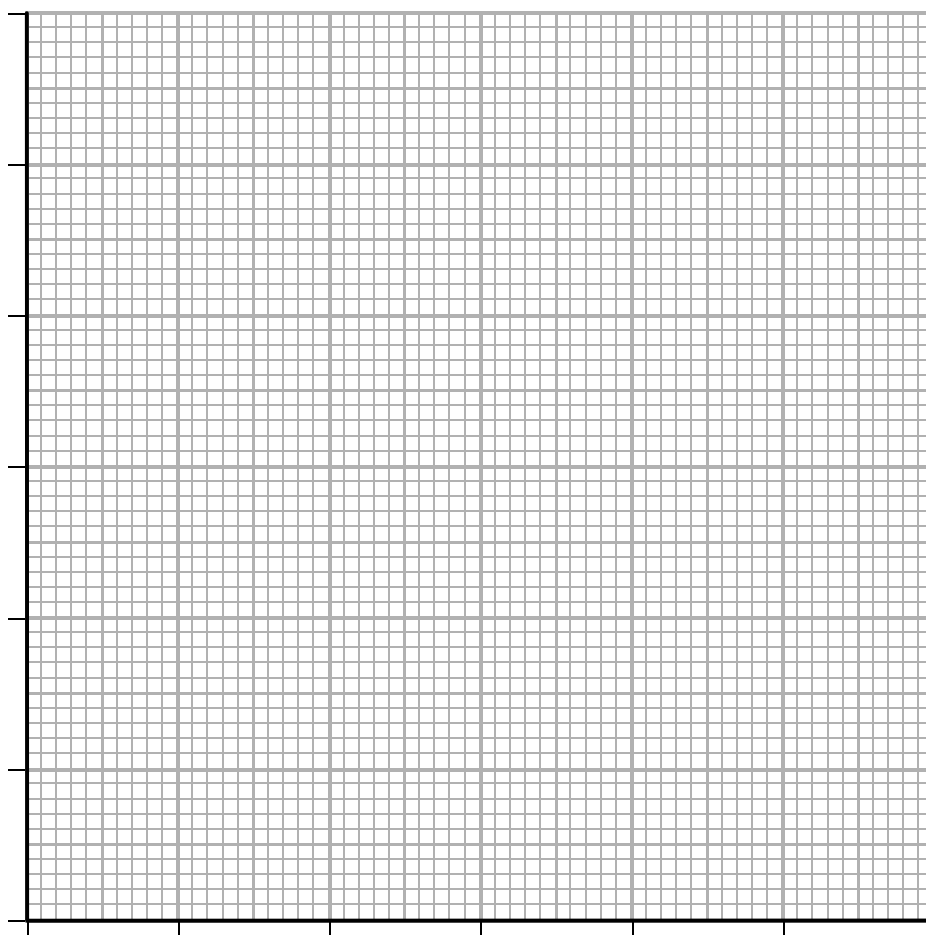
The results are shown in Figure 23.

weight (N)	extension (mm)
0.20	4.0
0.40	8.0
0.60	12.0
0.80	16.0
1.00	20.0
1.20	24.0

Figure 23

(i) Draw a graph for the readings, using the grid shown.

(3)



(ii) The student writes this conclusion:

'The extension of the spring is directly proportional to the weight stretching the spring.'

Comment on the student's conclusion.

(3)

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- (c) The student extends the investigation by finding information about the stretching of wires.

The student finds the graph shown in Figure 24 for the stretching of a wire.

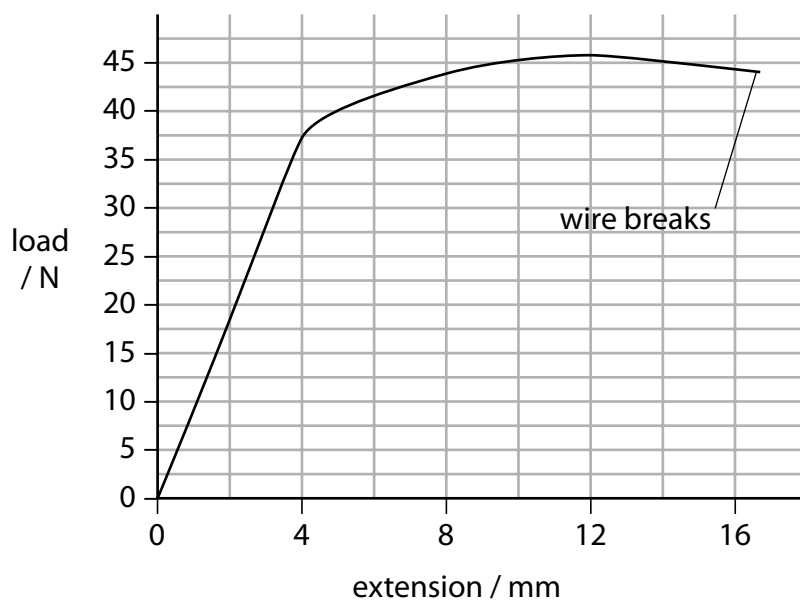


Figure 24

Describe the non-linear stretching of the wire shown in Figure 24.

(3)

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10 A scuba diver is on a sandy beach.

She checks her compressed air cylinders before a dive.
She has two identical steel cylinders, A and B.
Each cylinder contains the same amount of compressed air.

Figure 25 shows the diver's cylinders.

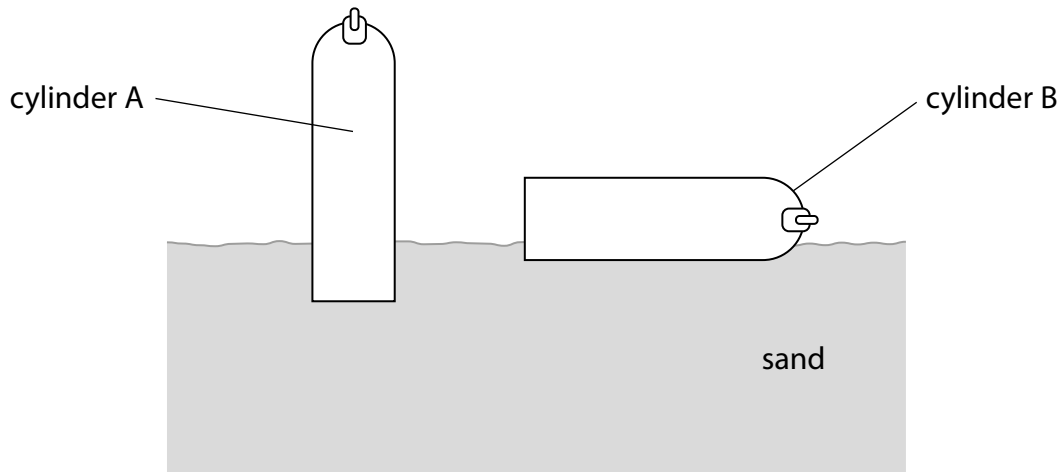


Figure 25

(a) Explain why cylinder A sinks further into the sand than cylinder B.

Use ideas about pressure, force and area in your answer.

(4)

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(b) When underwater, the diver tries to move a large stone block.

The diver uses a long iron bar and a pivot, as shown in Figure 26.

When pushing down with a force of 120 N, the block is balanced.

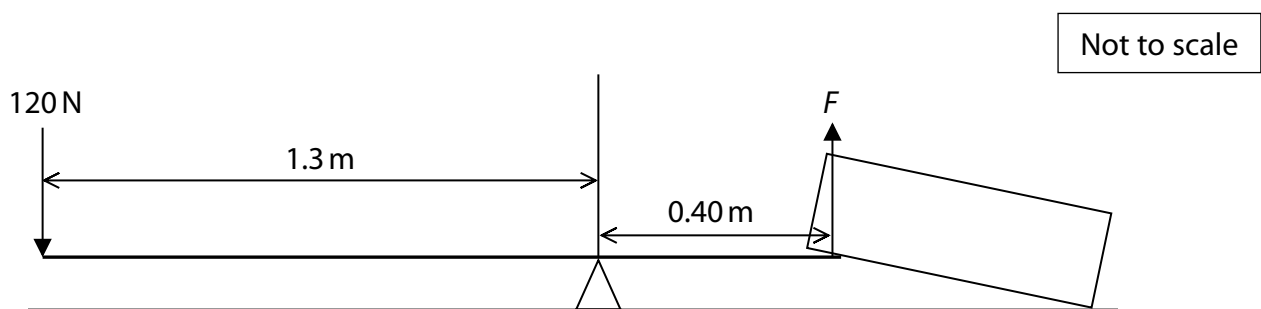


Figure 26

Calculate the size of the force, F , of the bar on the block.

(3)

force = N

Equations

(final velocity)² – (initial velocity)² = 2 × acceleration × distance

$$v^2 - u^2 = 2 \times a \times x$$

energy transferred = current × potential difference × time

$$E = I \times V \times t$$

potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil

$$V_p \times I_p = V_s \times I_s$$

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

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

thermal energy for a change of state = mass × specific latent heat

$$Q = m \times L$$

$$P_1 V_1 = P_2 V_2$$

to calculate pressure or volume for gases of fixed mass at constant temperature

energy transferred in stretching = 0.5 × spring constant × (extension)²

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

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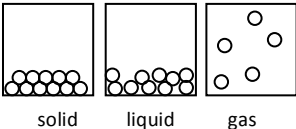
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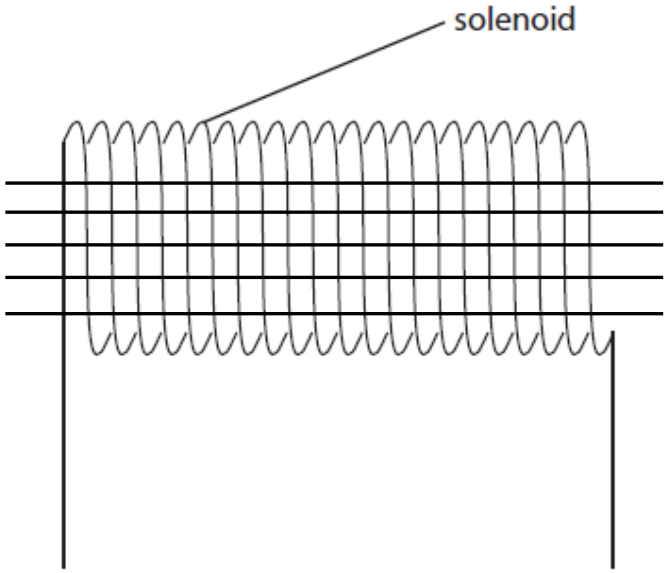
Paper 2 Foundation

Question number	Answer	Additional guidance	Mark
1(a)(i)	<p>In the solid box: regular arrangement and particles touching (1)</p> <p>In the liquid box: irregular arrangement and most particles touching (1)</p> <p>In the gas box: random and spaced (compared to liquid) (1)</p>	<p>ignore variation in particle size</p> <p>ignore arrows/lines indicating movement</p> <p>allow solid and liquid arrangements that do not fill the box</p>  <p style="text-align: center;">solid liquid gas</p>	(3)

Question number	Answer	Mark
1(a)(ii)	C	(1)

Question number	Answer	Additional guidance	Mark
1(b)(i)	<p>substitution (1) $100 \div 13$</p> <p>answer (1) $7.7 \text{ (g/cm}^3\text{)}$</p>	<p>award full marks for correct numerical answer without working</p> <p>allow $7.692 \text{ (g/cm}^3\text{)}$</p>	(2)

Question number	Answer	Additional guidance	Mark
1(b)(ii)	<p>An answer that provides a description by making reference to:</p> <ul style="list-style-type: none"> part fill a measuring cylinder with water and record the starting volume (1) completely immerse the stone in the water and record the final volume of water and stone (1) volume of stone = final volume – initial volume (1) 	<p>accept valid alternative methods, e.g.</p> <p>fill a displacement can until some water overflows/flows out of spout</p> <p>completely immerse the stone in the displacement can and collect the displaced water in a measuring cylinder</p> <p>volume of water displaced = volume of stone</p>	(3)

Question number	Answer	Additional guidance	Mark
2(a)(i)	<p>magnetic lines of force closely packed AND (almost) parallel (1)</p>	<p>ignore any arrows as direction of field is not required</p> <p>ignore any lines outside the coil</p> 	(1)

Question number	Answer	Additional guidance	Mark
2(a)(ii)	An answer that combines the following points of understanding to provide a logical description: <ul style="list-style-type: none"> plotting compass placed on card near wire and pencil mark made near N pole of compass (1) move compass so S pole is above pencil mark and keep repeating this until arrive at starting point (1) 	allow sprinkle iron filings on card tap card to allow filings to align with field	(2)

Question number	Answer	Mark
2(b)	All three materials correctly identified (1) (rod A – wood, rod B – soft iron, rod C – steel) One mark for each reason: <ul style="list-style-type: none"> rod B only attracts paper clips when there is a current in the coil (1) rod C attracts paper clips when there is a current in the coil and for some time after (1) 	(3)

Question number	Answer	Mark
3(a)(i)	A	(1)

Question number	Answer	Additional guidance	Mark
3(a)(ii)	An answer that provides a description by making reference to: <ul style="list-style-type: none"> thermal/heat energy (1) dissipated in/transferred to air/surroundings (1) 	allow heat 'lost' to surroundings	(2)

Question number	Answer	Additional guidance	Mark
3(b)	<p>An explanation that combines identification – improvement of the experimental procedure (1 mark) and justification/reasoning which must be linked to the improvement (1 mark):</p> <ul style="list-style-type: none"> place the beaker on an insulator (1) so this (material) will reduce rate of energy transfer (1) <p>or</p> <ul style="list-style-type: none"> wrap the beaker in an insulator (1) so this (material) will reduce the rate of energy transfer (1) <p>or</p> <ul style="list-style-type: none"> reduce the surface areas of the water (1) to give less evaporation (1) 	<p>allow named insulator, e.g. cork mat</p> <p>put a lid on the beaker/make the beaker taller and narrower</p>	(2)

Question number	Answer	Additional guidance	Mark
3(c)	<p>rearrangement (1)</p> $l = \frac{\Delta Q}{\Delta m}$ <p>substitution (1)</p> $l = \frac{270000}{0.12}$ <p>answer (1)</p> <p>2 250 000 (J/kg °C)</p>	<p>award full marks for correct numerical answer without working</p> <p>2250 (J/kg °C) gains 2 marks as power of 10 error</p>	(3)

Question number	Answer	Mark
4(a)(i)	B	(1)

Question number	Answer	Mark
4(a)(ii)	vertical arrow, acting downward through the suitcase	(1)

Question number	Answer	Additional guidance	Mark
4(b)(i)	substitution (1) $(KE =) \frac{1}{2} \times 85 \times 1.5^2$ answer (1) 96 (J)	award full marks for correct numerical answer without working allow 95.625 (J)	(2)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	rearrange (1) force = work done \div distance answer (1) (force) = 15 (N)	accept rearrangement with values subst., i.e. (force) = 1200 \div 80 award full marks for correct numerical answer without working	(2)

Question number	Answer	Additional guidance	Mark
4(c)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): <ul style="list-style-type: none"> the work done is the same for walking and running (1) because work done depends on force and distance only, not time (1) 	allow energy for work done because work done \div time is power	(2)

Question number	Answer	Additional guidance	Mark
4(d)	rearrangement (1) (height) = change in GPE ÷ (mass × g) answer (1) 2.2 (m)	accept rearrangement with values, i.e. $(h) = 264 \div (12 \times 10)$ or = $264 \div 120$ award full marks for correct numerical answer without working	(2)

Question number	Answer	Mark
5(a)(i)	B	(1)

Question number	Answer	Mark
5(a)(ii)	A	(1)

Question number	Answer	Mark
5(b)(i)	substitution into correct equation (1) $= 1.9 \times 10.0 \times 9.0$ answer (1) 171 (J) (which is about 170 J) Answer must be shown to 3 significant figures	(2)

Question number	Answer	Additional guidance	Mark
5(b)(ii)	rearrangement (1) (useful energy transferred) = efficiency × total energy supplied substitution (1) $= (70 \times 170) \div 100$ answer (1) 119 (J)	award full marks for correct numerical answer without working accept (useful energy transferred) $= 170 \times 0.7$ OR $= 171 \times 0.7$ accept alternative answer from 171 (J) i.e. 120 (J)	(3)

Question number	Answer	Mark
5(c)	B	(1)

Question number	Answer	Mark
5(d)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (2 marks): <ul style="list-style-type: none"> • the coil contains wires which have a resistance (1) • and current in the wire is due to movement of electrons through (close-packed) lattice of positive ions (1) • hence collisions between electrons and ions in the lattice transfer energy from electrons to the lattice (causing the temperature of the wires/coil to rise) (1) 	(3)

Question number	Answer	Mark
6(a)(i)	pressure = force ÷ area	(1)

Question number	Answer	Additional guidance	Mark
6(a)(ii)	rearrangement (1) $(F =) P \times A$ calculation of area (1) $2.4 \times 1.5 = 3.6$ substitution (1) $(F =) 12\,000 \times 3.6$ answer (1) 43 200 (N)	award full marks for correct numerical answer without working maximum 3 marks if kPa not converted to Pa	(4)

Question number	Answer	Mark
6(a)(iii)	B	(1)

Question number	Answer	Mark
6(b)	An answer that combines the following points to provide a plan: <ul style="list-style-type: none"> • put weights on the plunger to increase the pressure of the trapped air (1) • use scale on syringe to measure the volume of trapped air (1) • calculate the pressure from $P = \text{weight added}/\text{area of plunger}$ (1) • compare the increase in pressure to the volume of trapped air (1) 	(4)

Question number	Answer	Mark
7(a)(i)	B	(1)

Question number	Answer	Additional guidance	Mark
7(a)(ii)	<ul style="list-style-type: none"> • label to indicate that balloon Q has a positive charge (1) • label to indicate that balloon R has a negative charge (1) 	accept responses showing appropriate +/- signs or worded label	(2)

Question number	Answer	Additional guidance	Mark
7(b)(i)	An explanation that combines identification – knowledge (1 mark) and reasoning/justification – understanding (2 marks): <ul style="list-style-type: none"> • use of a conductor to connect between aircraft and ground (1) • allowing negative charge to move onto the aircraft (1) • therefore neutralising the positive charge(s) (1) 	accept (copper) wire accept earth for ground	(3)

Question number	Answer	Additional guidance	Mark
7(b)(ii)	<p>An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (2 marks):</p> <ul style="list-style-type: none"> • there is friction between aircraft and air (1) • which causes electron transfer between aircraft and air (1) 	<p>accept idea of air rubbing against wings</p> <p>ignore “charge” “static”</p> <p>do not allow (for second mark) idea of protons moving</p>	(2)

Question number	Answer	Additional guidance	Mark
7(c)	<p>equating energy in both equations (1)</p> $E = \text{weight} \times \text{height} = \text{power} \times \text{time}$ <p>rearrangement (1)</p> $\text{time} = \frac{(\text{weight} \times \text{height})}{\text{power}}$ <p>substitution and answer (1)</p> $\text{time} = 230\,000 \times \frac{4.7}{1600}$ $\text{time} = 680 \text{ (s)}$	<p>allow answers which round to 680, e.g. 675.6</p>	(3)

Question number	Answer	Additional guidance	Mark
8(a)(i)	<p>Any one reason from:</p> <ul style="list-style-type: none"> • the thermistor and the water are at the same temperature (1) • large volume of water gives a steady temperature rise (1) 	<p>accept idea that only small part of thermometer would be in contact with a thermistor in air</p> <p>accept difficult to control change in temperature of thermistor when heated in air</p>	(1)

Question number	Answer	Additional guidance	Mark
8(a)(ii)	Any one of the following developments to the procedure: <ul style="list-style-type: none"> • add ice to increase lower limit of temperature range (1) • use liquid with higher boiling point to increase upper limit of temperature range (1) 	accept named liquid with higher boiling point, e.g. oil	(1)

Question number	Answer	Additional guidance	Mark
8(b)	A comparison and contrast that must include at least one similarity and one difference from the following points to a maximum of three marks: Similarities <ul style="list-style-type: none"> • resistance of both changes with temperature (1) • both graphs show a non-linear relationship (1) • data comparison, e.g. both have the same resistance at 80 °C (1) Differences <ul style="list-style-type: none"> • resistance of A decreases with temperature but resistance of B increases with temperature (1) • for A, (largest slope/rate of change) is at lower temperature but for B, (largest slope/rate of change) is at higher temperature(s) (1) • for B, resistance is constant below 50 °C but for A resistance is roughly constant above 60 °C (1) 	accept (smallest slope/rate of change) for A is at higher temperature but (smallest slope/rate of change) for B is at lower temperature	(3)

Question number	Indicative content	Mark
*8(c)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p style="text-align: center;">AO1 (6 marks)</p> <ul style="list-style-type: none"> • Use of top pan balance to measure mass • Insulate beaker to reduce heat loss • Ammeter connected in series with heater • Voltmeter connected in parallel with heater • Use of $E = I \times V \times t$ to determine energy supplied to the water • Accept use of joule-meter to measure energy supplied • Use of $\Delta E = m \times c \times \Delta\theta$ to determine the specific heat capacity of the water • Measure p.d. across heater • Use stopwatch to measure time liquid is heating • Measure current in heater • Determine mass of water as mass of (beaker and water) – mass of beaker • Measure temperature before and after heating 	(6)

Level	Mark	Descriptor
	0	No awardable content.
Level 1	1–2	<p>Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. (AO1)</p> <p>Presents a description which is not logically ordered and with significant gaps. (AO1)</p>
Level 2	3–4	<p>Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. (AO1)</p> <p>Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing. (AO1)</p>
Level 3	5–6	<p>Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. (AO1)</p> <p>Presents a description that has a well-developed structure which is clear, coherent and logical. (AO1)</p>

Question number	Answer	Additional guidance	Mark
9(a)	evidence that anomalous reading excluded (1) answer (1) average length = 20.31 (mm)	accept 101.57 ($\div 5$) for first mark accept 20.314 (mm)	(2)

Question number	Answer	Additional guidance	Mark
9(b)(i)	<ul style="list-style-type: none"> • Axes with linear scales that use more than half of each edge of the grid and labelled with units from table (1) • All points correctly plotted to \pm half a square (1) • Single straight line passing through all points and the origin (1) 	allow 1 mark if only one plotting error and correct line drawn for points plotted	(3)

Question number	Answer	Additional guidance	Mark
9(b)(ii)	<p>A comment that makes reference to the following points:</p> <p>(using table)</p> <ul style="list-style-type: none"> • idea that equal increments of force/weight/mass cause equal increments of extension (1) • correct reference to figures in the table (1) <p>OR</p> <p>(using graph)</p> <ul style="list-style-type: none"> • the graph line is straight (1) • the graph line passes through the origin (1) <p>AND</p> <p>therefore the student's conclusion is correct (1)</p>	last marking point can only be achieved if at least one of the other two marks is awarded	(3)

Question number	Answer	Additional guidance	Mark
9(c)	<p>An answer that combines points of interpretation/evaluation to provide a logical description:</p> <ul style="list-style-type: none"> • above 37.5 N/4 mm there are large increases of extension for small increases in load (1) • the maximum extension of the wire is about 16.5 mm before it breaks (1) • above 12 mm the wire keeps on extending when the load is reduced below 46 N (1) 	accept extension is (much) greater for each 1 N increase in load above 37.5 N	(3)

Question number	Answer	Mark
10(a)	<p>An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (3 marks):</p> <ul style="list-style-type: none"> • the gas cylinders have the same weight (1) • but cylinder A has the smallest area (that is in contact with the ground) (1) • the smaller the area, the greater the pressure (or reference to $P = \frac{F}{a}$) (1) • hence cylinder A exerts a greater pressure on the ground (1) 	(4)

Question number	Answer	Additional guidance	Mark
10(b)	<p>rearrangement (1)</p> <p>force up = (force down × distance of force down from pivot)/distance of force up from pivot</p> <p>substitution into correct equation (1)</p> $F = \frac{120 \times 1.3}{0.40}$ <p>answer (1)</p> <p>390 (N)</p>	award full marks for correct numerical answer without working	(3)

Question number	Indicative content	Mark
*10(c)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p style="text-align: center;">AO2 (6 marks)</p> <ul style="list-style-type: none"> • The bubbles get bigger • Molecules of gas in constant motion • Molecules widely spaced and moving randomly • Molecules impact on surface of bubble/liquid molecules • Average of impacts produces gas pressure • Pressure is due to rate at which gas particles collide with liquid molecules/bubble surface • Liquid pressure decreases as bubble rises • $P_1V_1 = P_2V_2$ • If pressure decreases, volume of bubble will increase/volume of bubble must increase to give a decrease in pressure • As volume increases, rate at which particles collide with surface of bubble decreases 	(6)

Level	Mark	Descriptor
	0	No awardable content.
Level 1	1–2	<p>The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)</p> <p>Lines of reasoning are unsupported or unclear. (AO2)</p>
Level 2	3–4	<p>The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)</p> <p>Lines of reasoning mostly supported through the application of relevant evidence. (AO2)</p>
Level 3	5–6	<p>The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)</p> <p>Lines of reasoning are supported by sustained application of relevant evidence. (AO2)</p>