Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

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

Friday 16 June 2023

Morning (Time: 1 hour 10 minutes)

Paper reference **1SC0/2PH**

Combined Science

PAPER 6

Higher Tier

You must have:
Calculator, ruler, Equation Booklet (enclosed)

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 60.
- 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.
- A list of equations is included at the end of this exam paper.

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

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

Some questions must be answered with a cross in a box ☒. 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) Figure 1 shows some of the apparatus that students use to determine the resistance of a piece of iron wire.

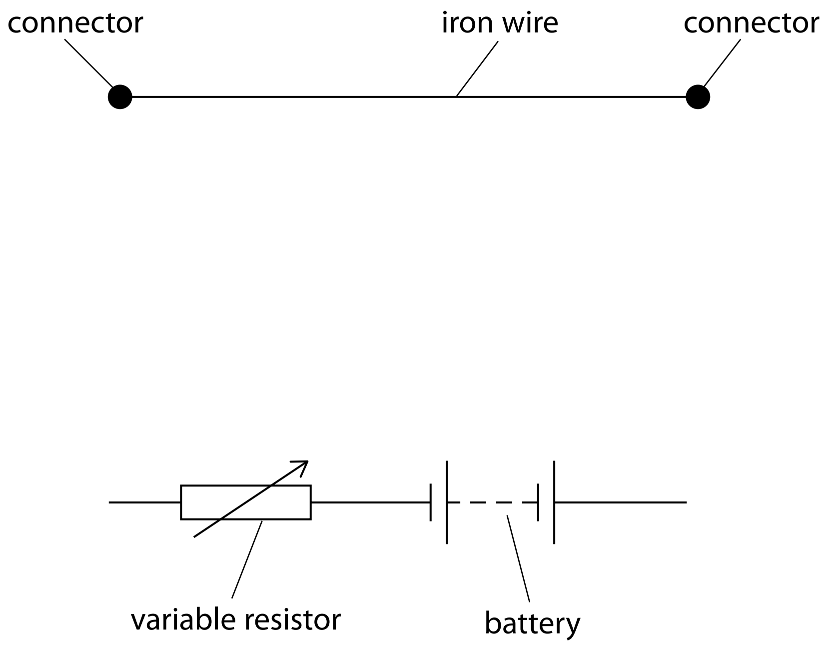

Figure 1

Add connecting wires, a voltmeter and an ammeter to complete the circuit in Figure 1 so that the students can determine the resistance of the piece of iron wire.

(2)

(b) The students extend the investigation to determine how the resistance of the iron wire changes with its length.

(i) Give the name of **one** additional piece of apparatus the students would need.

(1)

(ii) Figure 2 shows a graph of the results.

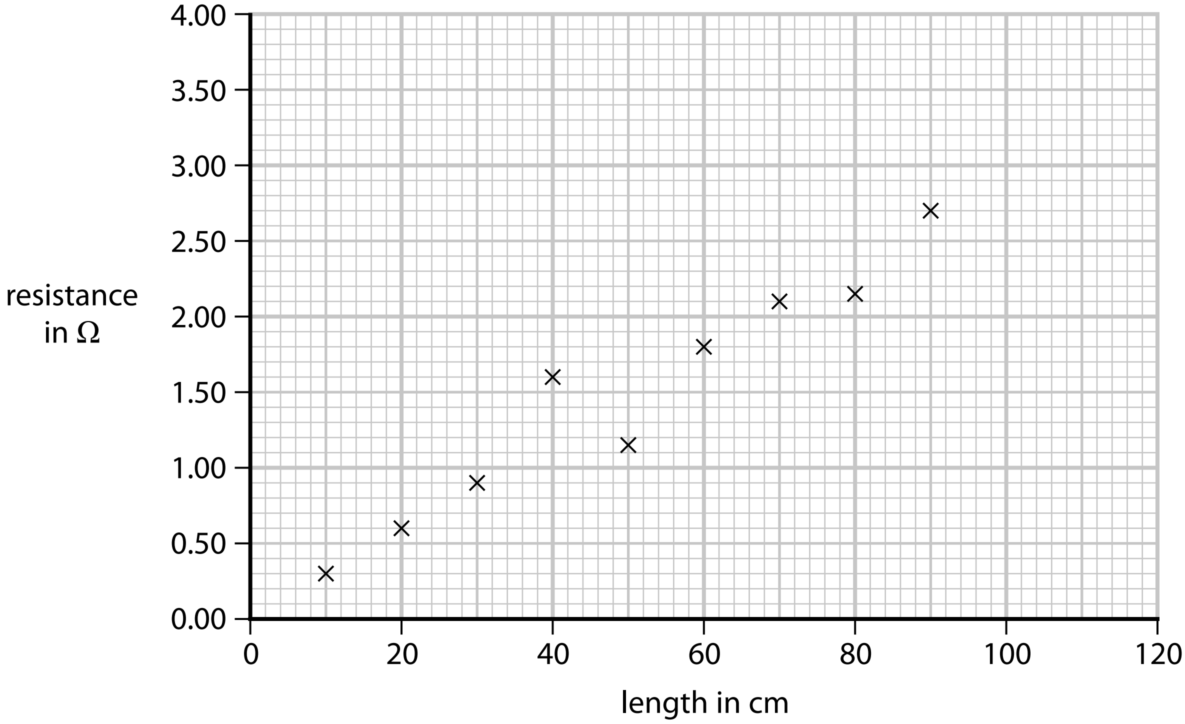

Figure 2

Draw a straight line of best fit on Figure 2.

(1)

(iii) Use Figure 2 to estimate the resistance of a 100 cm length of the iron wire.

(1)

resistance = ... Ω

(iv) The variable resistor shown in Figure 1 is used to prevent the iron wire from becoming too hot.

Explain how the variable resistor is used to prevent the iron wire from becoming too hot.

(2)

(c) The potential difference (voltage) across another piece of wire is 1.56 *V*.

The current in the wire is 0.45 *A*.

Calculate the resistance of this piece of wire.

Use the equation

$$V = I \times R$$

(2)

resistance = ... Ω

(Total for Question 1 = 9 marks)

2 (a) Which of these means changing state from solid directly to gas?

(1)

- ☐ **A** condensing
- ☐ **B** freezing
- ☐ **C** melting
- ☐ **D** sublimating

(b) An object has a mass of 7.22×10^{-2} kg and a volume of 2.69×10^{-5} m^3.

Calculate the density, ρ, of the object.

Use the equation

$$\rho = \frac{m}{V}$$

(3)

State the unit.

density = ... unit ....

(c) Aluminium has a melting point of 660 °C.

The absolute zero of temperature is –273 °C.

(i) Calculate the melting point of aluminium in kelvin.

(1)

melting point of aluminium = ... K

(ii) Describe the motion of particles in liquid aluminium (above 660 °C).

(2)

(d) A student determines the volume of a piece of metal by measuring the volume of water that it displaces.

The student wrote the following in his notebook.

I put some water into a measuring cylinder.
I put the piece of metal into the water in the measuring cylinder.
I took the reading of the new water level in the measuring cylinder.
This was the volume of the piece of metal.

The student's description is incomplete.

Suggest **two** sentences that the student could have included to provide a more complete description of the correct procedure.

(2)

1

2

(Total for Question 2 = 9 marks)

3 (a) Figure 3 shows two magnets with their N poles facing each other.

Figure 3

On Figure 3, draw the shape and direction of the magnetic field between the two magnets.

(2)

(b) Figure 4 shows a toy that has a plastic cylinder, a plastic base and two similar magnets. Each of the two magnets is in the shape of a ring.

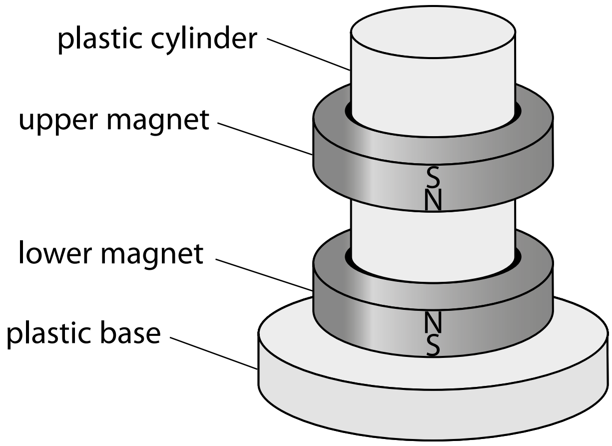

Figure 4

The upper magnet seems to float in the air above the lower magnet.

Describe the forces acting on the upper magnet.

Use the idea of magnetic fields in your answer.

(3)

(c) Figure 5 shows a current-carrying wire between the poles of a magnet.

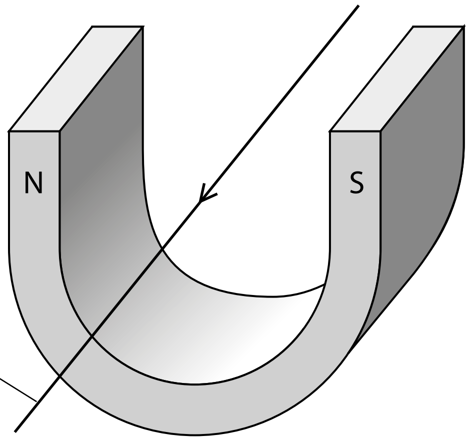

Figure 5

(i) The magnet and the wire each experience a force when there is a current in the wire.

(2)

1 State the direction of the force on the wire.

2 State the direction of the force on the magnet.

(ii) The force on the wire is 0.15 N.

The current in the wire is 2.7 A.

The magnet produces a field with a magnetic flux density of 0.50 T.

Calculate the length of the wire in the magnetic field.

Use an equation selected from the list of equations given at the end of the question paper.

(2)

length of the wire in the magnetic field = m

(Total for Question 3 = 9 marks)

4 (a) Figure 6 shows part of the inside of a pen.

The pen contains a spring that can be compressed.

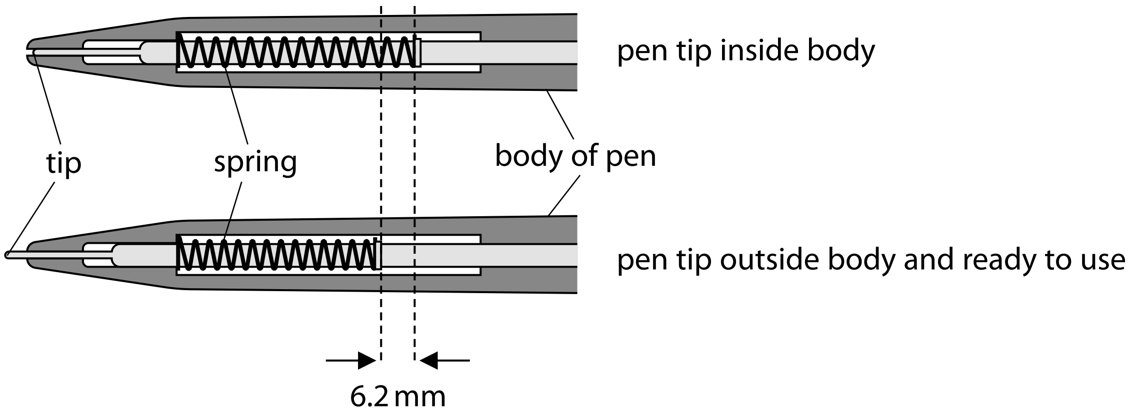

Figure 6

The spring constant of the spring is 260 N/m.

(i) Calculate the force needed to compress the spring by the amount shown in Figure 6.

Give your answer to an appropriate number of significant figures.

(3)

force = ... N

(ii) A student removes the spring from the pen and investigates the compression of the spring.

Figure 7 shows the equipment and the procedure that the student uses.

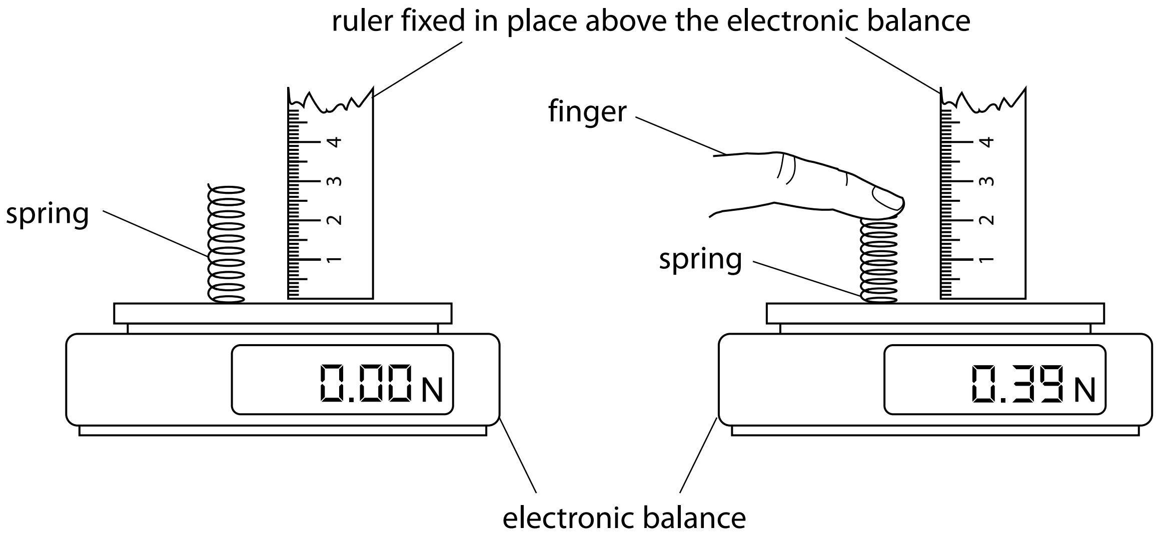

Figure 7

The student presses down on the spring to change its length.

The electronic balance measures the force applied to the spring.

Describe how the student can determine the change in length of the spring. You may add to Figure 7 to help your answer.

(3)

(iii) The student finds it difficult to make an accurate measurement of the change in length of the spring using the equipment as shown.

Describe **one** way that the student could improve the procedure.

(2)

(b) Figure 8 shows a different spring hanging from a hook fixed to the ceiling.

A block hangs from the other end of the spring.

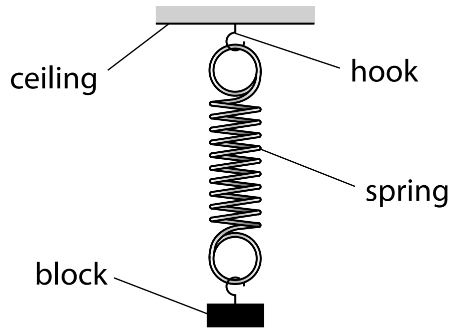

Figure 8

The weight of the spring is 1 N.
The weight of the block is 5 N.

The force exerted on the top of the spring by the hook is

(1)

☐ **A** 4 N down

☐ **B** 4 N up

☐ **C** 6 N down

☐ **D** 6 N up

(c) Figure 9 shows two forces, P and Q, acting at point X.

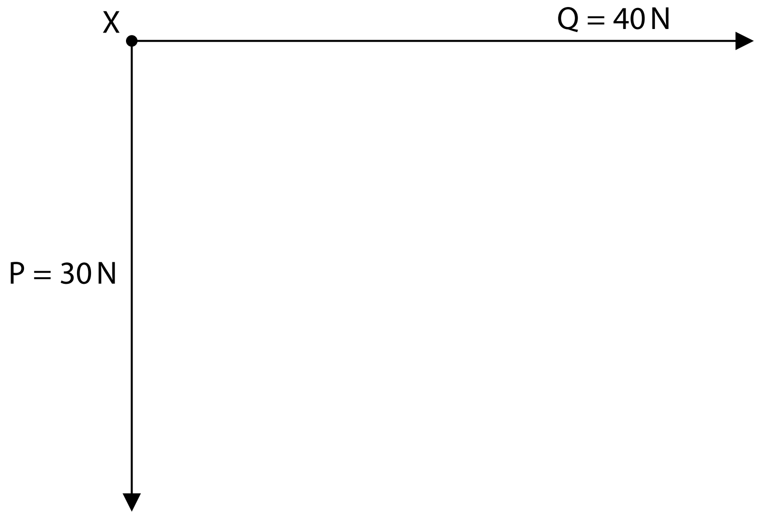

diagram is drawn to scale

Figure 9

Complete the diagram in Figure 9 to show the size and direction of the resultant force, R, on point X.

(2)

(Total for Question 4 = 11 marks)

5 (a) An electric car is travelling at a speed of 16.0 m/s.

The total mass of the car is 1200 kg.

(i) Calculate the kinetic energy, in kJ, of the car.

(2)

kinetic energy = ... kJ

(ii) On a journey, the car transfers energy from the battery at an average rate of 17.5 kW.

The battery in the car transfers a total of 126 MJ of energy before it becomes discharged.

Calculate the time taken for the battery to become discharged on this journey.

Give your answer in hours.

(2)

time taken = ... hours

(iii) Figure 10 shows an electrical device connected to the wheels of an electric car.

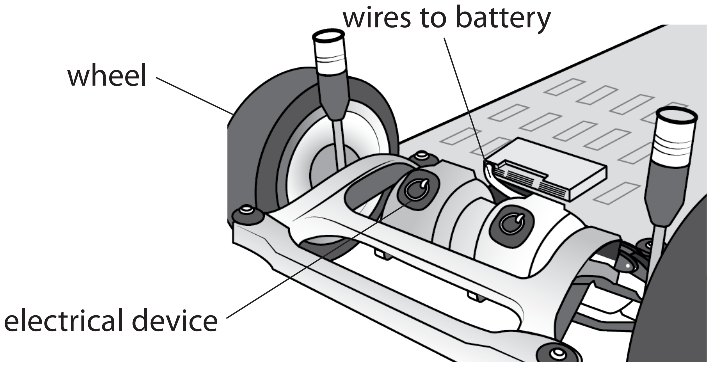

Figure 10

The electrical device is used as a motor when the car accelerates and as a dynamo when the car decelerates.

Explain how using the device can help to increase the time that the car can be driven before the battery becomes discharged.

(2)

(b) The battery can be recharged at a charging point.

The charging point provides an average current of 15.0 A to the battery, at a potential difference (voltage) of 400 V.

It is claimed that 126 MJ of energy can be transferred to the battery in less than 6 hours.

(i) Comment on this claim.

Use this equation to support your answer

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

(3)

(ii) Calculate the total charge that moves into the battery while it is being recharged.

Use the equation

$$E = Q \times V$$

(2)

charge = ... C

(Total for Question 5 = 11 marks)

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6 (a) Figure 11 shows a pulley system that enables a person to lift a heavy barrel.

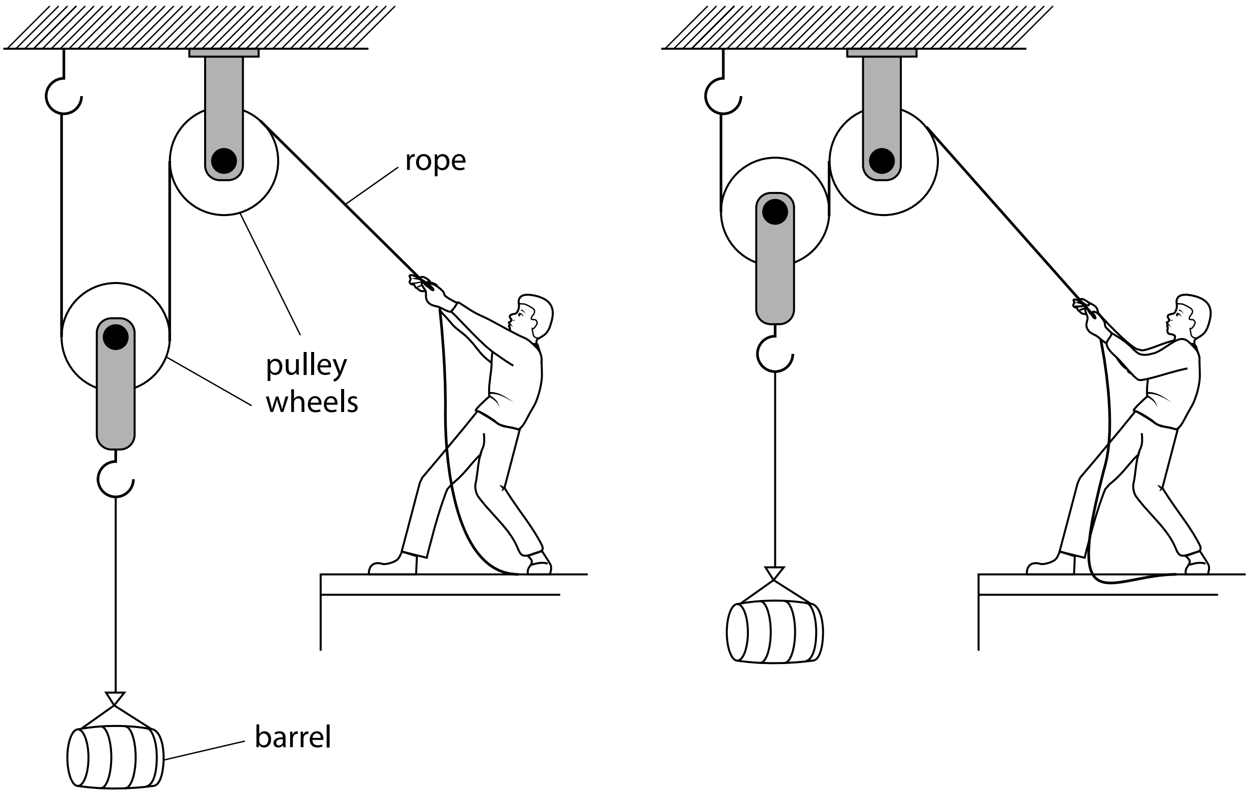

Figure 11

The person pulls down on the rope to make the barrel rise through 1.2 m.

The work done against gravity on the barrel is 1800 J.

(i) Calculate the weight of the barrel.

Use the equation

work done = force × distance moved in the direction of the force

(2)

weight of the barrel = ... N

(ii) The efficiency of the system is 64%.

Calculate the total work done by the person.

Use the equation

$$\text{efficiency} = \frac{\text{(work done against gravity on the barrel)}}{\text{(total work done by the person)}} \times 100\%$$

(2)

work done = ... J

(iii) Some energy is wasted due to friction.

Suggest **another** reason why some energy is wasted in using this pulley system.

(1)

*(b) A student has the equipment shown in Figure 12.

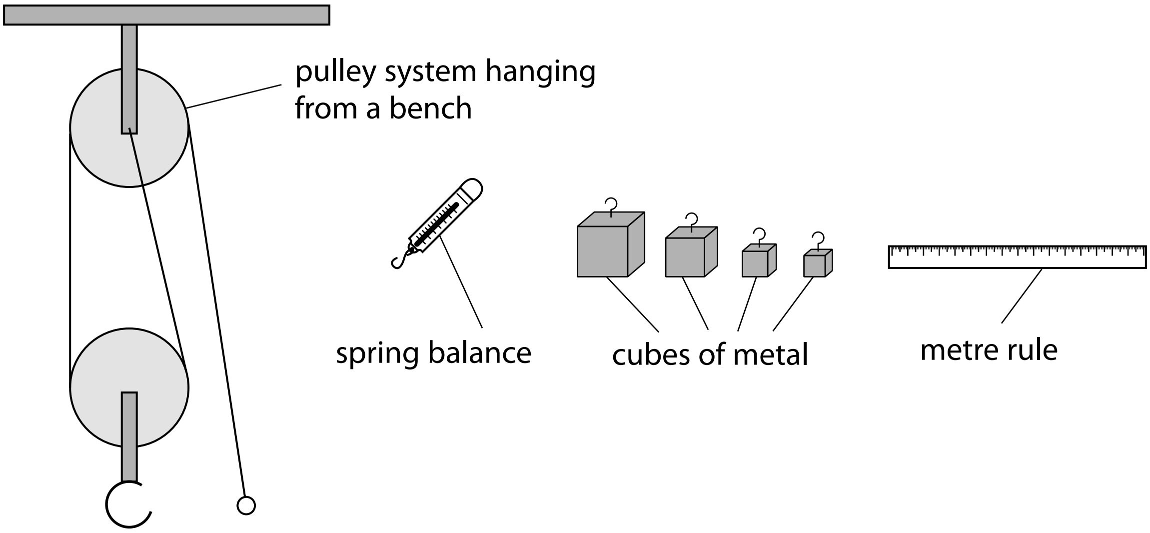

Figure 12

Devise an experiment to investigate how the efficiency of the pulley system varies with the weight of metal being lifted.

Your answer should include how you will use your measurements.

(6)

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

Equations

(final velocity)^2 − (initial velocity)^2 = 2 × acceleration × distance $v^2 - u^2 = 2 \times a \times x$
force = change in momentum ÷ time $F = \frac{(mv - mu)}{t}$
energy transferred = current × potential difference × time $E = I \times V \times t$
force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length $F = B \times I \times l$
$\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$
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 $Q = m \times L$
to calculate pressure or volume for gases of fixed mass at constant temperature $P_1 V_1 = P_2 V_2$
energy transferred in stretching = 0.5 × spring constant × (extension)^2 $E = ½ \times k \times x^2$
pressure due to a column of liquid = height of column × density of liquid × gravitational field strength $P = h \times \rho \times g$

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

May–June 2023 Assessment Window

Paper reference **1SC0/2PH**

Combined Science

PAPER 6

Higher Tier

Equation Booklet

Do not return this Booklet with the question paper.

Turn over

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N:1/

Pearson

If you're taking **GCSE (9–1) Combined Science** or **GCSE (9–1) Physics**, you will need these equations:

HT = higher tier

	distance travelled = average speed × time	
	acceleration = change in velocity ÷ time taken	$a = \frac{(v - u)}{t}$
	force = mass × acceleration	$F = m \times a$
	weight = mass × gravitational field strength	$W = m \times g$
HT	**momentum = mass × velocity**	$\boldsymbol{p = m \times v}$
	change in gravitational potential energy = mass × gravitational field strength × change in vertical height	$\Delta GPE = m \times g \times \Delta h$
	kinetic energy = 1/2 × mass × (speed)^2	$KE = \frac{1}{2} \times m \times v^2$
	efficiency = $\frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}}$	
	wave speed = frequency × wavelength	$v = f \times \lambda$
	wave speed = distance ÷ time	$v = \frac{x}{t}$
	work done = force × distance moved in the direction of the force	$E = F \times d$
	power = work done ÷ time taken	$P = \frac{E}{t}$
	energy transferred = charge moved × potential difference	$E = Q \times V$
	charge = current × time	$Q = I \times t$
	potential difference = current × resistance	$V = I \times R$
	power = energy transferred ÷ time taken	$P = \frac{E}{t}$
	electrical power = current × potential difference	$P = I \times V$
	electrical power = (current)^2 × resistance	$P = I^2 \times R$
	density = mass ÷ volume	$\rho = \frac{m}{V}$

	force exerted on a spring = spring constant × extension	$F = k \times x$
	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2 \times a \times x$
HT	**force = change in momentum ÷ time**	$\boldsymbol{F = \frac{(mv - mu)}{t}}$
	energy transferred = current × potential difference × time	$E = I \times V \times t$
HT	**force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length**	$\boldsymbol{F = B \times I \times l}$
	For transformers with 100% efficiency, 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	$Q = m \times L$
	energy transferred in stretching = 0.5 × spring constant × (extension)^2	$E = \frac{1}{2} \times k \times x^2$

If you're taking **GCSE (9–1) Physics**, you also need these extra equations:

	moment of a force = force × distance normal to the direction of the force	
	pressure = force normal to surface ÷ area of surface	$P = \frac{F}{A}$
HT	$\boldsymbol{\frac{\textit{potential difference across primary coil}}{\textit{potential difference across secondary coil}} = \frac{\textit{number of turns in primary coil}}{\textit{number of turns in secondary coil}}}$	$\boldsymbol{\frac{V_p}{V_S} = \frac{N_p}{N_S}}$
	to calculate pressure or volume for gases of fixed mass at constant temperature	$P_1 \times V_1 = P_2 \times V_2$
HT	**pressure due to a column of liquid = height of column × density of liquid × gravitational field strength**	$\boldsymbol{P = h \times \rho \times g}$

END OF EQUATION LIST

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