Write your name here

Surname	Other names

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

Centre Number	Candidate Number

Combined Science

Paper 6: Physics 2

Higher Tier

Sample Assessment Materials for first teaching September 2016
Time: 1 hour 10 minutes

Paper Reference
1SC0/2PH

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 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 ▶

Pearson

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) Some forces act at a distance.

One example is the gravitational attraction between the Moon and the Earth.

Describe an example of another type of force acting at a distance, where the force is **not** gravitational.

(2)

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(b) A rock falls off the top of a cliff of height *h*.

Figure 1 shows the rock falling.

The Earth exerts a force of 150 N on the rock.

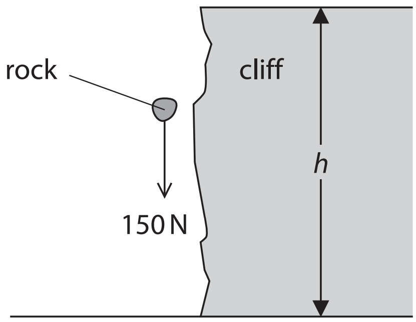

Figure 1

The work done by this force when the rock falls from the top to the bottom of the cliff is 2700 J.

(i) Calculate the height, *h*, of the cliff.

(2)

h = ... m

S 6 0 2 3 4 A 0 2 2 0

(ii) State the value of the kinetic energy of the rock just before it hits the ground.

(1)

kinetic energy = ... J

(iii) The mass of the rock in Figure 1 is 15 kg.

Calculate the velocity of the rock just before it reaches the bottom of the cliff.

(2)

velocity = ... m/s

(c) An electric motor is used to lift a box.

Figure 2 shows how the efficiency of the electric motor changes as the mass of the box increases.

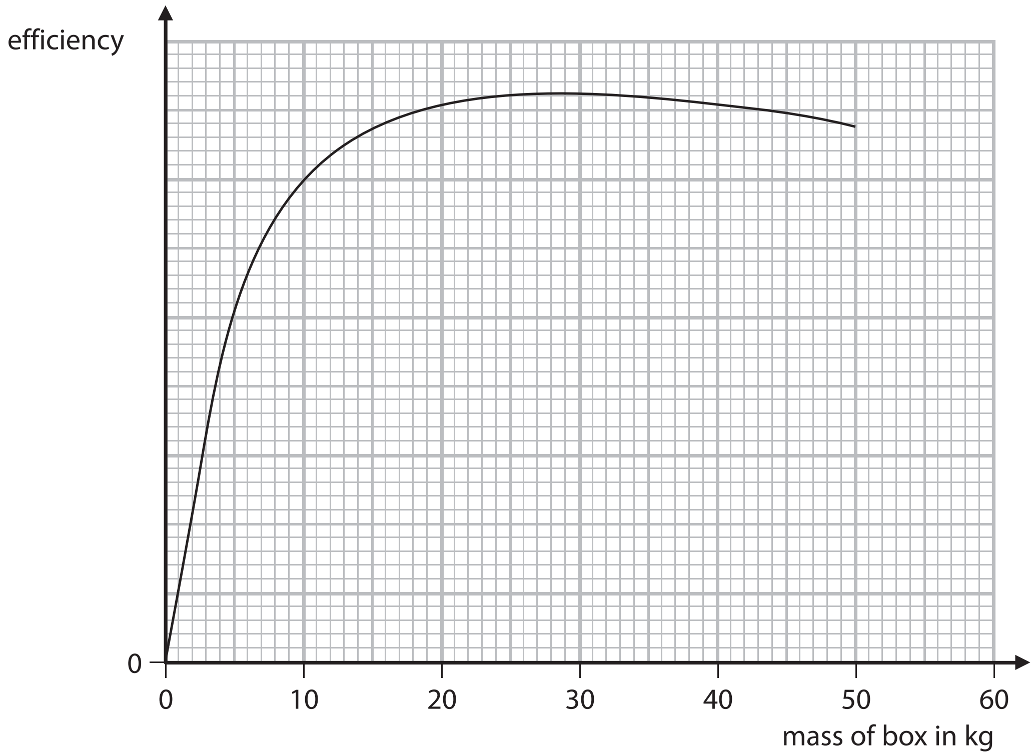

Figure 2

Describe how the efficiency of the electric motor depends on the mass of the box lifted.

(2)

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(Total for Question 1 = 9 marks)

2 (a) An electric heater is connected to a 230 V supply.

The power supplied to the heater is 2.6 kW.

Calculate the current in the heater.

(3)

current = ... A

(b) A car headlamp has a power rating of 55 W when the current in the headlamp is 4.4 A.

(i) State the equation relating power, current and resistance.

(1)

(ii) Calculate the resistance of the headlamp.

(3)

resistance = ... Ω

(Total for Question 2 = 7 marks)

3 (a) Explain how unwanted energy transfers may be reduced in mechanical systems.

(2)

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(b) In which of the following situations is a non-zero resultant force acting?

(1)

☒ **A** a book rests on a table

☒ **B** a car travels along a road at a constant speed

☒ **C** a javelin moves through the air after leaving an athlete's hand

☒ **D** a steel ball bearing descends through some car oil at a constant velocity

(c) Figure 3 shows a book resting on a table with some forces involved.

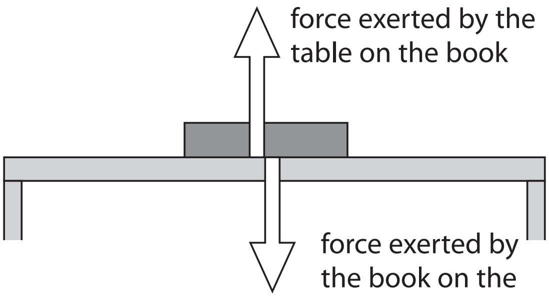

Figure 3

State why this diagram is **NOT** a free body force diagram.

(1)

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(d) Figure 4 shows two astronauts in space pushing at a satellite.

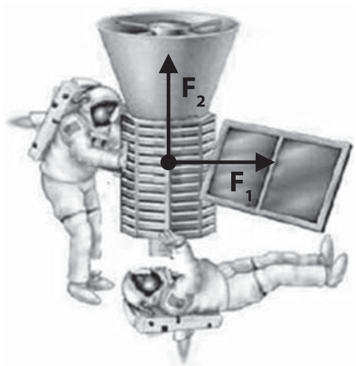
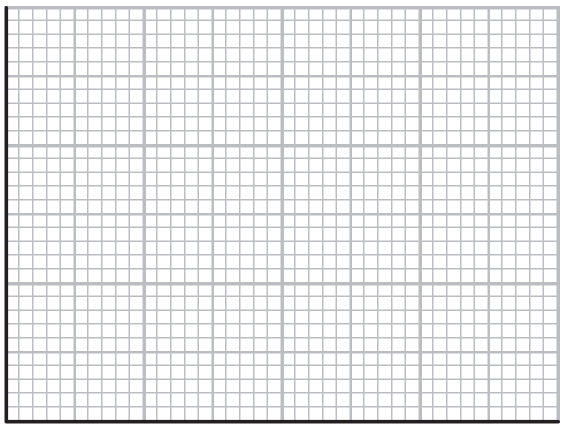


Figure 4

(i) The force F_1 is 3.0 N and the force F_2 is 2.0 N, acting at right angles to each other. Draw a vector diagram to scale showing these forces.

(2)



(ii) Use the diagram in (i) to estimate the magnitude of the resultant force acting on the satellite.

(2)

resultant force = ... N

(e) Figure 5 shows a box sliding down a slope in the direction shown.

(3)

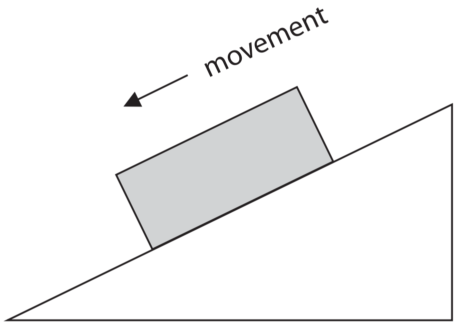


Figure 5

Draw two vector arrows on this diagram showing the 'normal contact force' and 'friction' acting on the box.
Label these two forces.

(Total for Question 3 = 11 marks)

4 (a) A steel ball has a volume of 3.6 cm^3 and a mass of 28 g.

(i) Calculate the density of steel in kg/m^3.

(3)

density = ... kg/m^3

(ii) The steel ball is at a room temperature of 20 °C.

It is then put in a pan of boiling water maintained at 100 °C.

Calculate how much thermal energy the ball gains as its temperature increases from 20 °C to 100 °C.

Specific heat capacity of steel = 510 J/kg °C

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

(2)

thermal energy gained = ... J

(iii) The steel ball is put into a furnace where it melts.
Compare the motion of particles in the steel when they are in the solid state with their motion when in the molten (liquid) state.

(3)

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(b) As part of the testing of different types of steel, a steelworker needs to obtain a temperature-time graph for **solidifying** molten steel.

Figure 6 shows an arrangement the steelworker could use.

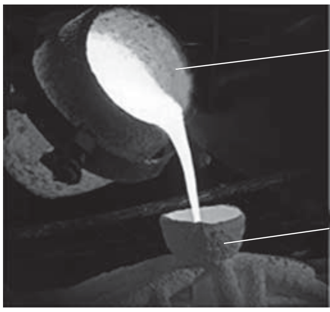

Figure 6

The following devices are available to the steel worker.
The melting point of these steels is between 1425 and 1540 °C

device	range of temperatures	other notes
Thermocouple thermometer	–50 to 1800 °C	Fast response time Probe inserted into melt
Infrared thermometer (pyrometer)	1200 to 2000 °C	Remotely read, using infrared radiation, measures the temperature of the surface it is aimed at
Platinum resistance thermometer	–200 to 850 °C	The most accurate of thermometers based on how resistance changes with temperature

Describe how the steelworker could obtain a temperature-time graph for steel as it goes from the liquid to the solid state.

(4)

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(Total for Question 4 = 12 marks)

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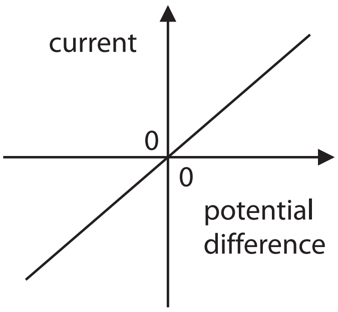
5 (a) Draw a circuit diagram you could use to investigate the relationship between potential difference, current and resistance for a filament lamp.

(3)

(b) The graphs P, Q and R in Figure 7 each show how the current in a component varies with the potential difference (voltage) across that component.

In each box, state the name of the component that matches the graph.

(3)



P

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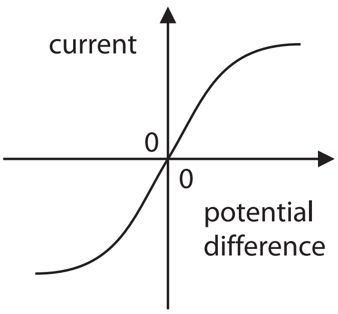

Q

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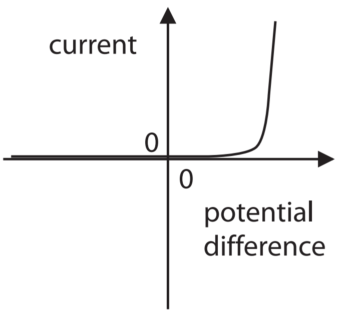

R

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Figure 7

(c) Explain how current varies with potential difference for the component that matches graph R. Refer to the resistance of the component in your answer.

(3)

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(Total for Question 5 = 9 marks)

6 (a) Figure 8 shows a demolition ball of mass 400 kg.

The ball is used to demolish a wall.

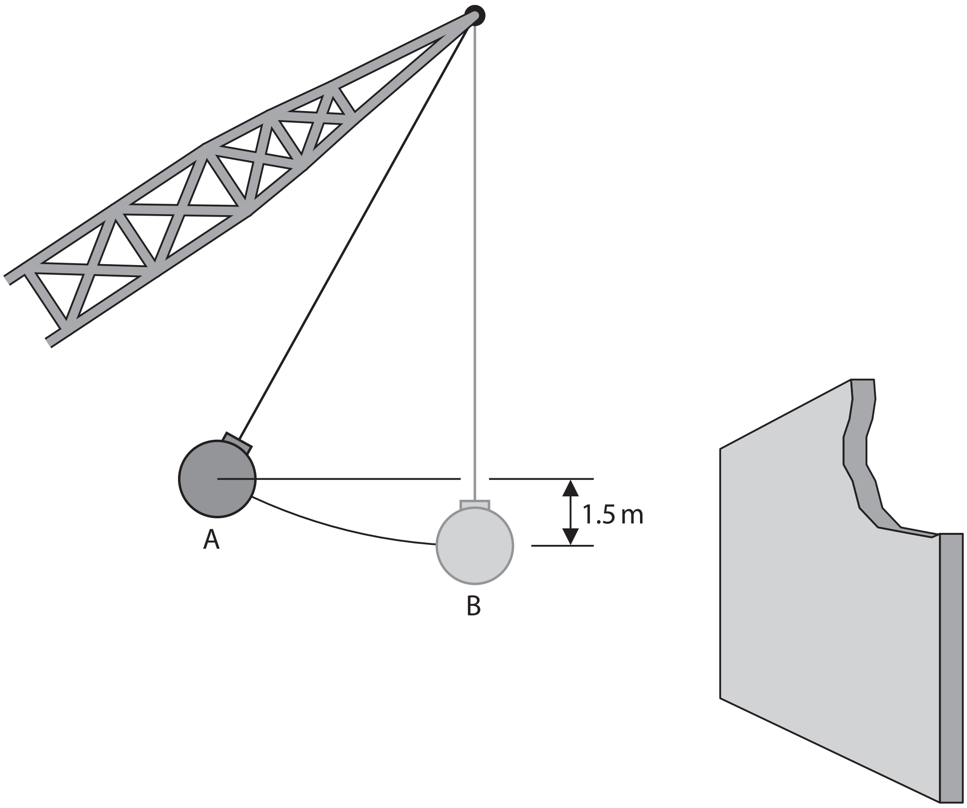

Figure 8

As the ball swings from A to B, it moves through a vertical height of 1.5 m.

(i) Calculate the change in gravitational potential energy.

Take gravitational field strength, g, to be 10 N/kg.

(3)

(ii) The heavy ball comes to rest soon after smashing into the wall. In doing this, the temperatures of the ball, wall and surroundings all increase slightly. Explain this observation.

(2)

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(iii) Which of these quantities of the ball changes in **both** magnitude and direction while the ball is swinging?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** gravitational potential energy

☐ **B** velocity

☐ **C** the gravitational force acting

☐ **D** kinetic energy

*(b) After knocking down the wall, the ball will swing **freely**.

The graph in Figure 9 shows how the height of the ball above ground varies with time during three swings.

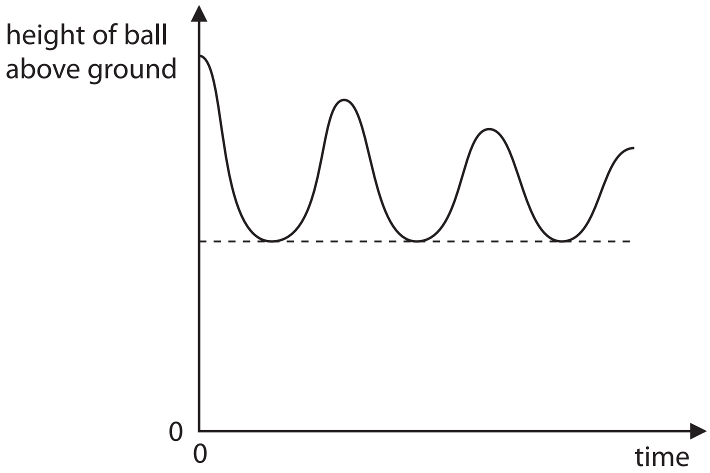

Figure 9

Explain how the energy within the system changes during this time.

The system consists of the swinging ball and its surroundings.

(6)

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(Total for Question 6 = 12 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 $F = \dfrac{(mv - mu)}{t}$
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 $F = B \times I \times l$
$\dfrac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \dfrac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$ $\dfrac{V_p}{V_s} = \dfrac{N_p}{N_s}$
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 $E = \frac{1}{2} \times k \times x^2$
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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