

**Student:** \_\_\_\_\_

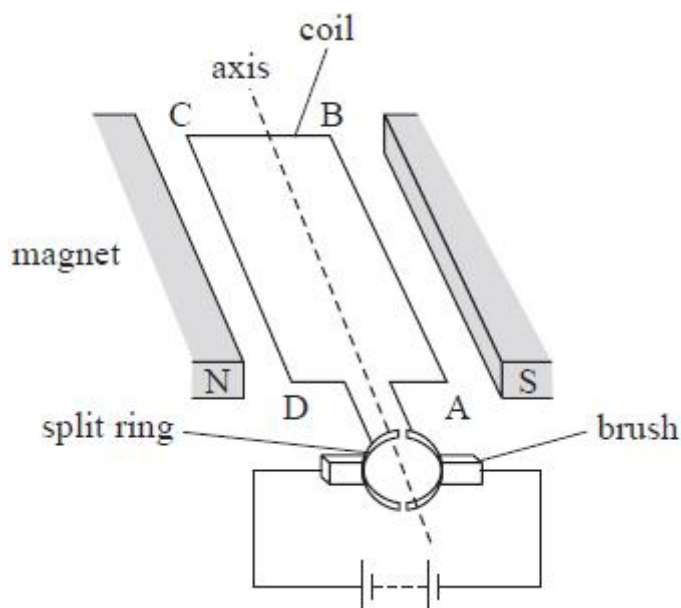
**Max. Marks : 19 Marks**

**Time : 19 Minutes**

**Q1.**

Electric vehicles use a direct current (d.c.) electric motor powered by a battery for propulsion. A simplified diagram of a d.c. electric motor is shown.

A split ring consists of two semi-circular sections that are attached to a coil. The coil is labelled ABCD. Two brushes, made of carbon, rub against and make electrical contact with the split ring.



\* Describe how this arrangement can lead to the coil rotating.

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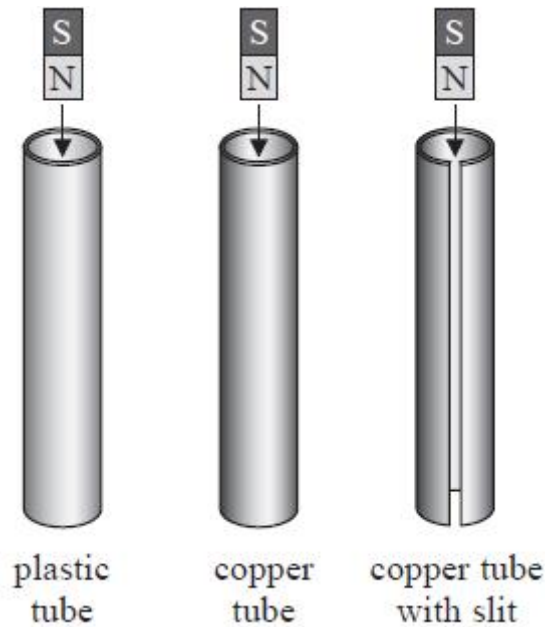
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**Q2.**

A teacher carries out a demonstration to illustrate the laws of electromagnetic induction.

She uses three tubes of identical dimensions. One is made of plastic, one copper and one copper with a slit cut into its length.



(a) The teacher releases a magnet from rest at the top of the plastic tube and it takes 0.45 s to fall through the tube.

Calculate the average acceleration of the magnet as it falls through the tube.

length of tube = 0.75 m

(2)

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Average acceleration = .....

\*(b) The teacher suggests that the magnet would take longer to fall through the copper tube as a consequence of the laws of electromagnetic induction.

Assess the validity of this suggestion.

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(c) Before the teacher releases the magnet through the copper tube with a slit along its length, she asks the class to consider how the time taken will compare with the time for the other copper tube. The class predicts that the time will be the same.

Explain, using electromagnetic induction, whether this prediction is correct.

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(d) The times for the magnets to fall through the tubes were measured manually using an electronic timer. Explain how suitable this is as a means of recording these times.

(2)

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(Total for question = 13 marks)