



Motor Effect

Questions

Name: _____

Class: _____

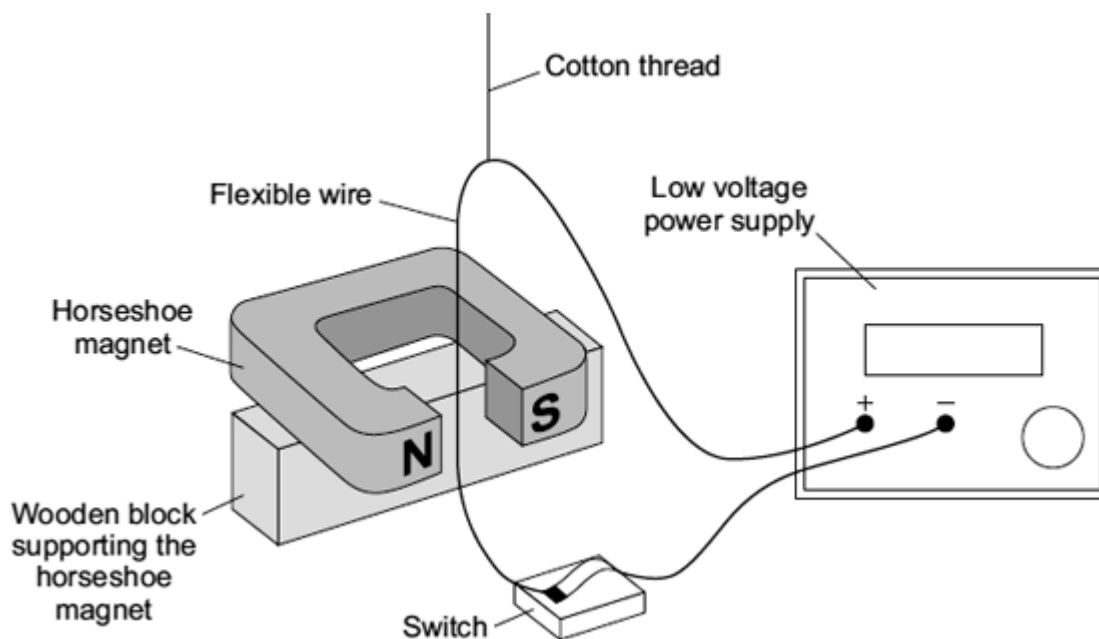
Date: _____

Time: **67 minutes**

Marks: **67 marks**

Comments:

- 1 (a) A laboratory technician sets up a demonstration.



A flexible wire is suspended between the ends of a horseshoe magnet. The flexible wire hangs from a cotton thread. When the switch is closed, the wire kicks forward.

Identify the effect which is being demonstrated.

(1)

- (b) A teacher makes some changes to the set-up of the demonstration.

What effect, if any, will each of the following changes have?

- (i) more powerful horseshoe magnet is used.

(1)

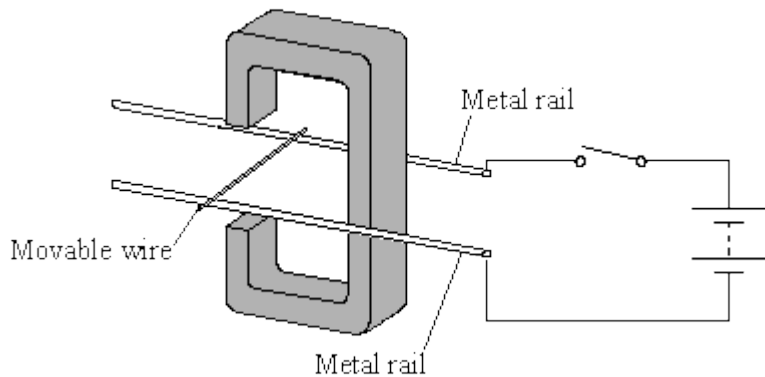
- (ii) The connections to the power supply are reversed.

(1)

(Total 3 marks)

2

The diagram shows apparatus used to demonstrate the electric motor effect. When the switch is closed the wire moves.



(i) Draw an arrow on the diagram to show the direction the wire moves.

(1)

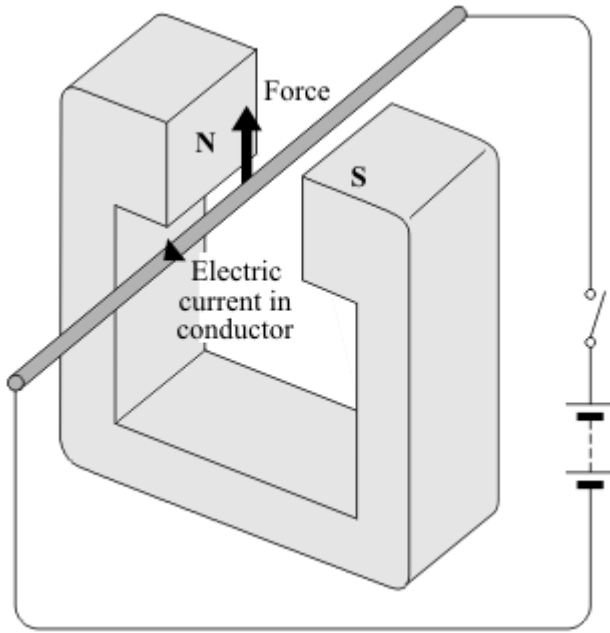
(ii) Explain why the wire moves.

(2)

(Total 3 marks)

3

When a conductor carrying an electric current is placed in a magnetic field a force may act on it.



(a) State **two** ways in which this force can be increased.

1. _____
2. _____

(2)

(b) State **two** ways in which this force can be made to act in the opposite direction.

1. _____
2. _____

(2)

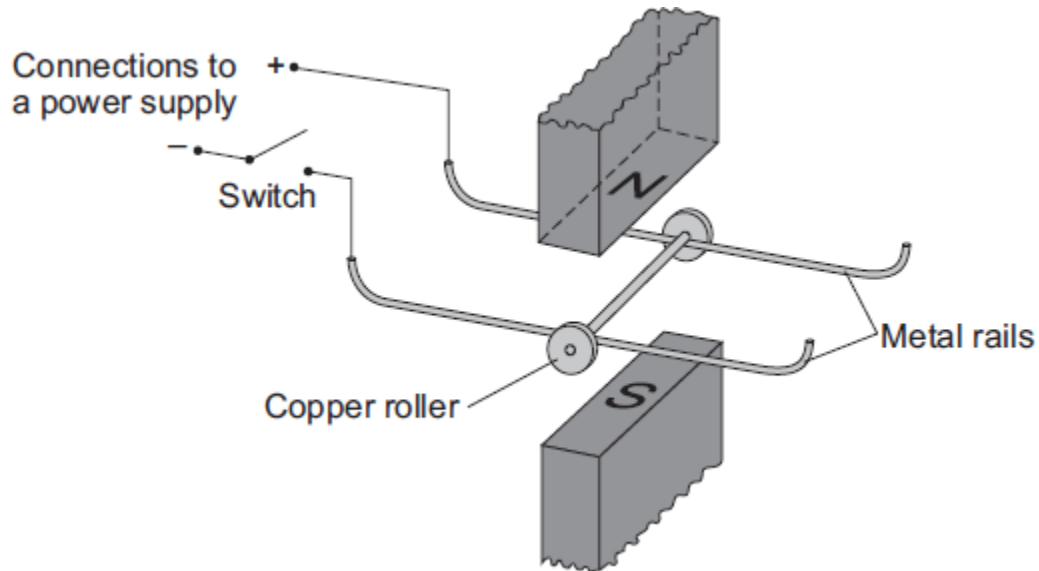
(c) In what circumstance will **no** force act on a conductor carrying an electric current and in a magnetic field?

(1)

(Total 5 marks)

4

- (a) A science technician sets up the apparatus shown below to demonstrate the motor effect. He uses a powerful permanent magnet.



The copper roller is placed across the metal rails. When the switch is closed, the copper roller moves to the right.

- (i) Complete the sentence by drawing a ring around the correct line in the box.

This happens because copper is

- | |
|---|
| <p>an electrical conductor.</p> <p>an electrical insulator.</p> <p>a magnetic material.</p> |
|---|

(1)

- (ii) Suggest **one** change that the technician can make which will cause the copper roller to move faster.

(1)

- (iii) Suggest **two** changes which the technician can make, each of which will separately cause the copper roller to move to the left.

1. _____

2. _____

(2)

(b) Many electrical appliances, such as vacuum cleaners, drills and CD players, contain electric motors. As more electrical appliances are developed, more electricity needs to be generated. Generating electricity often produces pollutant gases.

(i) Complete the sentence by drawing a ring around the correct line in the box.

Generating more electricity to power the increasing number of electrical

appliances used raises

an ethical
an environmental
a political

 issue.

(1)

(ii) The number of electrical appliances used in the world's richest countries is increasing yet many people in the world's poorest countries have no access to electricity.

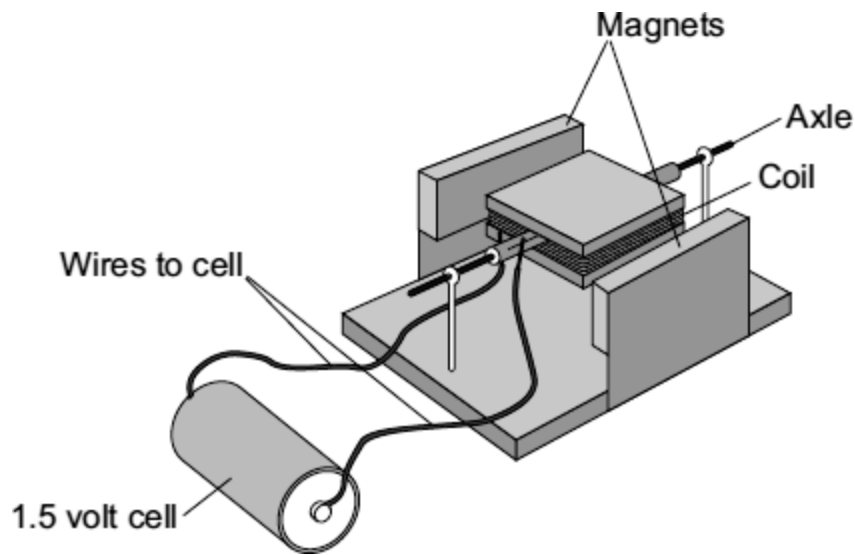
What type of issue does this inequality between people in different countries raise?

(1)

(Total 6 marks)

5

(a) Complete the description of the device shown below by drawing a ring around the correct line in each box.



(i) The device is being used as

an electric motor.
a generator.
a transformer.

(1)

(ii) The coil needs a flick to get started. Then one side of the coil is pushed by the

cell
coil
force

and the other side is pulled, so that the coil spins.

(1)

(b) Suggest **two** changes to the device, each one of which would make the coil spin faster.

1. _____

2. _____

(2)

(c) Suggest **two** changes to the device, each one of which would make the coil spin in the opposite direction.

1. _____

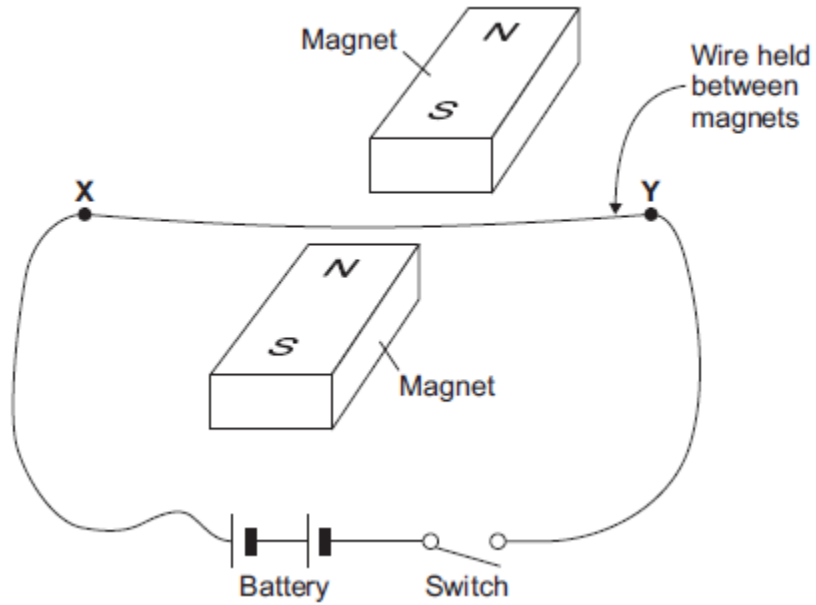
2. _____

(2)

(Total 6 marks)

6

The diagram shows apparatus set up by a student.



Closing the switch creates a force that acts on the wire **XY**.

(a) (i) Explain why a force acts on the wire **XY** when the switch is closed.

(3)

(ii) The force causes the wire **XY** to move.
 Draw an arrow on the diagram above to show the direction in which the wire **XY** will move.

(1)

(iii) State the effect that this experiment demonstrates.

(1)

- (b) The student replaced the battery with a low frequency alternating current (a.c.) power supply.

The student closed the switch.

- (i) Describe the movement of the wire.

(1)

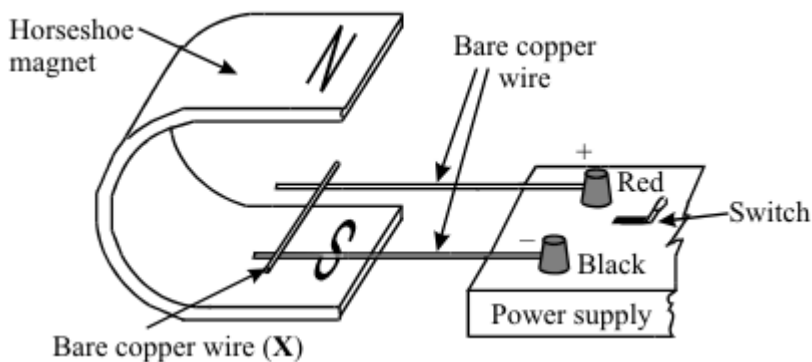
- (ii) Give a reason for your answer to part (i).

(1)

(Total 7 marks)

7

The diagram shows apparatus used to demonstrate the motor effect. **X** is a short length of bare copper wire resting on two other wires.



- (a) (i) Describe what happens to wire **X** when the current is switched on.

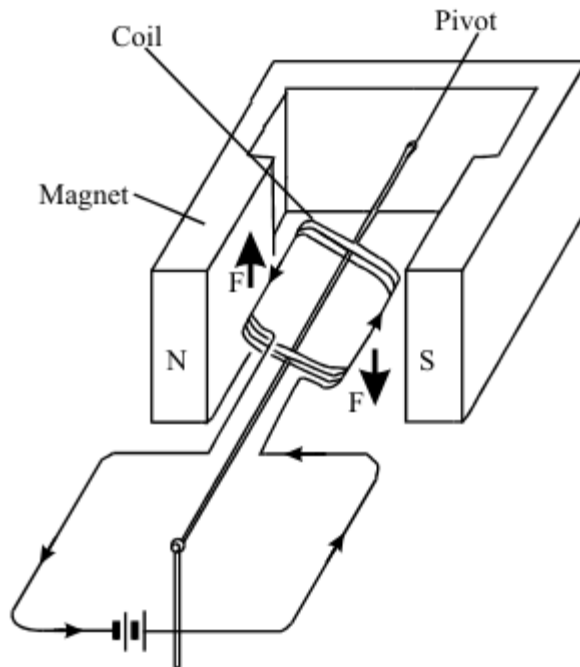
(ii) What difference do you notice if the following changes are made?

A The magnetic field is reversed.

B The current is increased.

(3)

(b) The diagram shows a coil placed between the poles of a magnet. The arrows on the sides of the coil itself show the direction of the conventional current.



The arrows labelled **F** show the direction of the forces acting on the sides of the coil. Describe the motion of the coil until it comes to rest.

(3)

(c) Most electric motors use electromagnets instead of permanent magnets. State three of the features of an electromagnet which control the strength of the magnetic field obtained.

1. _____

2. _____

3. _____

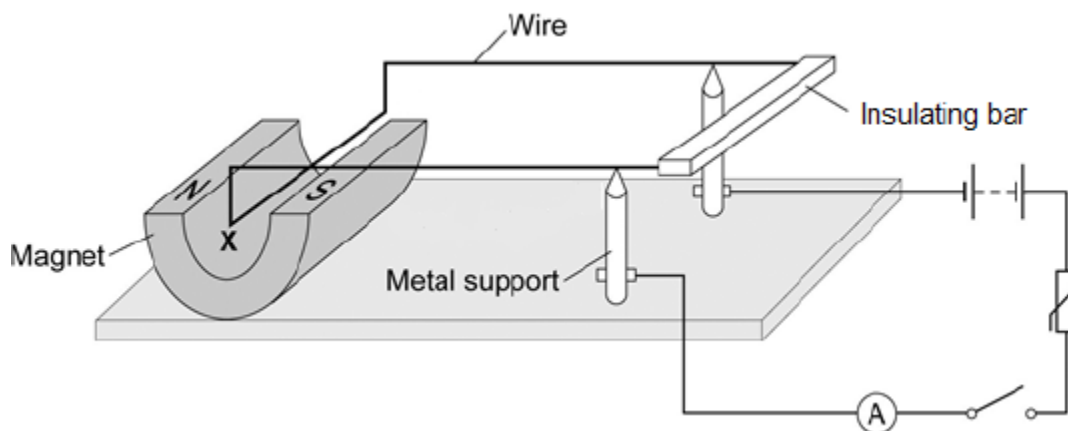
(3)

(Total 9 marks)

8

Figure 1 shows a piece of apparatus called a current balance.

Figure 1



When the switch is closed, the part of the wire labelled X experiences a force and moves downwards.

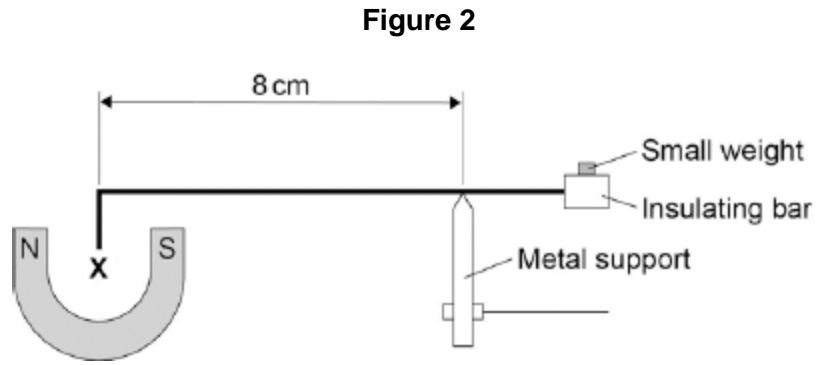
(a) What is the name of the effect that causes the wire X to move downwards?

(1)

(b) Suggest one change you could make to the apparatus in Figure 1 that would increase the size of the force that wire X experiences.

(1)

- (c) **Figure 2** shows how a small weight placed on the insulating bar makes the wire **X** go back and balance in its original position.



The wire **X** is 5 cm long and carries a current of 1.5 A.

The small weight causes a clockwise moment of 4.8×10^{-4} Nm.

Calculate the magnetic flux density where the wire **X** is positioned

Give the unit.

Magnetic flux density = _____ Unit _____

(6)
(Total 8 marks)

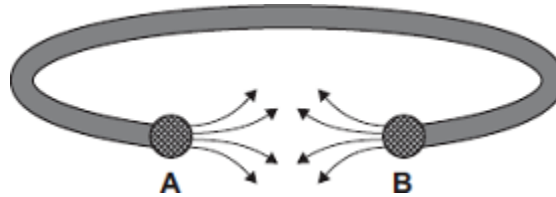
9

- (a) Some people wear magnetic bracelets to relieve pain.

Figure 1 shows a magnetic bracelet.

There are magnetic poles at both **A** and **B**.
Part of the magnetic field pattern between **A** and **B** is shown.

Figure 1



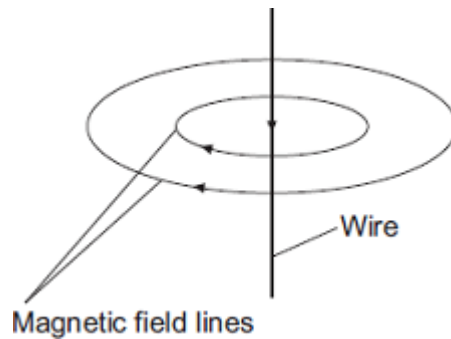
What is the pole at **A**? _____

What is the pole at **B**? _____

(1)

- (b) **Figure 2** shows two of the lines of the magnetic field pattern of a current-carrying wire.

Figure 2



The direction of the current is reversed.

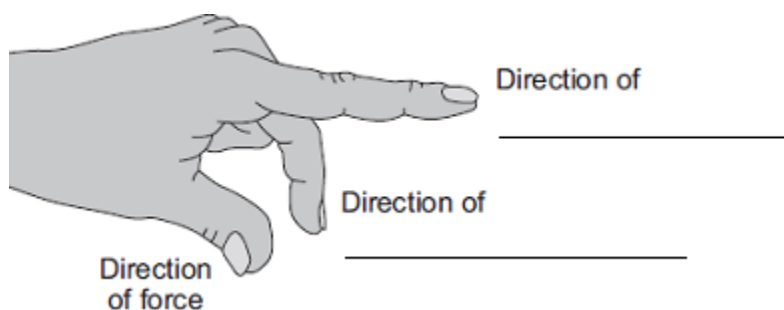
What happens to the direction of the lines in the magnetic field pattern?

(1)

(c) Fleming's left-hand rule can be used to identify the direction of a force acting on a current-carrying wire in a magnetic field.

(i) Complete the labels in **Figure 3**.

Figure 3

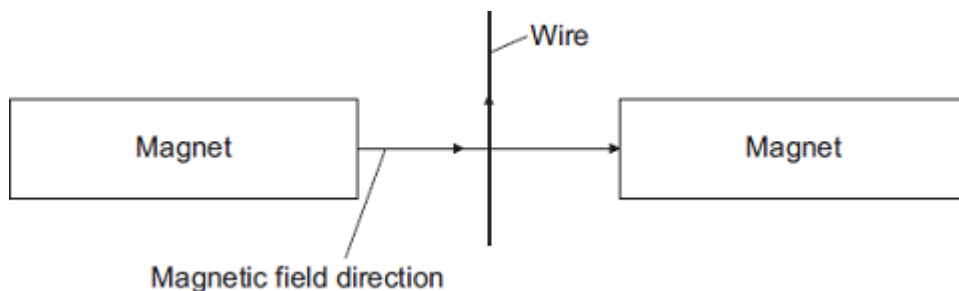


(2)

(ii) **Figure 4** shows:

- the direction of the magnetic field between a pair of magnets
- the direction of the current in a wire in the magnetic field.

Figure 4



In which direction does the force on the wire act?

(1)

(iii) Suggest **three** changes that would **decrease** the force acting on the wire.

1. _____

2. _____

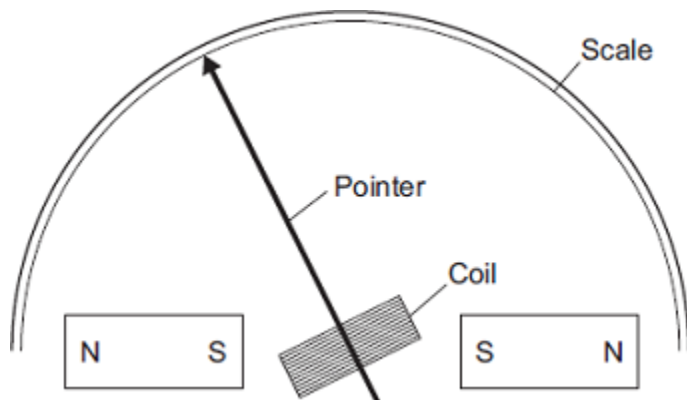
3. _____

(3)

(d) **Figure 5** shows part of a moving-coil ammeter as drawn by a student.

The ammeter consists of a coil placed in a uniform magnetic field. When there is a current in the coil, the force acting on the coil causes the coil to rotate and the pointer moves across the scale.

Figure 5



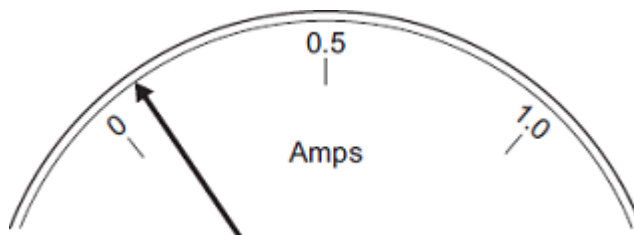
(i) The equipment has **not** been set up correctly.

What change would make it work?

(1)

(ii) **Figure 6** shows the pointer in an ammeter when there is no current.

Figure 6



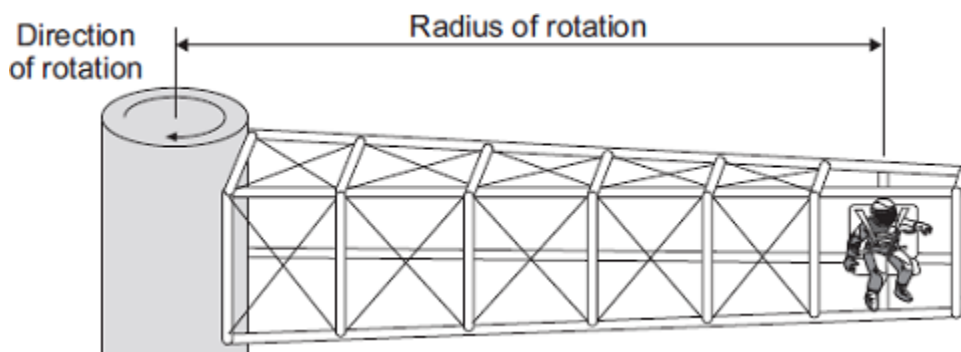
What type of error does the ammeter have?

(1)

(Total 10 marks)

10

The diagram shows a 'G-machine'. The G-machine is used in astronaut training.

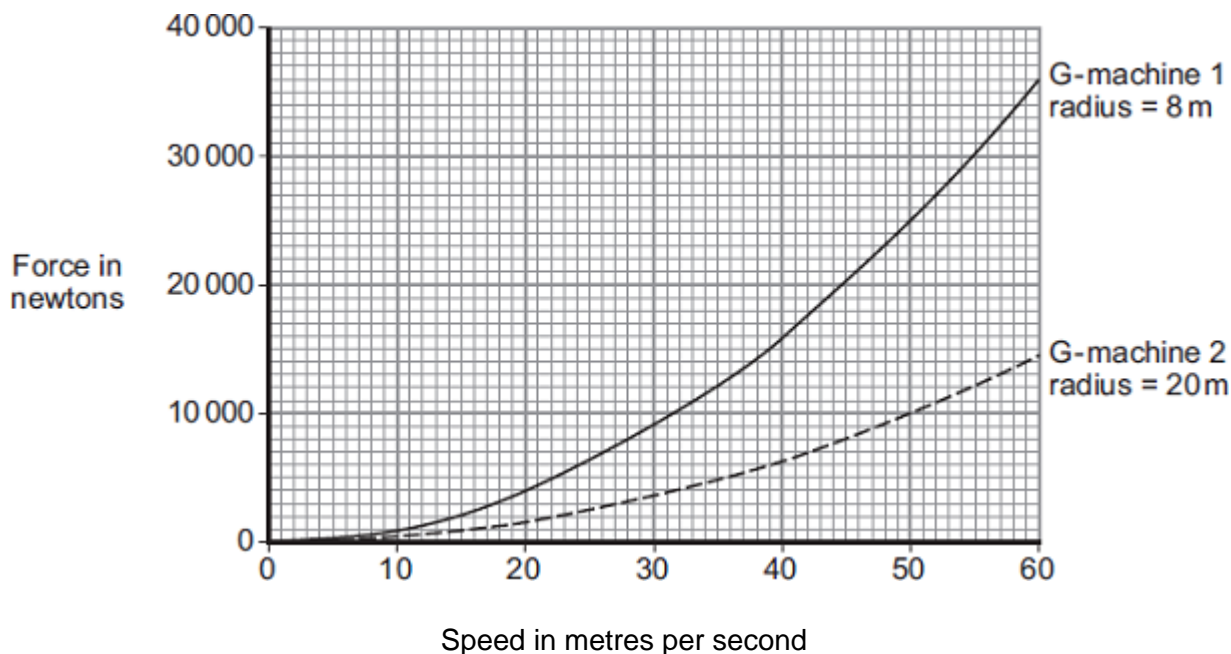


The G-machine moves the astronaut in a horizontal circle.

(a) The force causing the astronaut to move in a circle is measured.

The graph shows how the speed of the astronaut affects the force causing the astronaut to move in a circle for two different G-machines.

The radius of rotation of the astronaut is different for each G-machine.



(i) State **three** conclusions that can be made from the graph.

1. _____
- _____
2. _____
- _____
3. _____
- _____

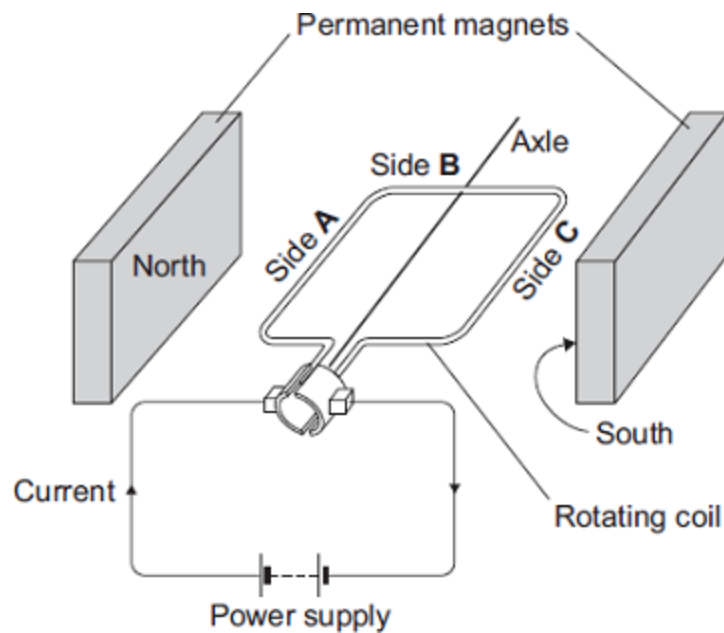
- (ii) The speed of rotation of G-machine 1 is increased from 20 m/s to 40 m/s.

Determine the change in force on the astronaut.

Change in force = _____ N

(1)

- (b) Each G-machine is rotated by an electric motor. The diagram shows a simple electric motor.



- (i) A current flows through the coil of the motor.

Explain why side **A** of the coil experiences a force.

(2)

- (ii) Draw arrows on the diagram to show the direction of the forces acting on side **A** of the coil and side **C** of the coil.

(1)

(iii) When horizontal, side **B** experiences no force.

Give the reason why.

(1)

(c) While a G-machine is rotating, the operators want to increase its speed.

What can the operators do to make the G-machine rotate faster?

(1)

(d) The exploration of space has cost a lot of money.

Do you think spending lots of money on space exploration has been a good thing?

Draw a ring around your answer.

Yes

No

Give a reason for your answer.

(1)

(Total 10 marks)