O Level Pure Physics

Electromagnetism Test 1.0

Q1

Fig. 8.1 shows a simple experimental set-up to study the motion of a motor. **AB** and **CD** are solenoids connected to a battery. **F** and **G** are connected to an external d.c. voltage supply.

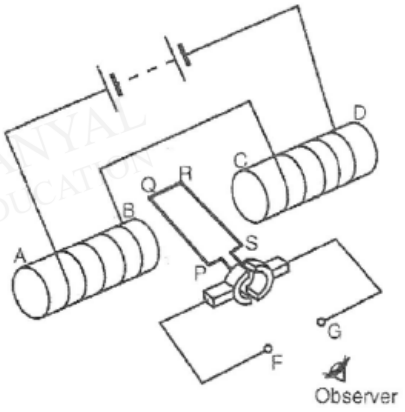

Fig. 8.1

(a) State the polarity of the solenoids

(i) at B,

..... [1]

(ii) at C.

..... [1]

(b) If the direction of rotation of the coil **PQRS** as seen by the observer is in the **clockwise direction**, state whether **F** or **G** is connected to a positive terminal.

..... [1]

(c) Suggest two ways that can be done to have the coil PQRS turn in the anti-clockwise direction.

1. .....

.....

2. .....

..... [2]

(d) The coil rotates continuously when the split-ring commutator is used. Explain why.

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.....

..... [2]

Q2

Fig. 7.1 shows the structure of a circuit-breaker that uses an electromagnet. The circuit-breaker operates when the current is greater than 10 A.

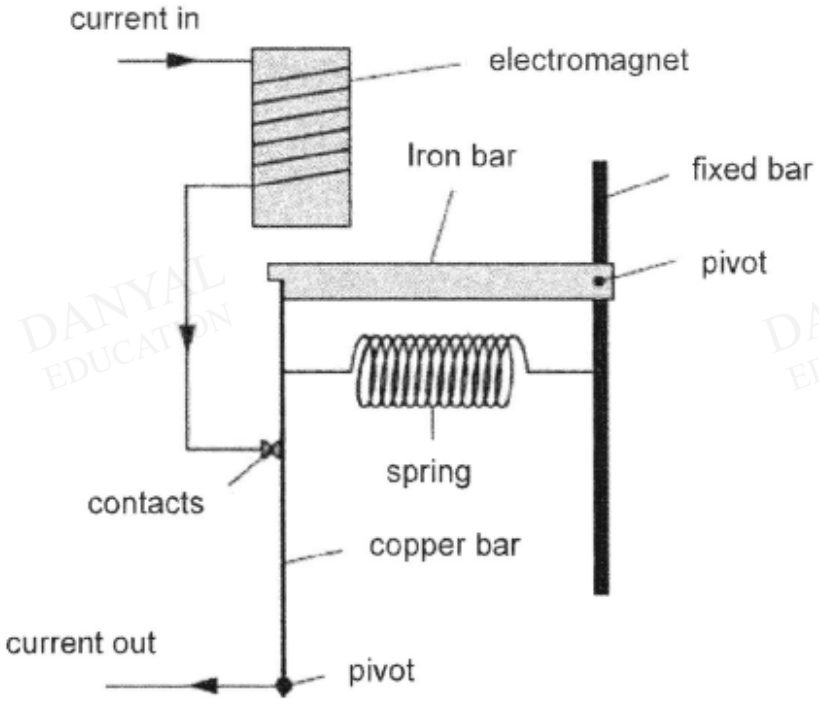


Fig. 7.1

(a) On Fig. 7.1, label the poles (N & S) induced on both ends of the electromagnet. [1]

(b) Describe and explain how the circuit breaker works.

[3]

(c) Suggest how the electromagnet can be altered so that the circuit-breaker stops the current at less than 10 A. Explain your answer.

[2]

Q3

A student builds a motor which consists of a coil **ABCD**, two metal rings and two magnets. The two ends of the coil are soldered to the two metal rings as shown in Fig. 12.1.

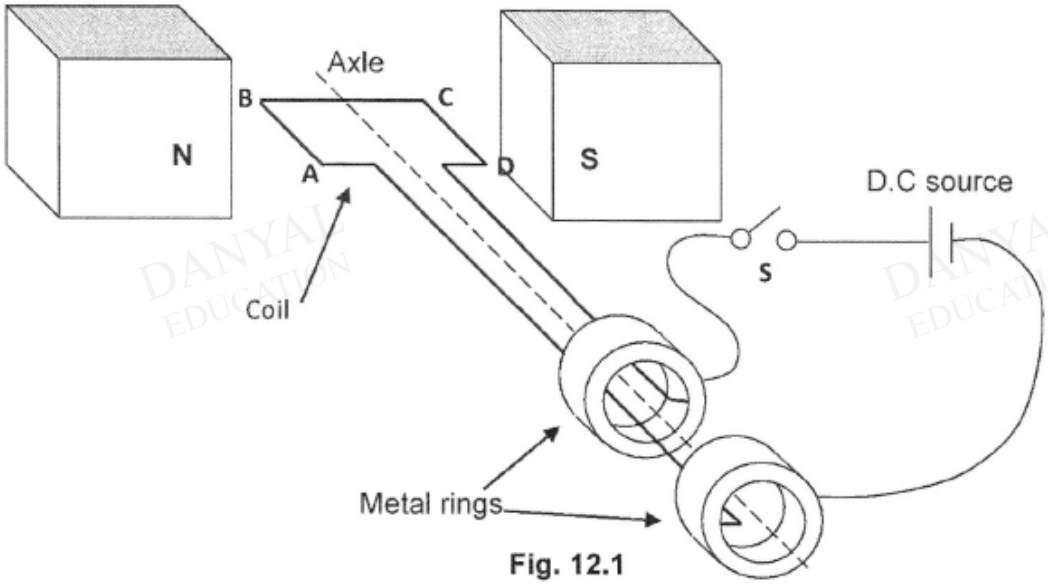


Fig. 12.1

(a) (i) Fig. 12. 1 shows the front view of the design of the motor. On Fig.12.1, draw the direction of the force acting on wire parts **AB** and **CD** when switch **S** is closed. **[1]**

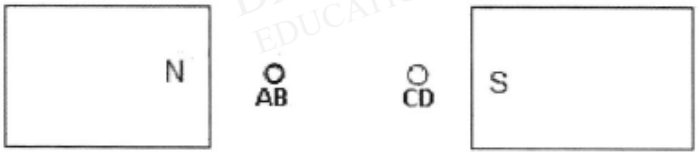


Fig. 12.2

(ii) Hence, state the direction in which the motor turns when switch **S** is closed. **[1]**

(iii) It is observed that due to momentum, the coil moves to the position as shown in Fig. 12.3. On Fig. 12.3, draw the direction of the force acting on wire parts **AB** and **CD**. **[1]**

Fig. 12.3

(iv) There is a fault with the design of this motor set up by the student. Explain what is wrong with the set up. **[1]**

(v) State a solution and explain briefly how it can help to rectify the motor's design. **[2]**

Q4

Fig. 11.1 shows a setup used to investigate motor effect.

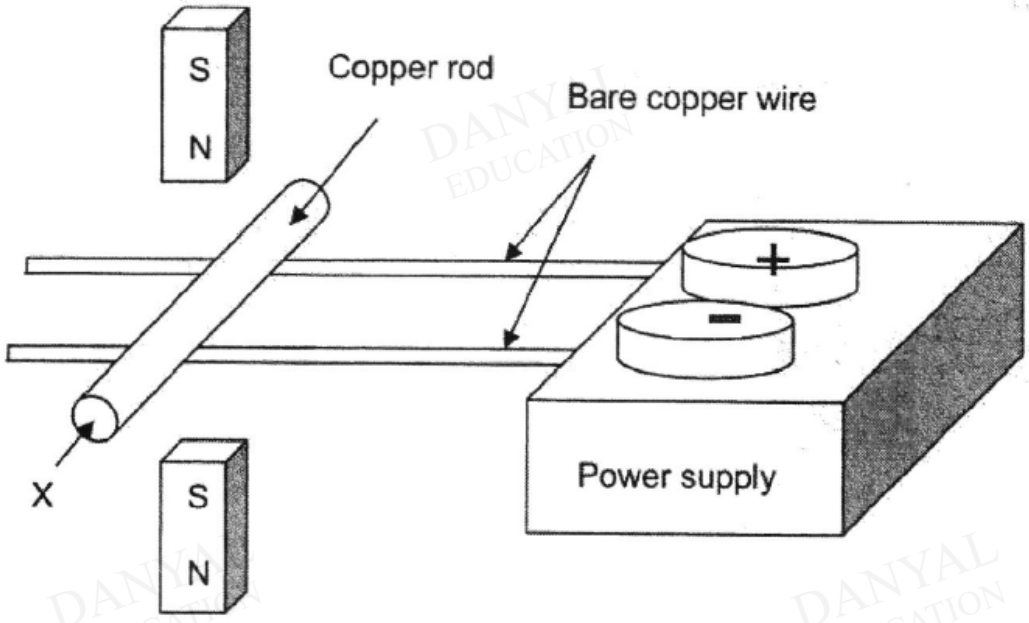


Fig. 11.1

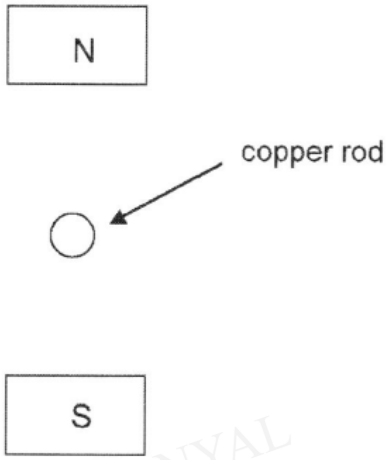
(a) Describe and explain what happens to the copper rod when the current is switched on.

.....

.....

.....[2]

(b) Sketch a drawing showing the magnetic field between the two magnets, looking from point X in **Fig. 11.1** when the power supply is switched on. Indicate also the direction of current flow in the copper rod. [3]



(c) Explain what happens when a 50 Hz alternating current is used in the power supply instead of a direct current.

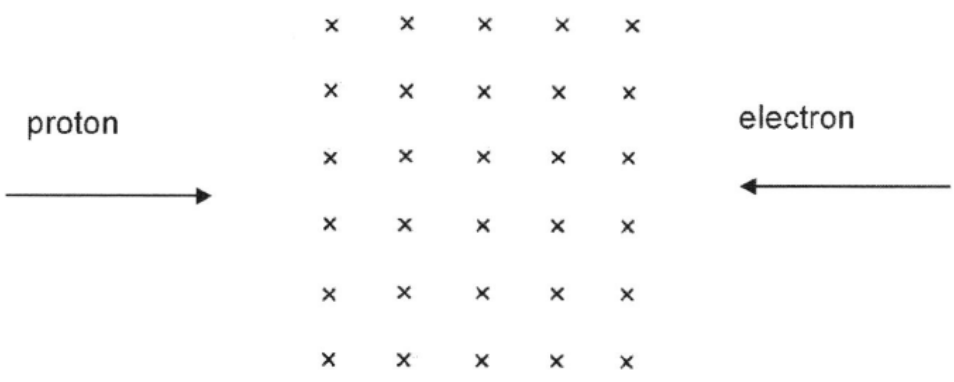
.....

.....

.....

.....[2]

(d) A stream of protons and electrons enters a magnetic field in opposite directions and from the centre of the sides of the field. Draw the expected path of the protons and electrons, ignoring the attractive forces between the two particles. [3]



Q5

A magnetic relay uses a small circuit to control a larger circuit. Fig. 7.1 shows a simple magnetic relay, together with three contacts X, Y and Z, used to control the operation of two lamps L_1 and L_2.

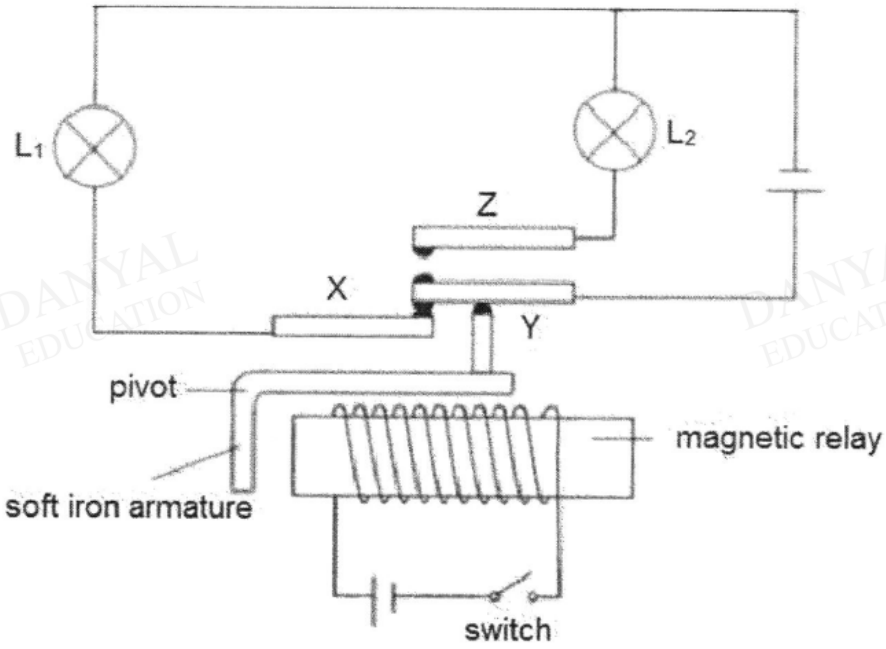


Fig 7.1

The switch is closed.

(a) On Fig. 7.1, draw the magnetic field around the magnetic relay. [2]

(b) Describe the changes that occur in L_1 and L_2.

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.....

.....

.....[3]

Answers

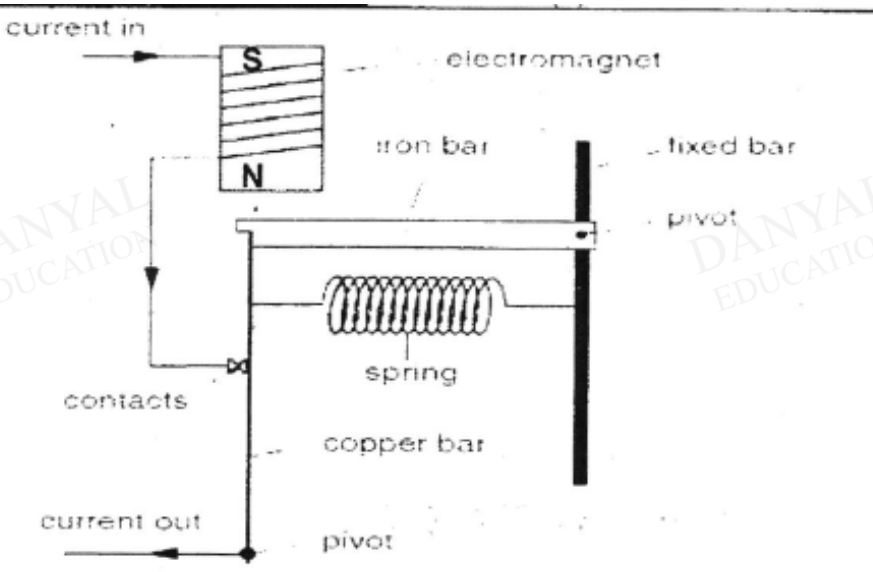
Electromagnetism Test 1.0

Q1

ai	B is north pole. [A1]
aii	C is south pole. [A1]
b	G is connected to the positive terminal. [A1]
c	1. reverse polarity of E, 2. wind the solenoids differently from the given to give a S pole on the left and N pole on the right 3. reverse the polarity at F or G Any correct 2 ways – [A1] mark each
d	The split-ring allows the current direction in the coil to be reversed for every half rotation. [A1] By Fleming's Left Hand Rule, an upward force always acts on the left side and a downward force always acts on the right side of the coil since the current direction is the same on each side. [B1] This allows the coil to rotate continuously in one direction.

Q2

(a)



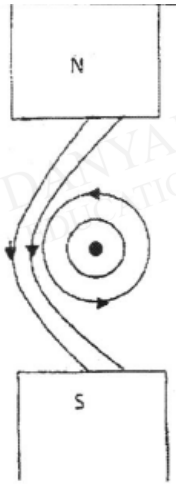
[1]

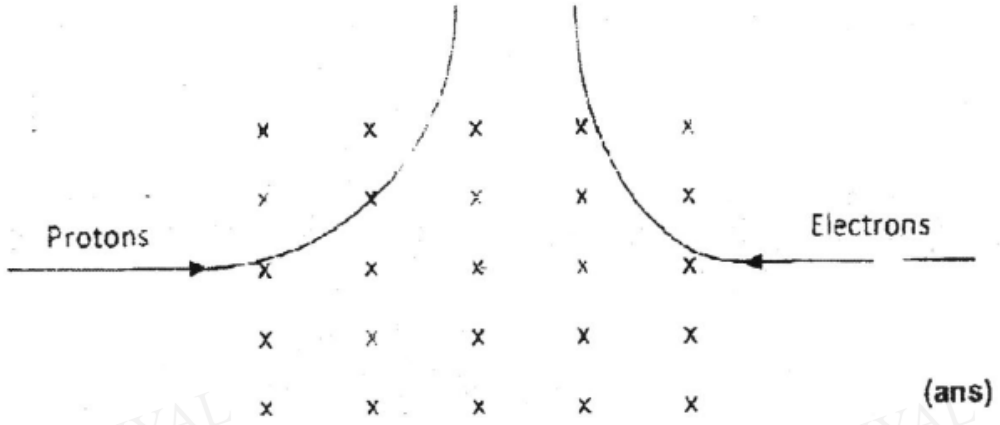
(b)	When the current is greater than 10 A, the electromagnet becomes strongly magnetised and attracts the iron bar upwards. The spring pulls the copper bar, breaking the contacts. The circuit is now open and the current stops flowing.	[1] [1] [1]
(c)	Increase the number of turns in the coil. This will increase the attractive force acting on the iron bar when the current is less 10 A. (accept other answers involving force on the iron bar)	[1] [1]

Q3

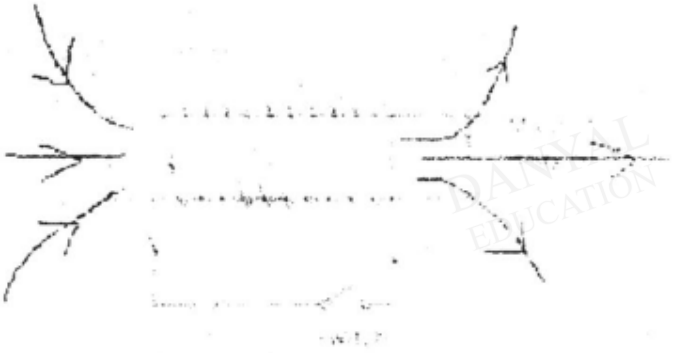
(a) (i)	Use ruler to draw arrow to indicate AB up and CD down	B1
(ii)	Clockwise direction	B1
(iii)	Use ruler to draw arrow to indicate AB up and CD down	B1
(iv)	The rectangular coil will only swing in a clockwise manner and turn anticlockwise after passing through the vertical position. It will oscillate about the vertical position. (not the question is about the fault and not what should be done)	B1
(v)	The ends of coil **ABCD** should be connected to a **split ring commutator. Each half of the** commutator presses against a **carbon brush in good contact.** The **commutator reverses the direction of the current in the coil every half a revolution whenever the split ring changes contact from one carbon brush to the other brush.**	B1 B1

Q4

(a)	The copper rod moves to the right. According to Fleming's left hand rule, the force acting on the copper rod points to the right.	[1] [1]
(b)		[2]
(c)	The current in the copper rod changes direction at a rate of 50 Hz, causing the direction of the force to change accordingly. Hence the copper rod moves and changes its direction of motion 100 times per second.	[1] [1] [1]

(d)	 (ans)	[1] protons deflect upwards [1] electrons deflect upwards [1] electrons deflects more than protons
c	None of the students obtained the mark that showed that the electron deflects more than the protons	

Q5

a	 [1] – magnetic field arrows [1] – magnetic field shape/curvature	B1 B1
b	Magnetic relay is magnetised and attracts the soft iron armature. This breaks contact X with the battery and L1 switches off. Contact Y now touches contact Z and L2 lights up.	B1 B1 B1