PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



EXAM QUESTION PACK

TOPIC 10: ELECTRICITY AND CIRCUITS (PACK 2)

SCORE	PERCENTAGE
/89	%

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Q1.

Figure 11 shows the three-pin plug used to connect the kettle to the mains.

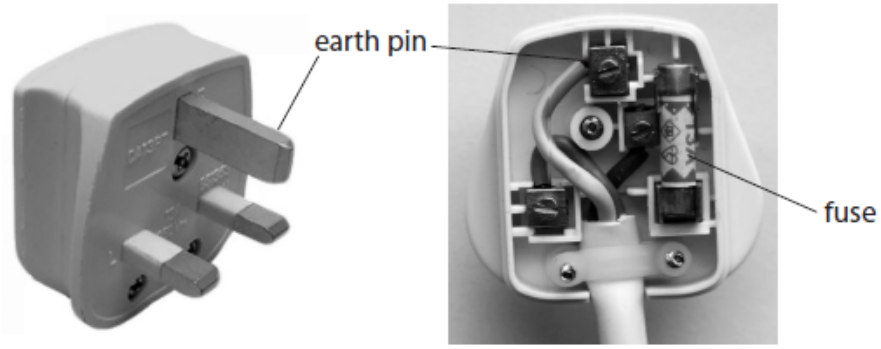


Figure 11

A fault occurs in the kettle causing the live wire to touch the metal case of the kettle.

Explain how the safety features of the plug operate when this fault occurs.

(6)

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(Total for question = 6 marks)

Q2.

Figure 23 shows an electric car connected to a battery charger.



(Source: © Danil Roudenko/123RF)

Figure 23

* The battery charger shown in Figure 23 is connected to the 230 V a.c. domestic mains supply.

The output voltage of the charger is 335 V and it provides a d.c. charging current. Charging stops if the charging current exceeds 15 A.

Explain how electrical components in the charger can be connected together to give this type of output.

(6)

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(Total for question = 6 marks)

Q3.

A student investigates how the resistance of a thermistor varies with temperature.

Figure 8 shows the apparatus used for this investigation.

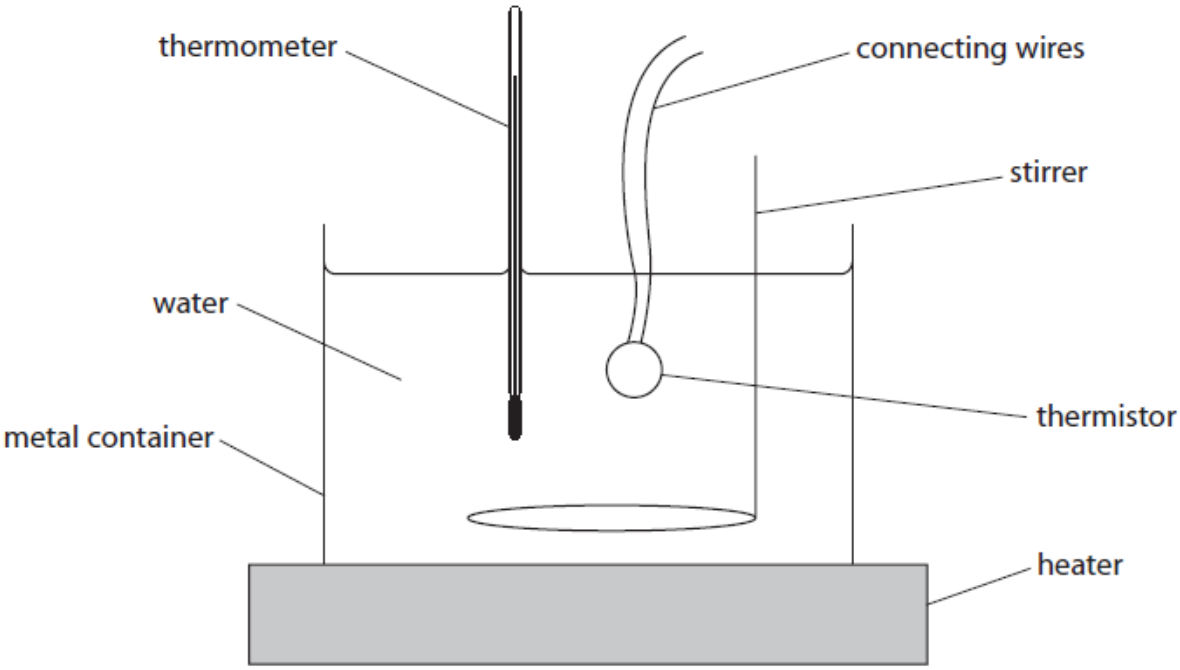


Figure 8

(i) Explain **one** improvement in measurement that the student could make in the investigation.

(2)

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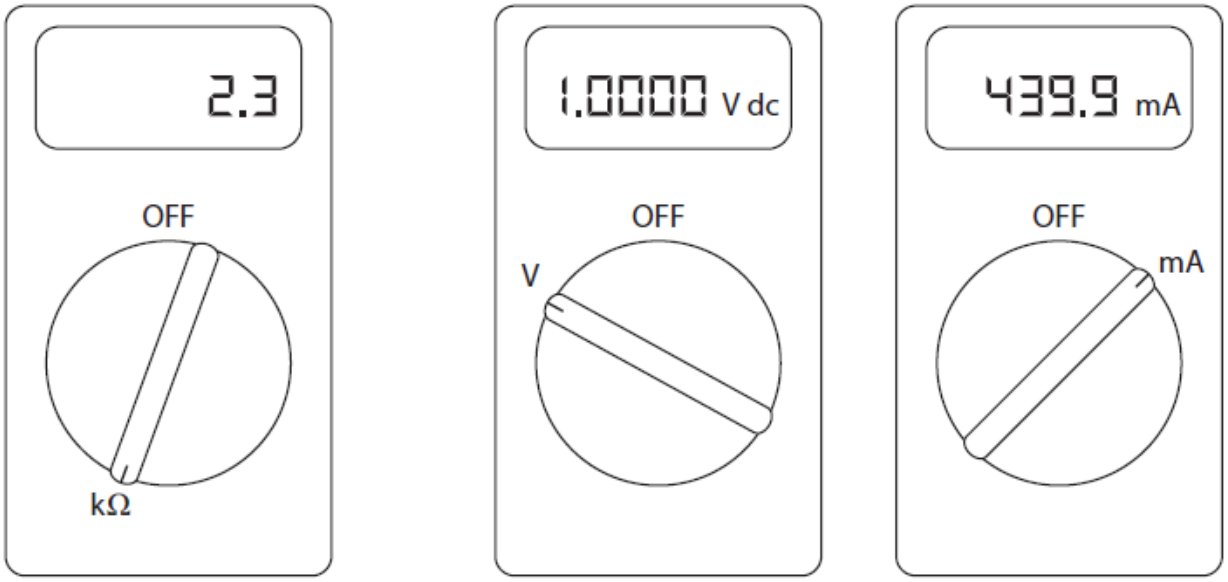
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In this investigation, the resistance can be measured in two ways.

Method 1 – use an ohmmeter.

Method 2 – use an ammeter and a voltmeter.



Method 1

using an ohmmeter

Method 2

using an ammeter and voltmeter

Figure 9

(ii) Explain why method 2 gives more precise results than method 1.

(2)

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(Total for question = 4 marks)

Q4.

Figure 2 shows an open door.

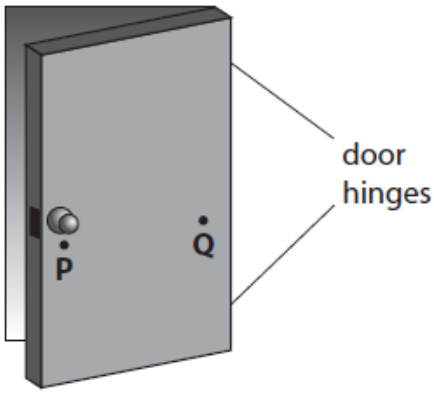


Figure 2

Explain why it is easier to close the door by pushing at point **P** rather than pushing at point **Q**.

(2)

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(Total for question = 2 marks)

Q5.

Figure 7 shows a person trying to lift a large rock using a metal bar.

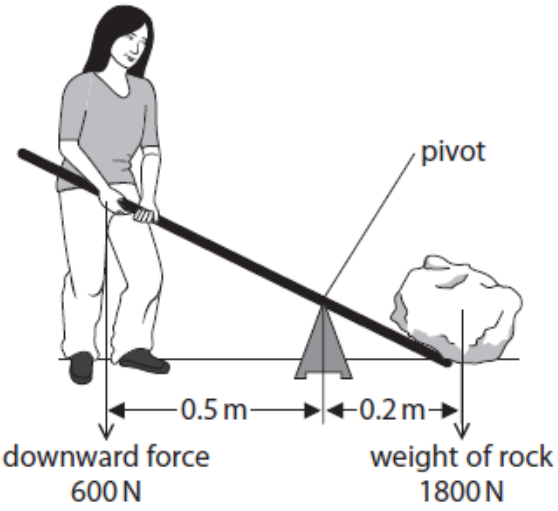


Figure 7

The rock weighs 1800 N.

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

The person cannot lift the rock.

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

(3)

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

(2)

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(Total for question = 5 marks)

Q6.

A resistor is connected to a power supply.

The resistor becomes warm while there is a current in it.

Explain why the resistor becomes warm.

(2)

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(Total for question = 2 marks)

Q7.

(i) Figure 14 shows the vertical forces on an aeroplane.

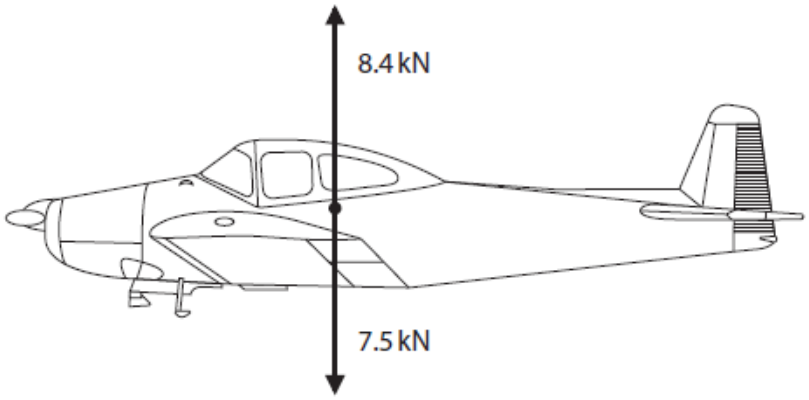


Figure 14

Use information from the diagram to determine the size and direction of the resultant vertical force on the aeroplane.

(2)

size = ... kN, direction is .....

(ii) The aeroplane is descending.

Figure 15 shows a diagram of the resultant vertical and horizontal forces on the aeroplane as it is descending.

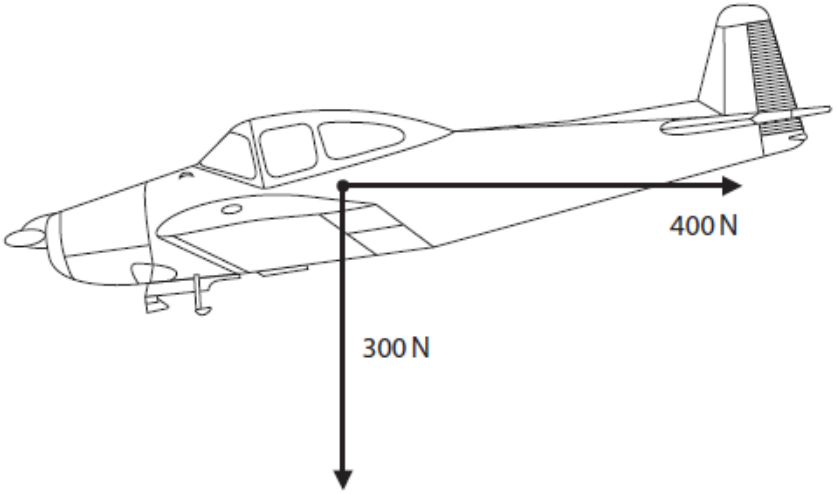


Figure 15

Complete the diagram to show the resultant of these two forces.

(1)

(iii) The mass of the aeroplane is 750 kg.

Calculate the change in gravitational potential energy of the aeroplane as it descends from 1300 m to the ground.

Gravitational field strength (g) = 10 N/kg

(2)

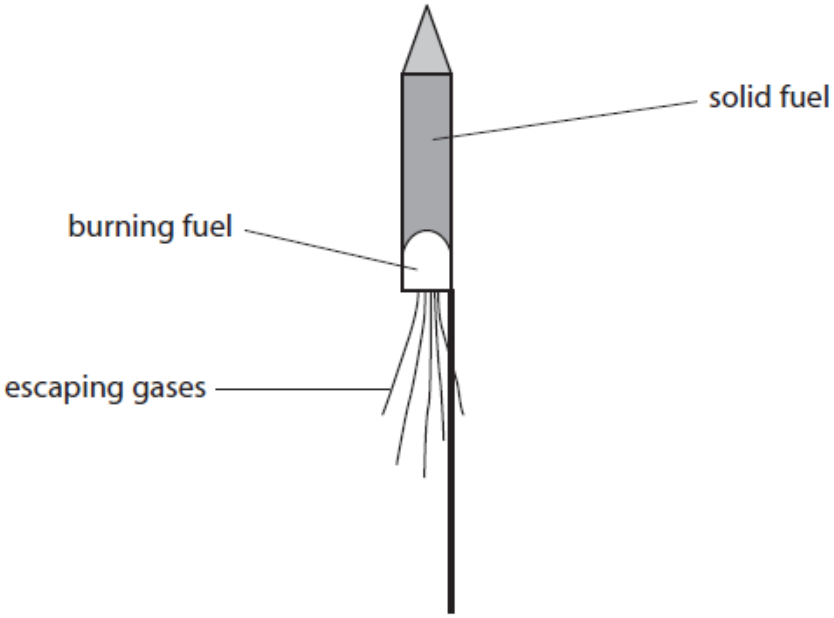
energy = ... J

(Total for question = 5 marks)

Q8.

A firework rocket contains a solid fuel inside a cardboard tube.

The burning of the fuel creates a thrust to propel the rocket upwards.



(i) Scientists can refer to several different quantities when describing the motion of the rocket.

mass	energy	speed	force

Only one of these quantities is a vector.

Complete this sentence using **one** of the words from the box.

(1)

The vector quantity is .....

(ii) Before the fuse is lit, the total weight of a rocket including fuel is 0.7N.

The gravitational field strength is 10 N/kg.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The total mass of the rocket including fuel is

(1)

☒ **A** 0.007 kg

☒ **B** 0.07 kg

☒ **C** 0.7 kg

☒ **D** 7 kg

(iii) There is a resultant force on the rocket of 0.5 N upwards when it takes off.

The arrow on the diagram shows the size and direction of the force of gravity acting on the rocket when it takes off.



Add another arrow to the diagram to show the thrust produced by the burning fuel at the time the rocket takes off.

You should label the arrow with the size of the thrust.

(2)

Q9.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

Two cyclists ride on a hilly road and go through points P, Q, R and S.

The diagram in Figure 16 shows how the vertical height of the road changes during the journey from P to S.

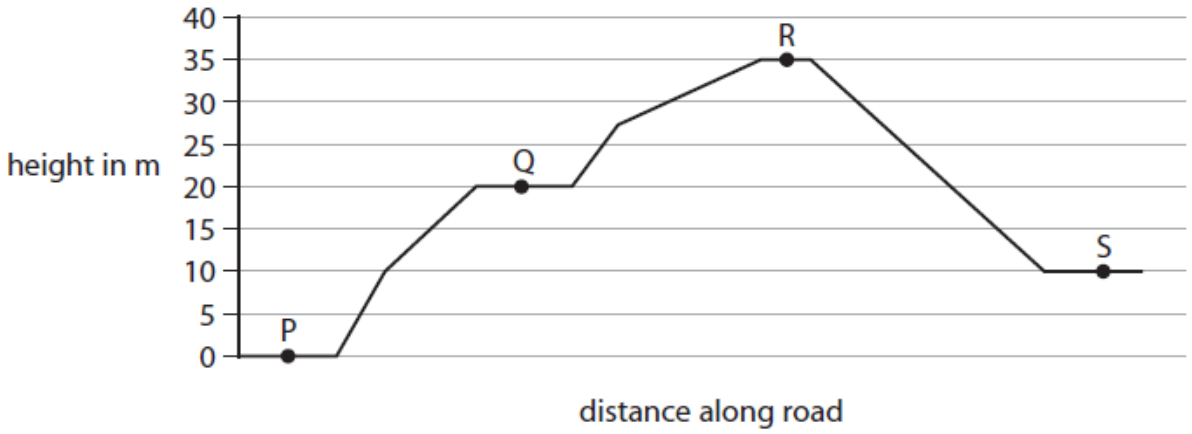


Figure 16

(i) The greatest overall change in gravitational potential energy for each cyclist is between which two points on the journey?

(1)

☒ **A** P and Q

☒ **B** Q and R

☒ **C** P and S

☒ **D** R and S

(ii) The total weight of one cyclist and bicycle is 700 N.

Calculate the total amount of work done against gravity when the cyclist travels from point P to point Q in the journey.

(2)

work done = ... J

(iii) The gravitational potential energy of the other cyclist changes by 11 250 J when travelling from point Q to point R.

Calculate the mass of this cyclist.

Gravitational field strength = 10 N / kg

Use the equation

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

(2)

mass = ... kg

(iv) Explain why the total amount of work done by a cyclist between points Q and R is different from the change in gravitational potential energy of the cyclist between points Q and R.

(2)

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.....

(v) The cyclists lubricated the chains and the wheel bearings of their bicycles before setting off.

Lubricating the chains and wheel bearings helps to

(1)

☒ **A** decrease the amount of work done against gravity

☒ **B** decrease the efficiency of the cyclist and bicycle

☒ **C** increase the efficiency of the cyclist and bicycle

☒ **D** increase the overall amount of energy transferred by the cyclist

(Total for question = 8 marks)

Q10.

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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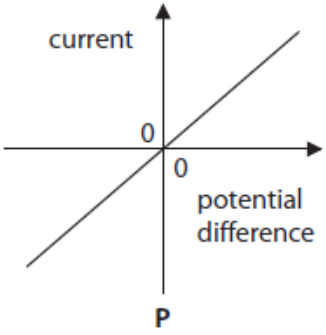
(Total for question = 3 marks)

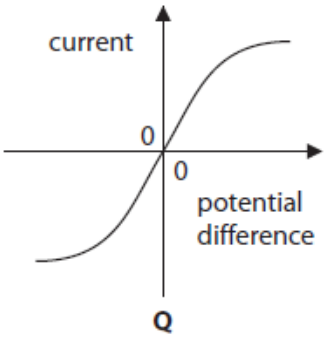
Q11.

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)





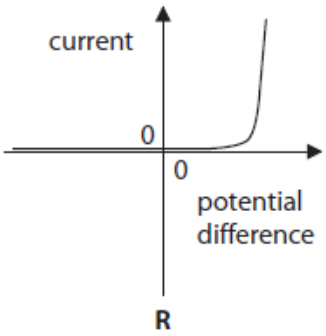


Figure 7

(Total for question = 3 marks)

Q12.

Explain how unwanted energy transfers may be reduced in mechanical systems.

(2)

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(Total for question = 2 marks)

Q13.

Figure 6 shows a book resting on a table with some forces involved.

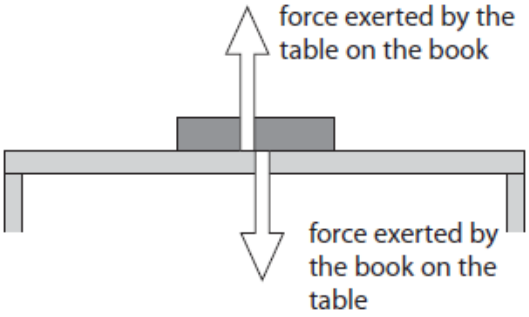


Figure 6

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

(1)

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.....

(Total for question = 1 mark)

Q14.

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

(Total for question = 1 mark)

Q15.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The magnitude and direction of a force can be represented by a vector.
Figure 22 shows the forces acting on four identical trolleys. The arrows show the magnitude and direction of the forces.

Which diagram shows a pair of forces that will produce zero acceleration?

(1)

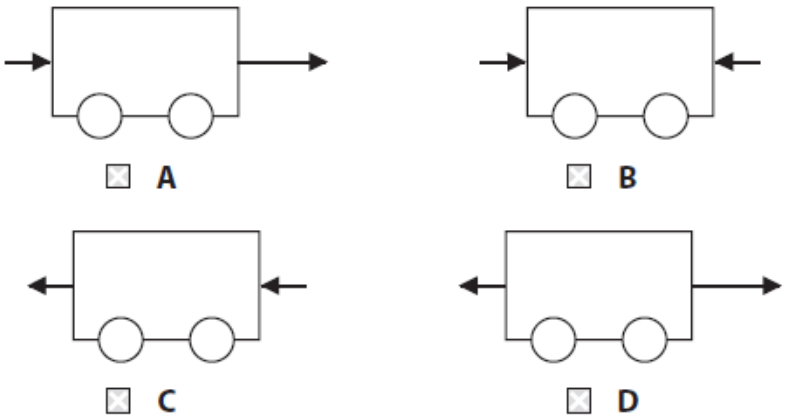


Figure 22

(Total for question = 1 mark)

Q16.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 6 shows four forces, P, Q, R and S, acting on a rod.

The rod can rotate around an axle.

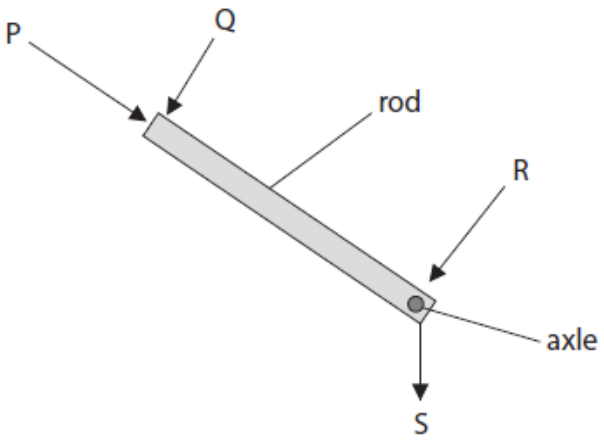


Figure 6

Which force will make the rod rotate about the axle?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(Total for question = 1 mark)

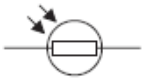
Q17.

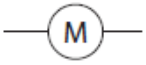
Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Which of these symbols is used to represent a thermistor in an electrical circuit?

(1)

☒ A 

☒ B 

☒ C 

☒ D 

(Total for question = 1 mark)

Q18.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 1 shows some forces acting on a seesaw.

The forces shown have the same magnitude but act in different directions.

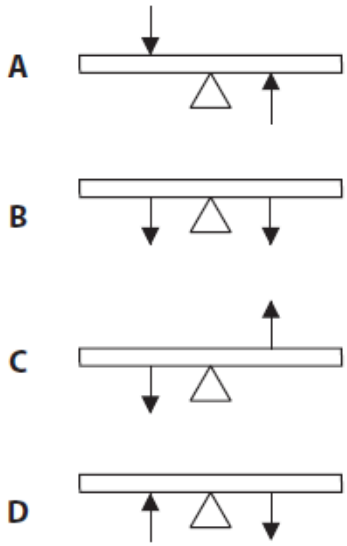


Figure 1

In which of these could the forces acting on a seesaw be in equilibrium?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for question = 1 mark)

Q19.

A student investigates the relationship between the magnetic flux density and the electromagnetic force on a current-carrying wire.

The student has the equipment shown in Figure 19.

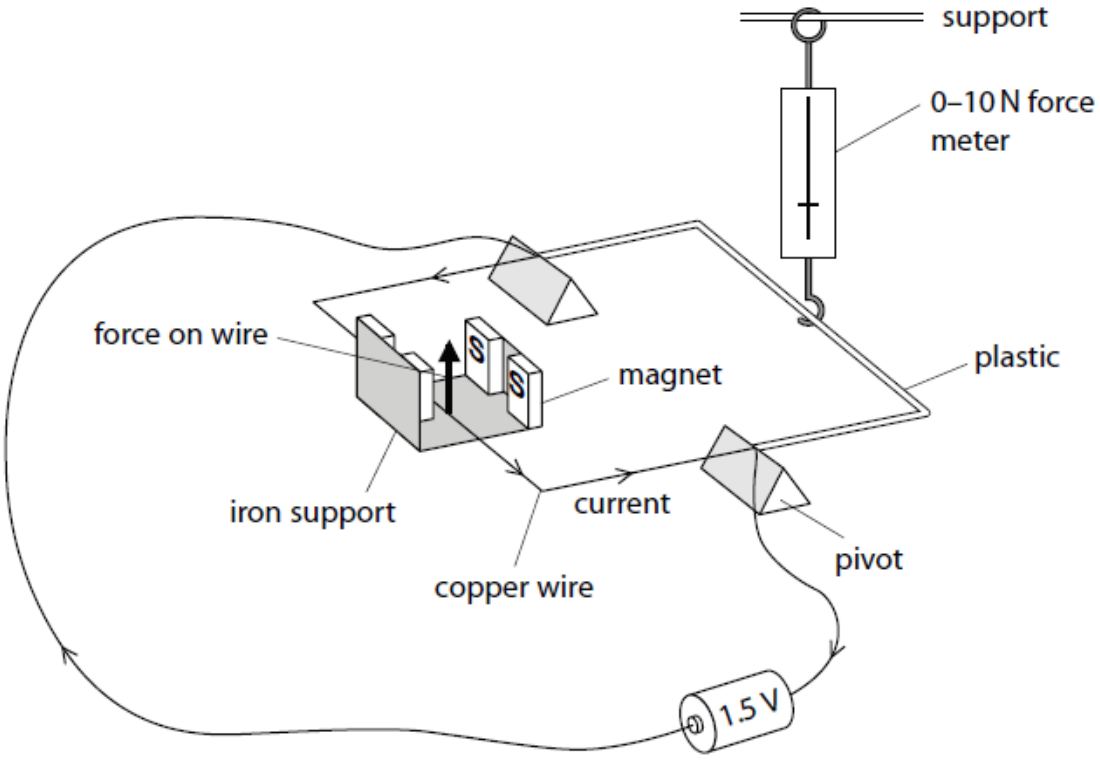


Figure 19

The student varies the number of magnets and measures the force on the wire using the force meter.

The results are shown in Figure 20.

number of pairs of magnets	reading on force meter (N)
1	0.0
2	0.0
3	0.1

Figure 20

The student decides that his equipment is not sufficiently sensitive.

Give **three** ways the student should develop his investigation to improve the quality of his results.

(3)

1 .....

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2 .....

.....

3 .....

.....

(Total for question = 3 marks)

Q20.

A student investigates how the resistance of a thermistor varies with temperature.

(a) The student sets up the circuit shown in Figure 5 to measure current and voltage.

He finds that it does not work.

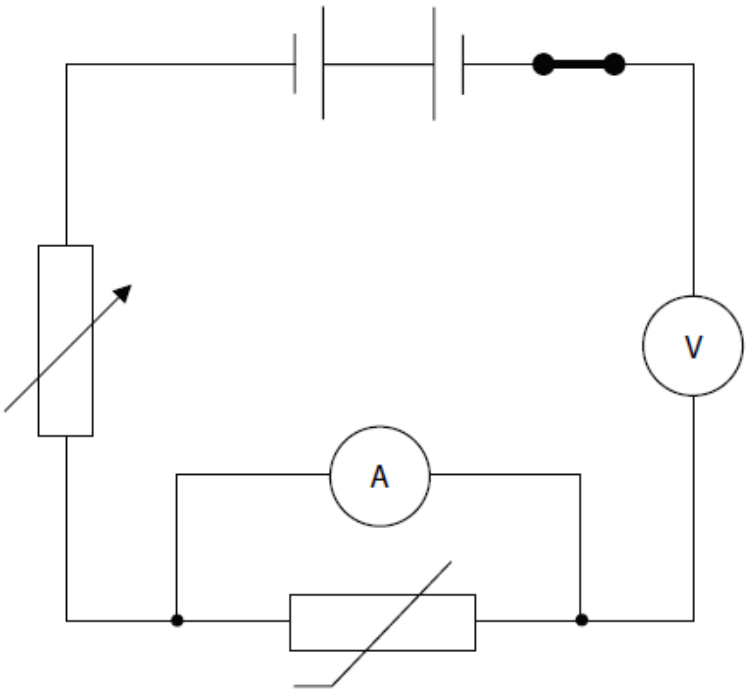


Figure 5

Give **three** modifications the student should make to the circuit so that the circuit works correctly.

(3)

1 .....

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2 .....

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3 .....

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(b) The student uses the equipment shown in Figure 6 to measure the temperature of the thermistor.

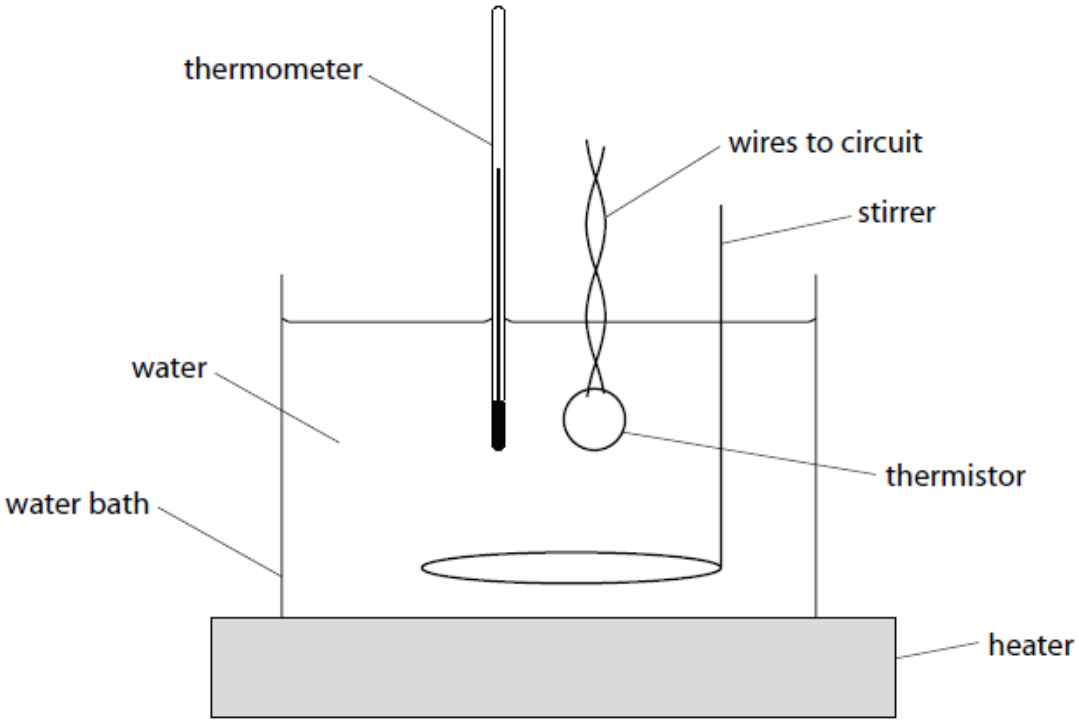


Figure 6

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

(1)

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.....

(ii) The equipment shown in Figure 6 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.

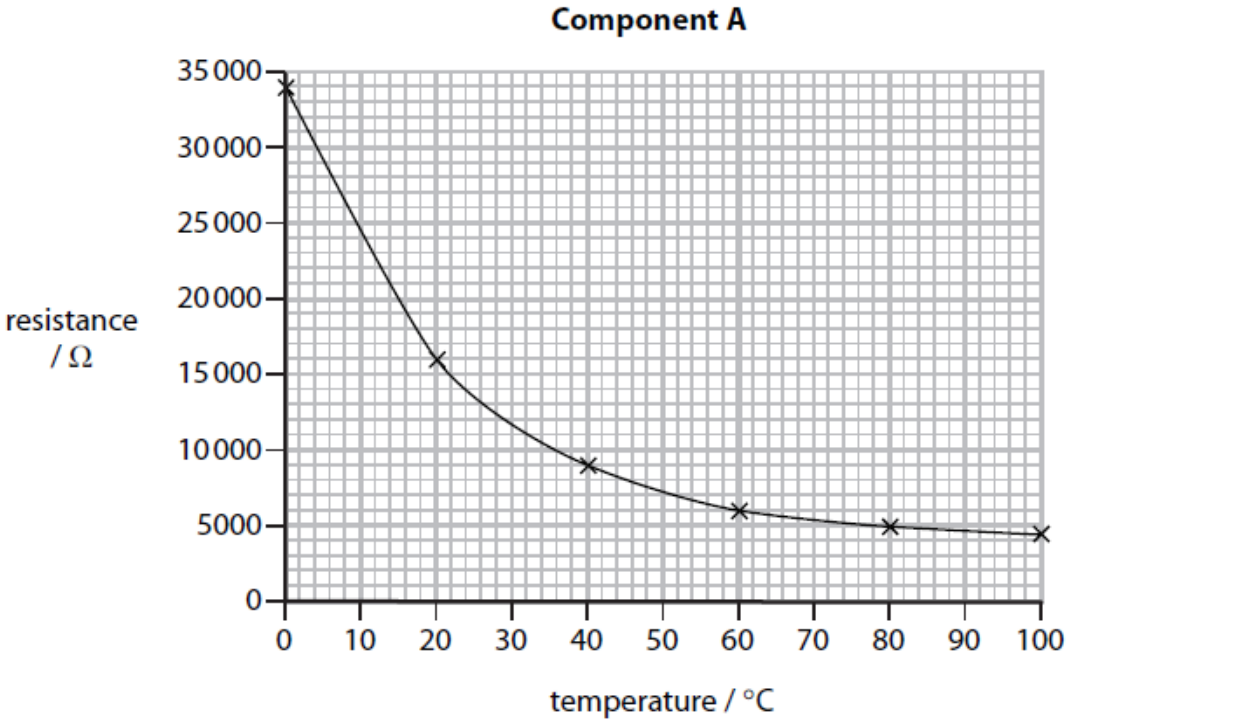
(1)

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.....

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

The results for both these components are shown in Figure 7.



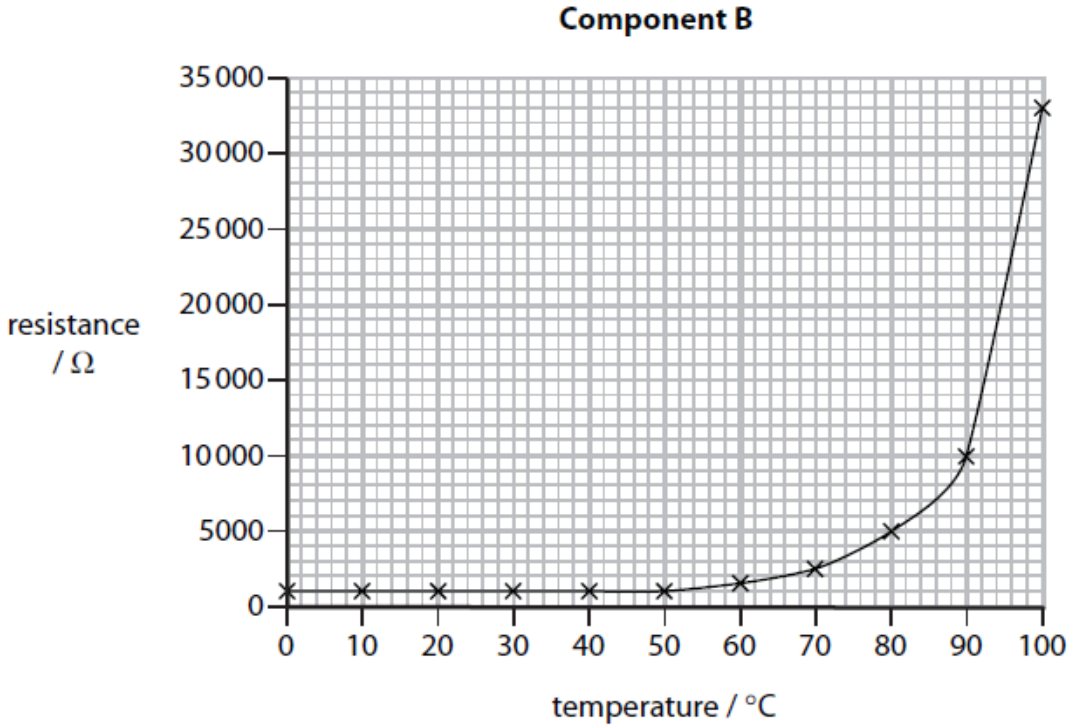


Figure 7

(i) Compare and contrast how the resistances of component **A** and component **B** vary with temperature.

(3)

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(ii) Component **A** is connected to a 12 V supply.

Which of these is the current in component **A** when the temperature is 80°C?

(1)

☒ **A** $I = 12 \times 5000$

☒ **B** $I = \frac{12}{5000}$

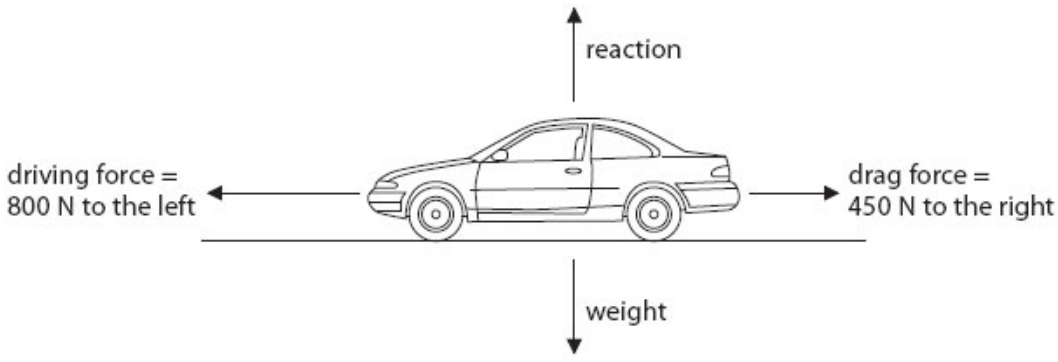
☒ **C** $I = \frac{12^2}{5000}$

☒ **D** $I = \sqrt{\left(\frac{12}{5000}\right)}$

(Total for question = 3 marks)

Q21.

The diagram shows the forces acting on a car which is travelling along a flat straight road.



(a) (i) The size of the resultant force on the car is 350 N.

In which direction is the resultant force acting?

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

(1)

☒ **A** down ↓

☒ **B** to the left ←

☒ **C** to the right →

☒ **D** up ↑

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The car is

(1)

☒ **A** accelerating

☒ **B** decelerating

☒ **C** moving at a constant speed

☒ **D** not moving

(2)

(iii) The mass of the car is 625 kg.

Calculate the weight of the car.

gravitational field strength = 10N/kg

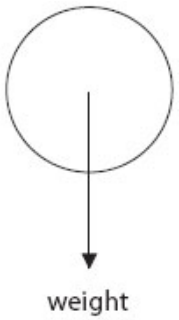
(2)

weight of car = ...N

(b) Forces also act on objects when they fall through the air.

There are two forces acting on this ball as it falls through the air.

The weight is shown on the diagram.



(i) Draw and label an arrow on the diagram to show the other force acting on the ball.

(2)

(ii) Use words from the box to complete the sentences.

(2)

balanced	changing	greater	smaller	zero

After a short time the ball falls at a steady speed.

The forces acting on the ball are now .....**.**

The acceleration of the ball is now .....**.**

(Total for Question is 8 marks)

Q22.

Figure 8 shows a box sliding down a slope in the direction shown.

(3)

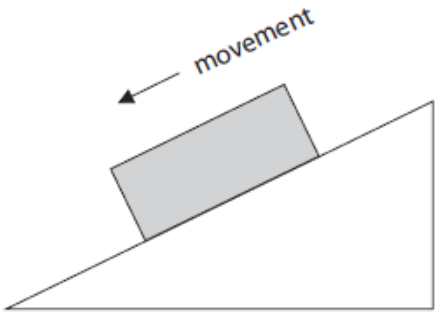


Figure 8

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 marks)

Q23.

Figure 18 shows identical filament lamps connected together to a 12 V power supply.

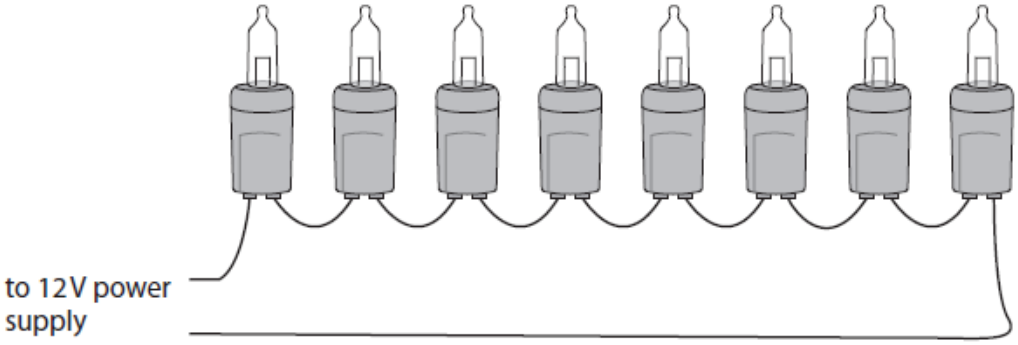


Figure 18

(i) Calculate the potential difference across each lamp.

(1)

potential difference = ... V

(ii) The power output of each lamp is 0.75 W

Calculate the resistance of each lamp.

(4)

resistance = ... Ω

(Total for question = 5 marks)

Q24.

A technician investigates different electrical devices that are used in a car.

The technician connects a device to the 12 V car battery.

The technician measures the current in the circuit and the potential difference (voltage) across the device.

Figure 8 shows the car battery and the device that is being tested.



Figure 8

(i) Draw on Figure 8 to show how the circuit should be completed so that the current in the circuit and voltage across the device can be measured.

(2)

(ii) The technician tests a headlamp.

The current in the headlamp is 4.8 A when connected to the 12 V battery.

Calculate the power supplied to the headlamp.

(2)

power = ... W

(iii) The technician tests an interior light.

The current in the interior light is 600 mA when connected to the 12 V battery.

Calculate the energy transferred to the interior light in 7 minutes.

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

(2)

energy transferred = ... J

(Total for question = 6 marks)

Q25.

Figure 1 shows a lamp connected to a d.c. power supply.

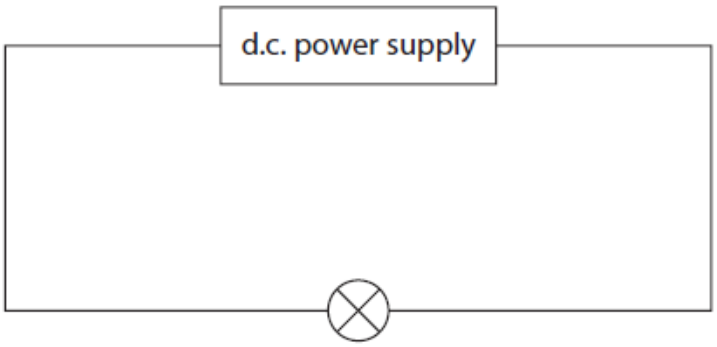


Figure 1

The power supply provides a potential difference (voltage) of 4.5 V.

The current in the lamp is 0.30 A.

Another **identical** lamp is added to the circuit, as shown in Figure 2.

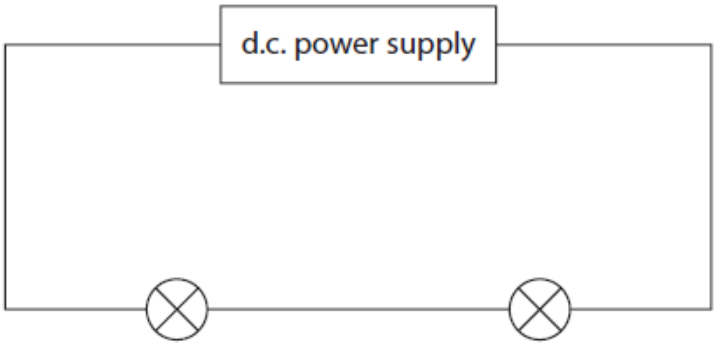


Figure 2

The power supply provides the same potential difference as it provided in the circuit in Figure 1.

State and explain the difference between the brightness of the lamp in Figure 1 and the brightness of a lamp in Figure 2.

(3)

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(Total for question = 3 marks)

Q26.

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 = 4 marks)

Q27.

A student investigates moments of forces.

Figure 14 shows the apparatus used.

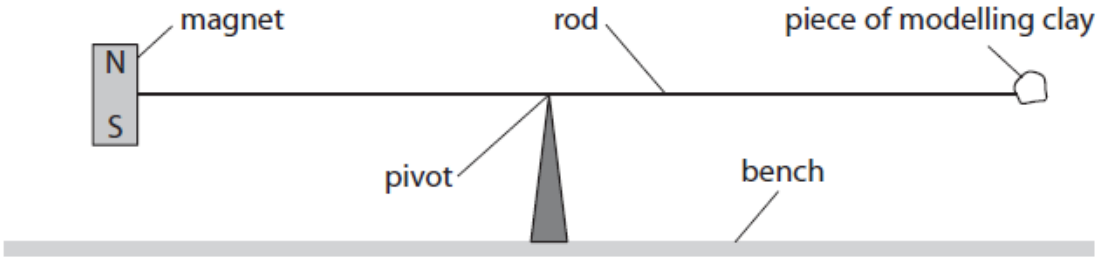


Figure 14

The pivot is under the centre of the rod.

A magnet is fixed to one end of the rod.

A piece of modelling clay is fixed to the other end of the rod.

The system is in equilibrium.

State the relationship between the moment of the weight of the magnet and the moment of the weight of the piece of modelling clay about the pivot.

(1)

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(Total for question = 1 mark)

Q28.

Figure 16 shows a cardboard tube with a wire coming out from each end.



Figure 16

There are two 10 ohm resistors inside the cardboard tube.

A potential difference of 6.0 V is connected between P and Q.

There is a current of 1.2 A in the wires.

Deduce how the resistors have been arranged inside the cardboard tube.

(3)

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(Total for question = 3 marks)

Q29.

Figure 10 shows an arrangement of gears.

Each gear turns around a fixed axle.

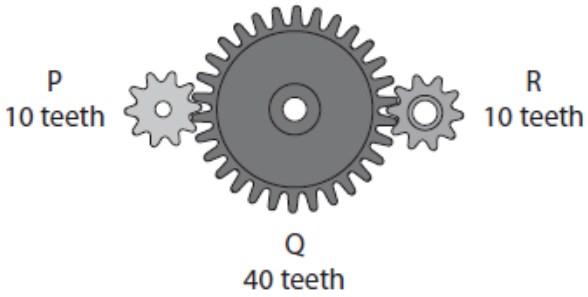


Figure 10

Gear P is turned through one complete revolution per second.

(i) Which of the following describes the motion of gear R?

(1)

		speed (revolutions per second)	direction of rotation
☒	**A**	4	same as P
☒	**B**	1	same as P
☒	**C**	4	opposite to P
☒	**D**	1	opposite to P

(ii) Figure 11 shows the same arrangement with gear R replaced by a rack.

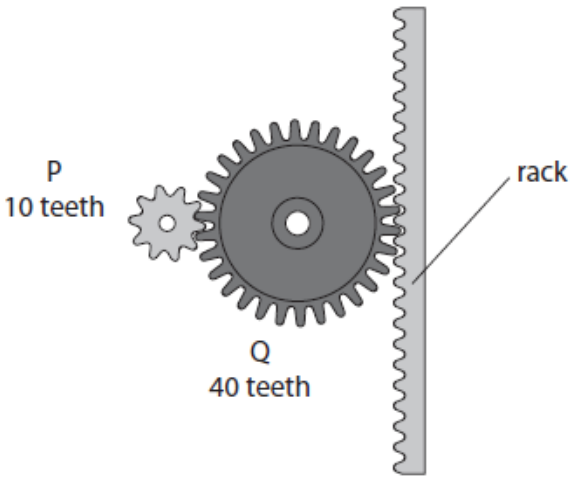


Figure 11

The rack can move up or down when the gears turn.

The teeth on the rack are 2 mm apart.

Calculate how far the rack moves when P turns through to one complete revolution.

(2)

distance = ... mm

(Total for question = 3 marks)

Q30.

Figure 24 shows a submarine underwater.

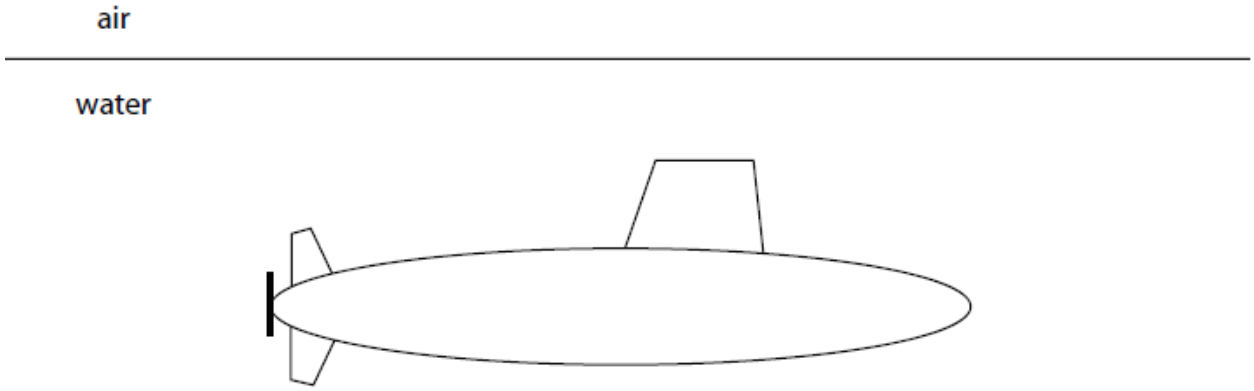


Figure 24

The motor in the submarine turns the gear wheels shown in Figure 25.

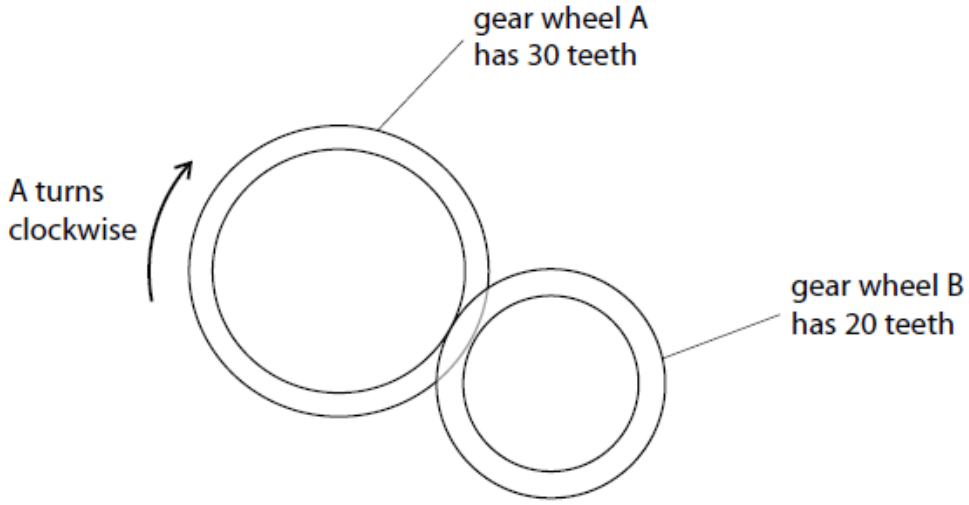


Figure 25

Gear wheel A rotates clockwise through one complete turn.

Which of these is correct for gear wheel B?

(1)

	amount that gear wheel B rotates	direction gear wheel B rotates
☒ A	1½ turns	clockwise
☒ B	1½ turns	anticlockwise
☒ C	⅔ of a turn	clockwise
☒ D	⅔ of a turn	anticlockwise

(Total for question = 1 mark)

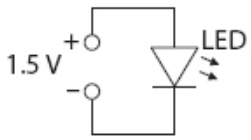
Q31.

(a) What is the name of the device used to change the size of an alternating voltage?

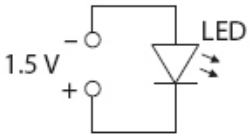
(1)

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(b) A light emitting diode (LED) can only emit light when connected correctly to a potential difference.

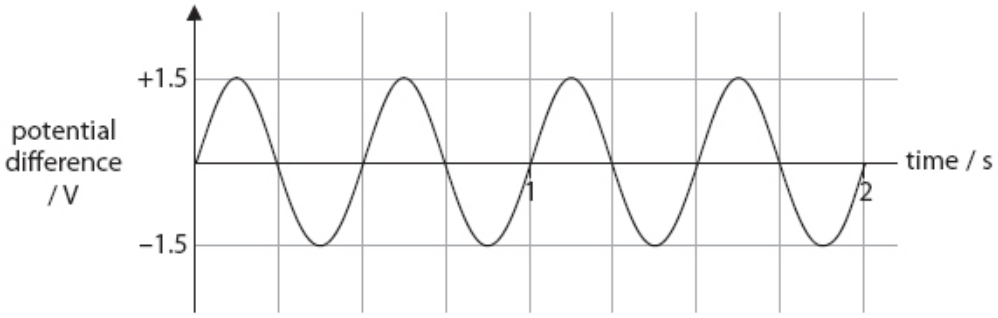


LED emits light



LED does **not** emit light

Use this information to suggest what happens when this alternating voltage is connected across the LED.



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(c) A LED lamp has a power rating of 3 W.
The voltage across the lamp is 12 V.
Calculate the current in the lamp.

(3)

current in the lamp =.....A

*(d) Some research has been carried out into replacing fluorescent lamp fittings with LED fittings.



photo of stairwell
with fluorescent fitting



photo of stairwell
with LED fitting

The data in the table is taken from the report of a trial using LEDs to light stairwells and corridors in a large building.

total energy saved each year by using LEDs	3 000 kW h
LED fitting cost	£2 000
CO_2 saving each year by using LEDs	1.6 tonnes
change in lighting levels by using LEDs	200%
average price of electrical energy	14 p / kW h
average lifetime of LED fittings	50 000 hours
average lifetime of fluorescent fittings	10 000 hours

Use the information to discuss the benefits of replacing fluorescent fittings with LED fittings.

(6)

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(Total for Question = 12 marks)

Q32.

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 (☒).

Which of these is a vector quantity?

(1)

☒ **A** acceleration

☒ **B** speed

☒ **C** time

☒ **D** distance

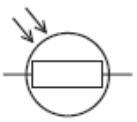
(Total for question = 1 mark)

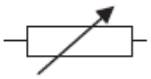
Q33.

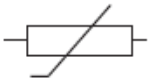
Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

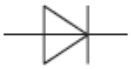
Which of these shows the correct circuit symbol for a thermistor?

(1)

☐ **A** 

☐ **B** 

☐ **C** 

☐ **D** 

(Total for question = 1 mark)

Q34.

The photograph shows the security check-in at an airport.



An X-ray machine is used to scan luggage for dangerous items.
A metal detector is used to check people for dangerous items.

(a) (i) Suggest why people are not scanned with X-rays in an airport but have X-rays in a hospital.

(2)

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(ii) The security people work near the X-ray machine.

Explain how they are protected from the X-rays.

(2)

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(b) X-rays are produced when fast moving electrons collide with a metal anode in a vacuum tube.

(i) The electrons come from the cathode by the process of thermionic emission.

Explain what is meant by thermionic emission.

(2)

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(ii) The current in the vacuum tube is 7.0 mA.
charge on an electron is 1.6×10^{-19} C.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The number of electrons colliding with the metal anode in one second is

(1)

☒ **A** 2.3×10^{-20}

☒ **B** 2.3×10^{-17}

☒ **C** 4.4×10^{16}

☒ **D** 4.4×10^{19}

(iii) In order to produce X-rays which can penetrate the luggage, each electron must have at least an energy of 1.4×10^{-14} J.
The charge on an electron is 1.6×10^{-19} C.

Calculate the accelerating potential difference which will produce electrons of this energy.

(3)

accelerating potential difference = ... V

(Total for Question = 10 marks)