Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
PHYSICS

H

Higher Tier

Paper 2H

Specimen 2018 (set 2)

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator
- a protractor
- the Physics Equations Sheet (enclosed)

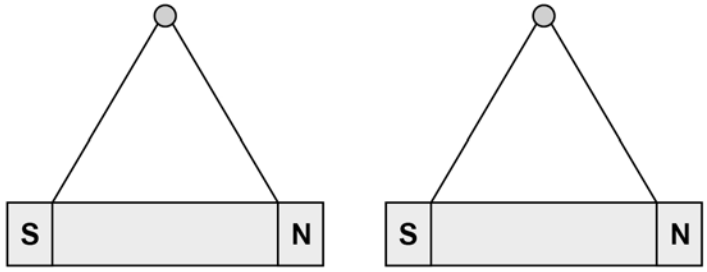
Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

0 1 **Figure 1** shows two bar magnets suspended close to each other.

Figure 1



0 1 . 1 Explain what is meant by the following statement.

'A non-contact force acts on each magnet'.

[2 marks]

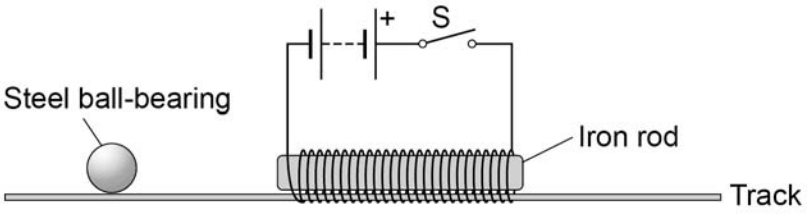
0 1 . 2 Describe how to plot the magnetic field pattern of a bar magnet.

[3 marks]

A student has set up the apparatus shown in **Figure 2**.

The iron rod is fixed to the track and cannot move.

Figure 2



0 1 . 3 The student gives the steel ball bearing a gentle push in the direction of the iron rod.

At the same time the student closes the switch **S**.

Explain the effect on the motion of the ball bearing when the switch **S** is closed.

[4 marks]

9

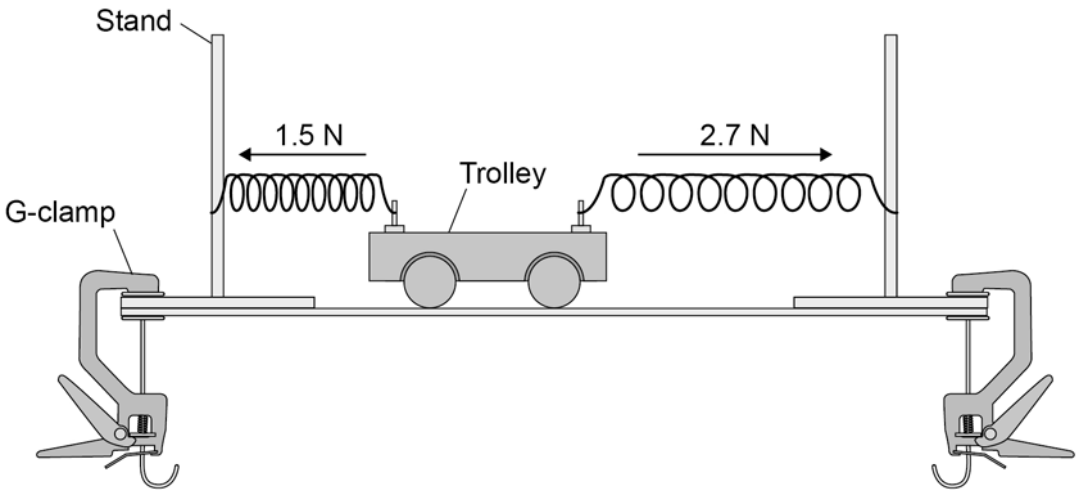
Turn over for the next question

0 2 A trolley is attached to two identical springs.

The trolley is pushed to the left and then released.

Figure 3 shows the horizontal forces acting on the trolley just after it is released.

Figure 3



0 2 . 1 Write down the equation which links acceleration, mass and resultant force.

[1 mark]

0 2 . 2 The trolley has a mass of 0.75 kg

Calculate the acceleration of the trolley just after it is released.

Give the unit.

[4 marks]

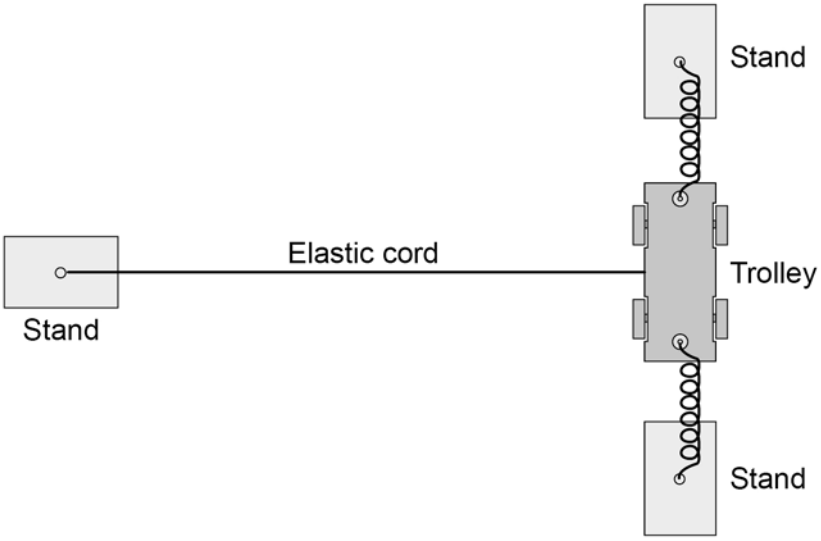
Acceleration = _____ Unit _____

An elastic cord is fixed to the trolley.

Figure 4 shows the arrangement viewed from above.

Figure 4

View from above



When the trolley is pushed and released a wave travels along the cord.

0 2 . 3 What type of wave travels along the cord?

[2 marks]

Give the reason for your answer.

0 2 . 4 Suggest **one** change that could be made to the apparatus shown in **Figure 4** to produce a wave with a lower frequency.

[1 mark]

8

0 3 Two students investigated how the acceleration of a trolley depends on the force applied to the trolley.

Before starting the investigation each student wrote a hypothesis.

Hypothesis of Student **A**:

'The acceleration of the trolley is directly proportional to the force applied to the trolley.'

Hypothesis of Student **B**:

'Changing the force applied to the trolley will change the acceleration of the trolley.'

0 3 . 1 Consider the hypothesis of student **A**.

Predict what would happen to the acceleration of the trolley if the force applied to the trolley is doubled.

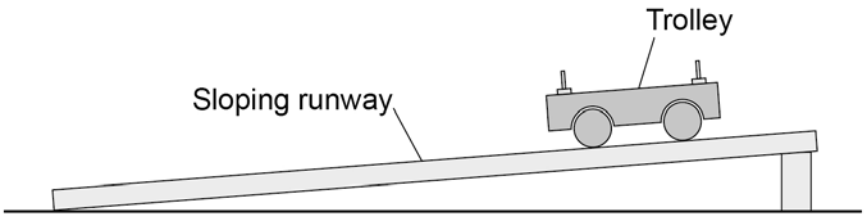
[1 mark]

0 3 . 2 Why is it difficult to make a valid prediction using the hypothesis of student **B**?

[1 mark]

Figure 5 shows some of the equipment used by the students.

Figure 5



0 3 . 3 Write a list of any other equipment the students will need in order to complete the investigation.

[2 marks]

0 3 . 4 Why should the students use a sloping runway?

[1 mark]

Tick **one** box.

To reduce the effect of friction on the trolley. ☐

To decrease the acceleration of the trolley. ☐

To stop the trolley rolling back up the runway. ☐

Question 3 continues on the next page

0 3 . 5 Describe a method the students could have used for their investigation.

[6 marks]

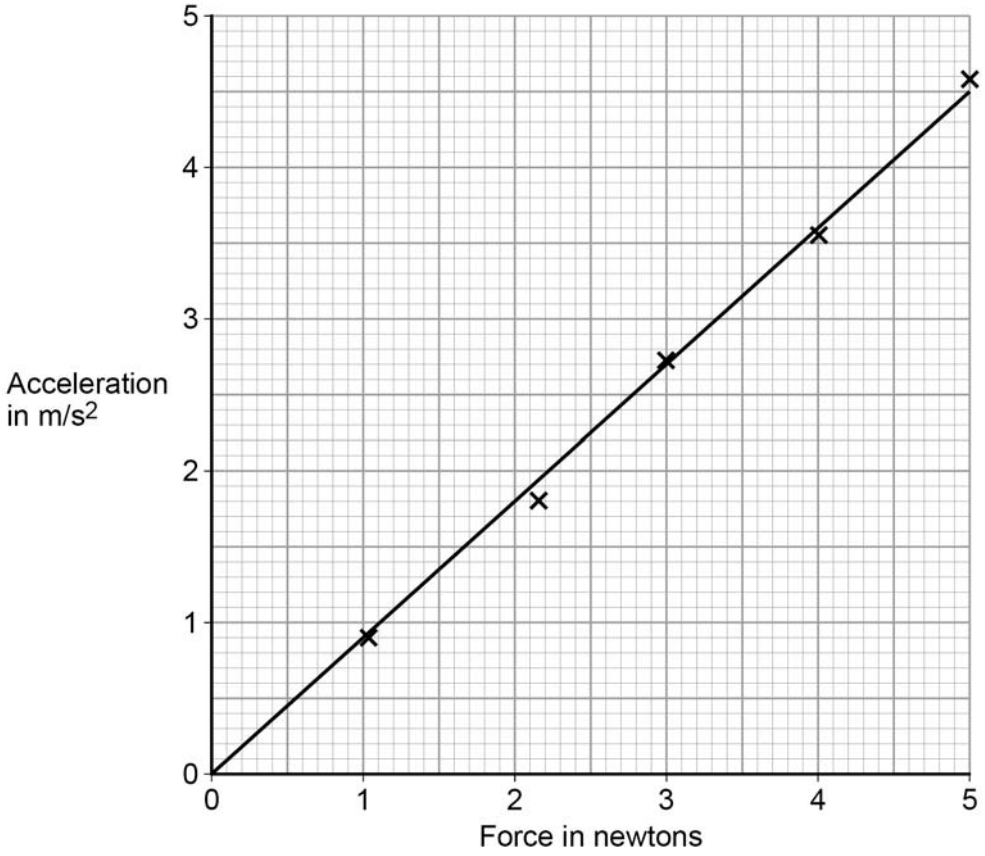
0 3 . 6 The students used the same trolley throughout the investigation.

Suggest why.

[2 marks]

The students' results are shown as a graph in **Figure 6**.

Figure 6



0 3 . 7 Explain why hypothesis **A** gives a better explanation of the results.

[2 marks]

15

Turn over ►

0 4 . 1 Which **one** of the following types of electromagnetic wave has the highest frequency?

[1 mark]

Tick **one** box.

Gamma rays ☐

Infrared ☐

Microwaves ☐

Ultraviolet ☐

0 4 . 2 What makes microwaves suitable for sending communications to a satellite in space?

[1 mark]

0 4 . 3 Scientists have detected short bursts of radio waves emitted from a distant galaxy.

The scientists think that the radio waves may have been emitted from a neutron star.

What event leads to a neutron star forming?

[1 mark]

0 4 . 4 Some of the radio waves from the distant galaxy have a frequency of 1.2 gigahertz (GHz).

Which of the following is the same as 1.2 GHz?

[1 mark]

Tick **one** box.

1.2×10^3 Hz ☐

1.2×10^6 Hz ☐

1.2×10^9 Hz ☐

1.2×10^{12} Hz ☐

0 4 . 5 Radio waves travel through space at a speed of 3.0×10^8 m/s

Calculate the wavelength of the 1.2 GHz radio waves emitted from the distant galaxy.

[3 marks]

Wavelength = _____ m

0 4 . 6 When radio waves are absorbed by an aerial they may create an alternating current in an electrical circuit.

If an alternating current is created what frequency would it have?

[1 mark]

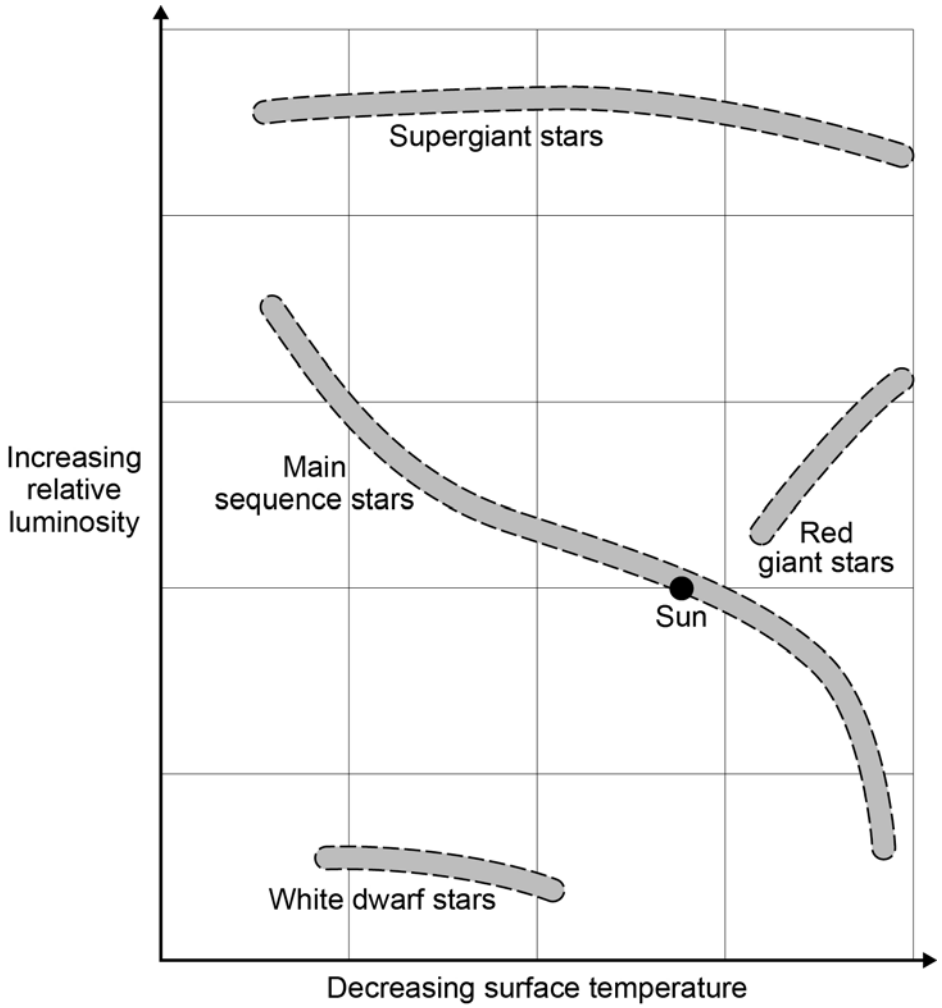
Question 4 continues on the next page

Figure 7 shows four groups of stars.

The surface temperature and relative luminosity determine which group a star is in.

A star with a relative luminosity of 1 emits the same amount of energy every second as the Sun.

Figure 7



0 4 . 7 The Sun is in the group of main sequence stars. These stars are stable.

Explain why a star remains stable.

[2 marks]

0 4 . 8 At different points in their lifecycle stars change from one group to another.

Describe what will happen to the Sun between it leaving the main sequence group and becoming a white dwarf.

Use information from **Figure 7**.

[4 marks]

14

Turn over for the next question

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

0 5 Momentum is a vector quantity.

0 5 . 1 How is a vector quantity different to a scalar quantity?

[1 mark]

0 5 . 2 Name another vector quantity.

[1 mark]

0 5 . 3 Give the definition of momentum.

[1 mark]

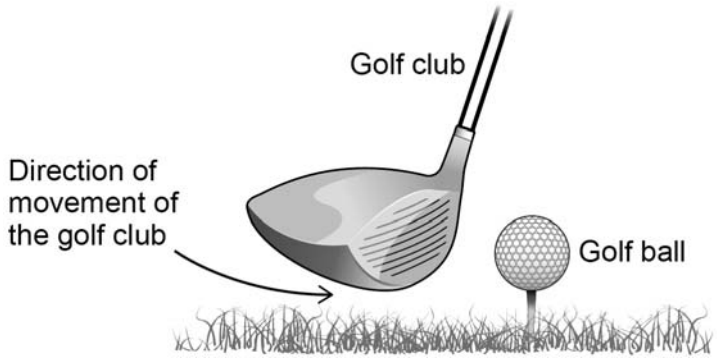
0 5 . 4 What is the unit of momentum?

[1 mark]

Question 5 continues on the next page

0 5 . 5 **Figure 8** shows a golf club about to hit a stationary golf ball.

Figure 8



The golf club is in contact with the golf ball for 1.8 ms and exerts a force of 1500 N on the golf ball.

The mass of the golf ball is 0.045kg

Calculate the velocity of the golf ball as it leaves the golf club.

Use the Physics Equations Sheet.

[4 marks]

Velocity = _____ m/s

0 5 . 6 When hitting the golf ball the golfer swings the golf club to keep it in contact with the golf ball for as long as possible.

The force acting on the golf ball is constant during this time.

Explain the effect that the time of contact between the golf club and the golf ball has on the distance the golf ball travels.

[4 marks]

12

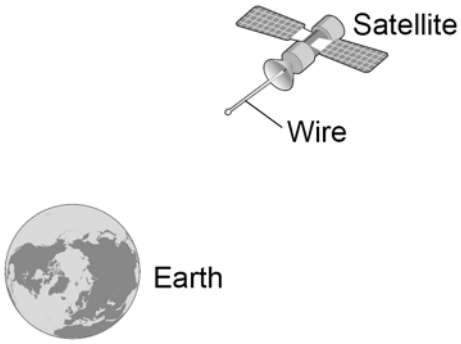
Turn over for the next question

0 6 Scientists have used a satellite system to investigate the idea of generating electricity in space.

As the system orbited the Earth a 20 km copper wire was reeled out.

Before the wire snapped a current of 1 amp was induced in the wire.

Figure 9



0 6 . 1 What provides the force needed to keep a satellite in orbit around the Earth?

[1 mark]

0 6 . 2 Explain how a current is induced in the wire.

[3 marks]

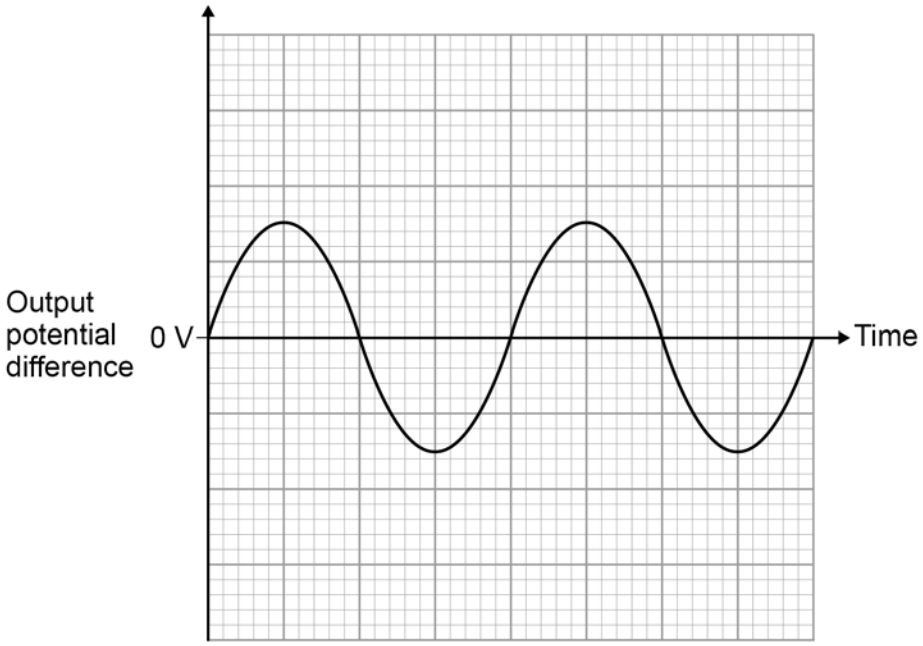
Question 6 continues on the next page

An alternator is connected to a data logger.

The data logger is connected to a computer.

Figure 10 shows how the output potential difference of the alternator varies with time.

Figure 10



0 6 . 3 The coil inside the alternator now rotates at twice the frequency.

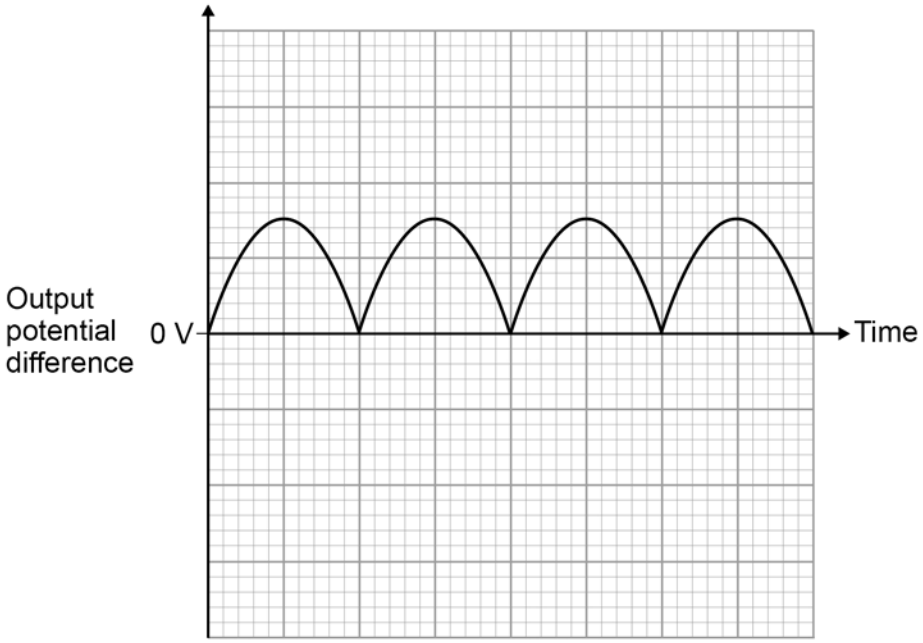
Draw on **Figure 10** to show how the output potential difference varies with time at this new frequency.

[2 marks]

Another type of generator is now connected to the data logger and computer.

Figure 11 shows how the output potential difference varies with time for this generator.

Figure 11



0 6 . 4 What name is given to this second type of generator?

[1 mark]

0 6 . 5 Look at **Figure 10** and **Figure 11**.

Give **one** difference between the outputs from the two types of generator.

[1 mark]

Question 6 continues on the next page

0 6 . 6 The charger used to charge the battery inside a laptop computer contains a small transformer.

The charger plugs into the mains electricity supply.

mains electricity supply = 230 V

number of turns on the primary coil of the transformer = 690

number of turns on the secondary coil of the transformer = 57

Calculate the potential difference applied by the charger across the battery inside the computer.

Use the Physics Equations Sheet.

[3 marks]

Potential difference = _____ V

11

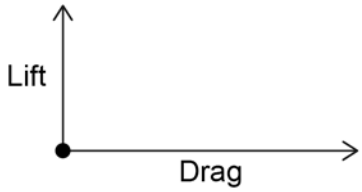
0 7 . 1 **Figure 12** shows an aircraft flying at a constant velocity and at a constant height above the ground.

Figure 12

Complete the free body diagram in **Figure 13** to show the other two forces acting on the aircraft.

[2 marks]

Figure 13



0 7 . 2 A small aircraft accelerated down a runway at 4.0 m/s^2

The aircraft started from rest and reached a speed of 34 m/s just before take-off.

Calculate the distance the aircraft travelled while accelerating.

Give your answer to 2 significant figures.

Use the Physics Equations Sheet.

[4 marks]

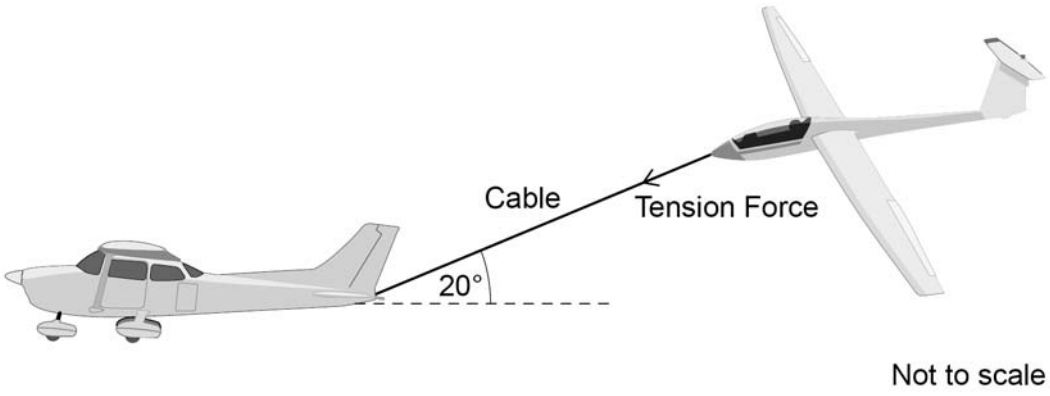
Distance = _____ m

Question 7 continues on the next page

Turn over ►

0 7 . 3 **Figure 14** shows the small aircraft being used to tow a glider.

Figure 14



The tension force in the cable can be resolved into a horizontal component and a vertical component.

The tension in the cable is 2000 N

The cable makes an angle of 20° with the horizontal.

Draw a vector diagram to determine the magnitude of the two components of the tension force in the cable.

[4 marks]

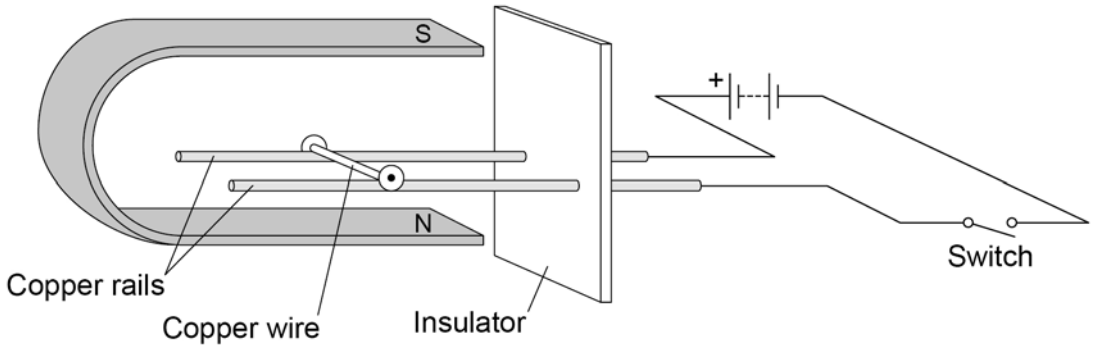
Magnitude of the horizontal component = _____ N

Magnitude of the vertical component = _____ N

10

0 8 . 1 **Figure 15** shows one way that the motor effect can be demonstrated.

Figure 15



When the switch is closed the copper wire moves.

Describe how the direction that the copper wire will move can be predicted using Fleming's Left Hand rule.

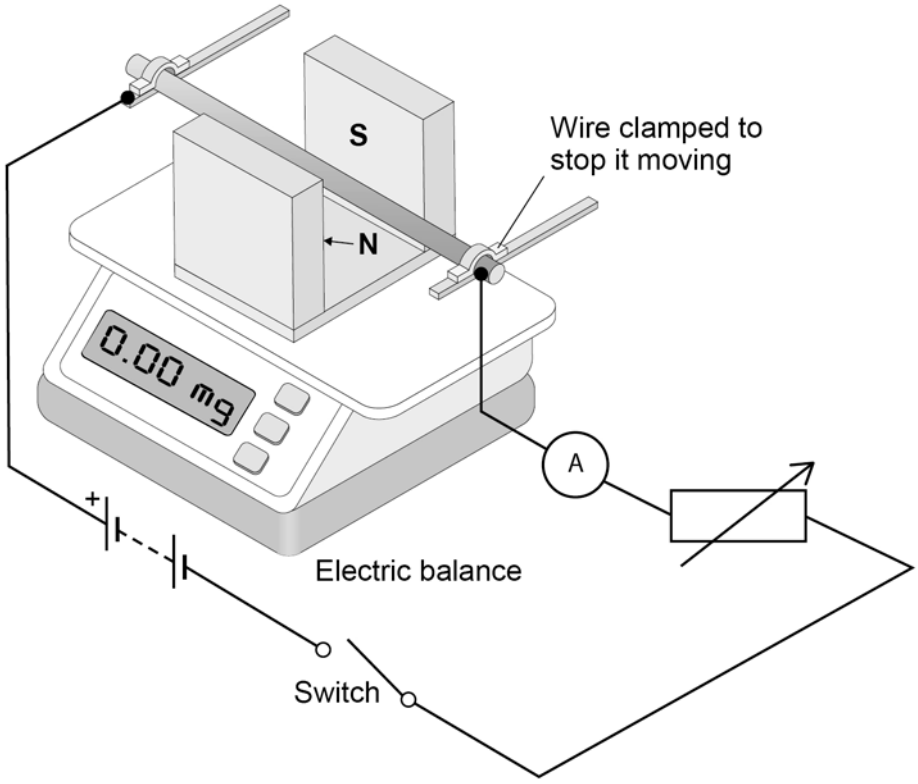
[4 marks]

Question 8 continues on the next page

Figure 16 shows the apparatus a student used to measure the force acting on a conducting wire in a magnetic field.

The wire is clamped to stop it moving.

Figure 16



This is the method used.

1. The student set the reading on the balance to zero.

2. The student closed the switch and recorded the new balance reading.

3. The student then repeated the procedure three more times. Each time the current was kept the same.

0 8 . 2 The four balance readings taken by the student are given in the box.

0.21	0.23	0.25	0.23

Estimate the uncertainty in the balance readings taken by the student.

Show how you estimate the uncertainty.

[2 marks]

Uncertainty = ± _____ mg

Question 8 continues on the next page

0 8 . 3 The student changed the current in the wire and recorded the new balance reading.

Table 1 shows all of the data recorded by the student.

Table 1

Current in the wire	2.2 A
Balance reading	0.40 g
Magnetic flux density	0.030 T
Gravitational field strength	9.8 N/kg

Calculate the length of the wire in the magnetic field.

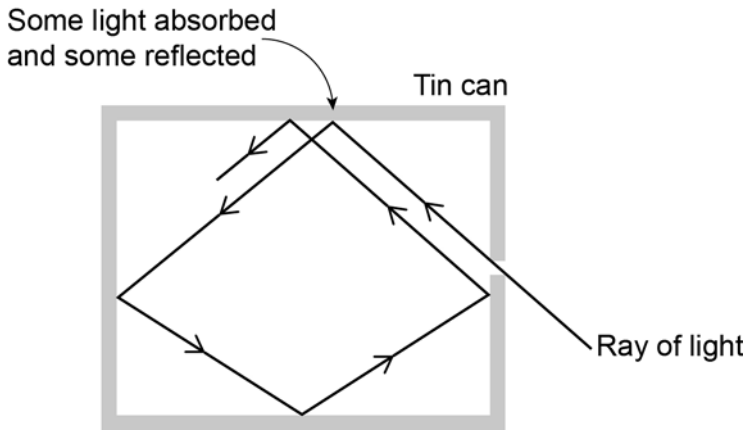
[5 marks]

Length of wire = _____ m

11

0 9 **Figure 17** shows what happens when a ray of light enters a tin can through a small hole.

Figure 17



0 9 . 1 Explain why the small hole looks black.

[2 marks]

0 9 . 2 All objects absorb and emit radiation.

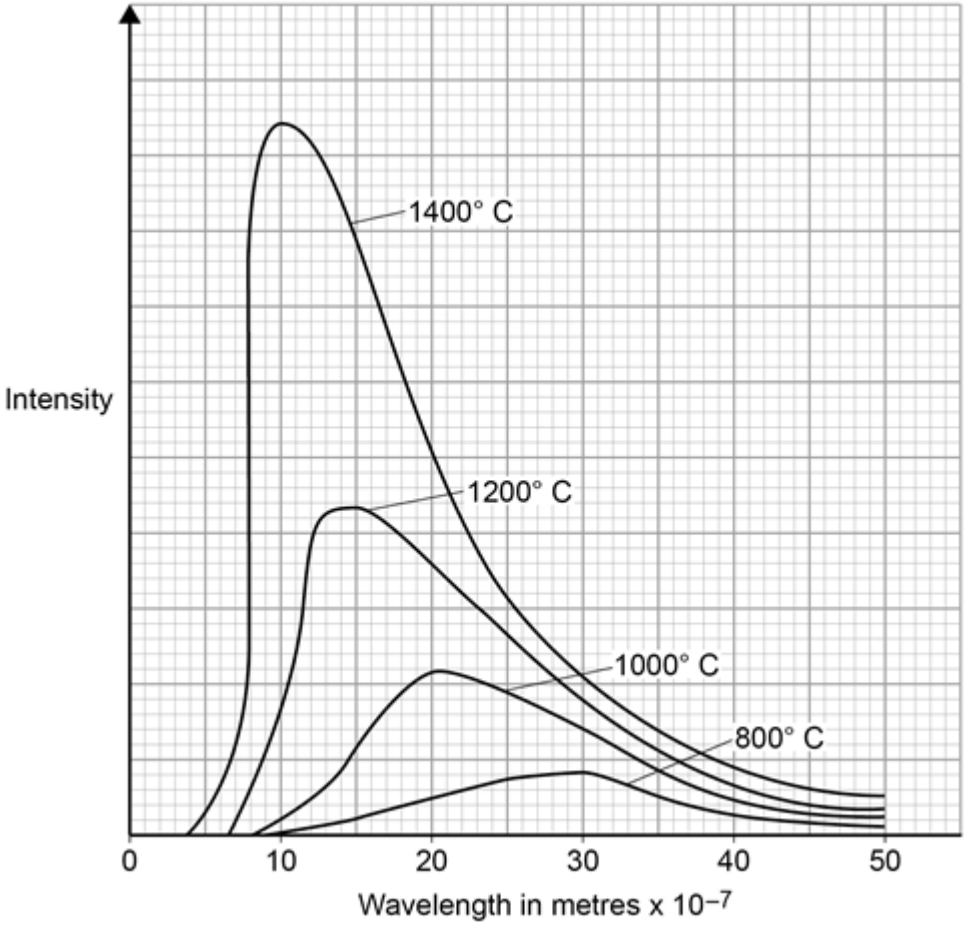
What is meant when an object is described as a perfect black body?

[1 mark]

Question 9 continues on the next page

Figure 18 shows how the intensity of different wavelengths of radiation from a hot object varies with temperature.

Figure 18



0 9 . 3 What can be concluded from **Figure 18** about how the distribution of the intensity of radiation from an object changes as the temperature of the object increases?

[3 marks]

0 9 . 4 The wavelength at which the Sun emits the maximum intensity of radiation is approximately 5×10^{-7} m

Estimate the surface temperature of the Sun.

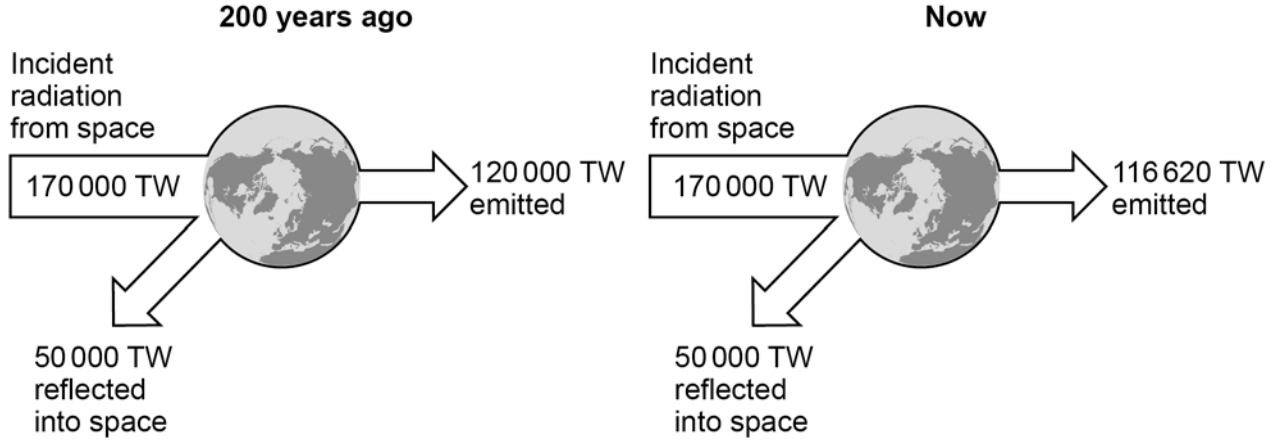
Use **Figure 18**.

[1 mark]

Question 9 continues on the next page

0 9 . 5 **Figure 19** shows how the balance between the incident radiation from space and the radiation emitted by the Earth into space has changed over the last 200 years.

Figure 19



Explain how the temperature of the Earth and its atmosphere has changed over the last 200 years.

Use the information in **Figure 19**.

[3 marks]

10

END OF QUESTIONS