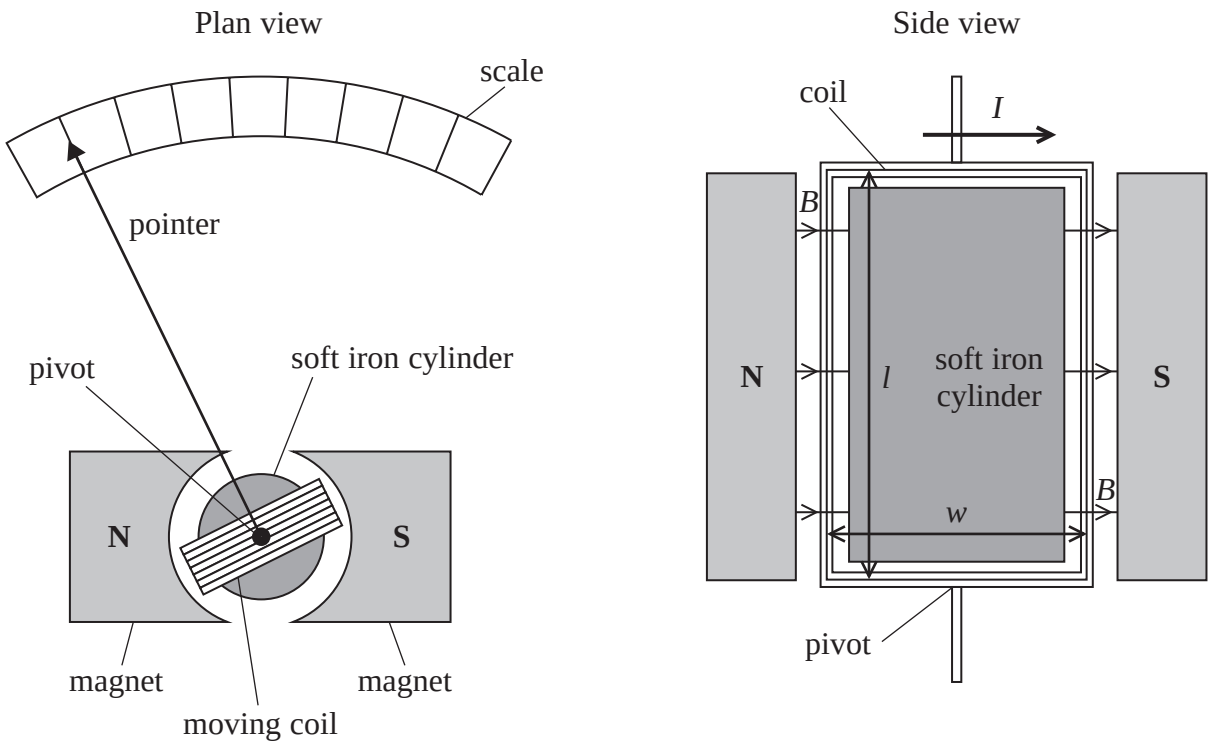
17 The diagrams show the plan view and side view of a moving coil ammeter.



The fixed soft iron cylinder and magnets produce a uniform magnetic field of magnetic flux density *B*. The coil is able to rotate within this magnetic field. The coil has width *w* and length *l*. There is a current *I* in the coil in the direction shown in the side view diagram.

(a) (i) Explain which way the coil will rotate.

(2)

(ii) Show that the moment *M* on the coil about the pivot, due to the magnetic field, is given by

$$M = BAIN$$

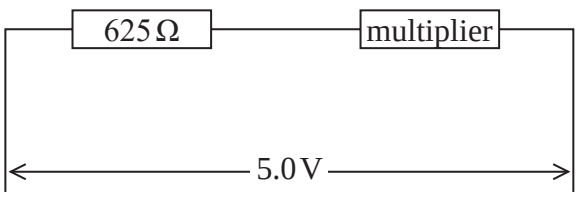
where
A is the cross-sectional area of the coil
N is the number of turns of wire on the coil.

(4)

(b) An ammeter of this type has a resistance of 625 Ω and will measure a maximum current of 1.6 mA.

The ammeter can be adapted to measure potential difference by adding a resistor in series with the ammeter. This resistor is known as a multiplier.

The ammeter is adapted so that it can measure potential differences up to 5.0 V as shown.



The following multipliers are available:

200 Ω 2500 Ω 3125 Ω 3750 Ω

Deduce which multiplier should be used.

(3)

(c) The coil within a very sensitive moving coil ammeter can be damaged when the ammeter is transported. The two ends of the coil are connected together when the ammeter is transported. This reduces the movement of the coil and makes it less likely to be damaged.

A student suggests that this is due to Faraday's law and Lenz's law.

Explain how these laws apply to this situation.

(4)

(Total for Question 17 = 13 marks)