Oxford Cambridge and RSA

A level Physics A

H556/03 Unified physics

Question Set 11

1 **(a)** A magnet rotates inside a shaped soft iron core. A coil is wrapped around the iron core as shown in Fig. 5.1. The coil is connected to an oscilloscope.

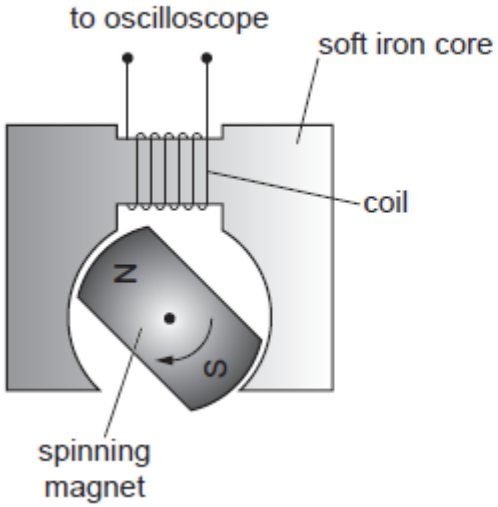

Fig. 5.1

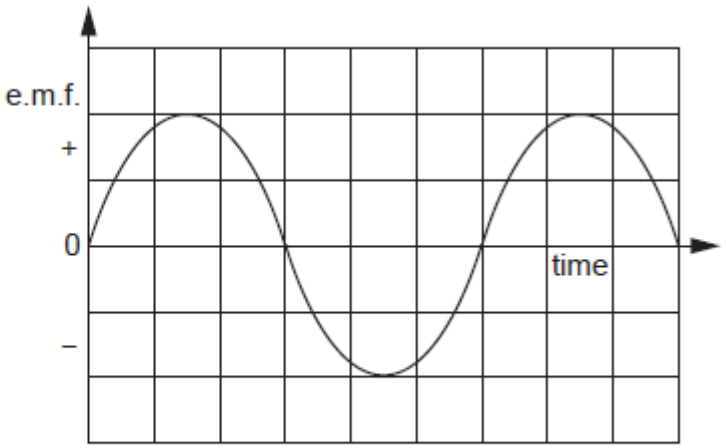

Fig. 5.2

The spinning magnet induces an e.m.f. in the coil. A graph of the e.m.f. displayed on the oscilloscope screen is shown in Fig. 5.2.

(i) Explain the shape of the graph in terms of the magnetic flux linking the coil.

[2]

(ii) On Fig. 5.3 sketch a graph of the magnetic flux linkage of the coil against time. The variation of the induced e.m.f. across the coil is shown as a dotted line. **[1]**

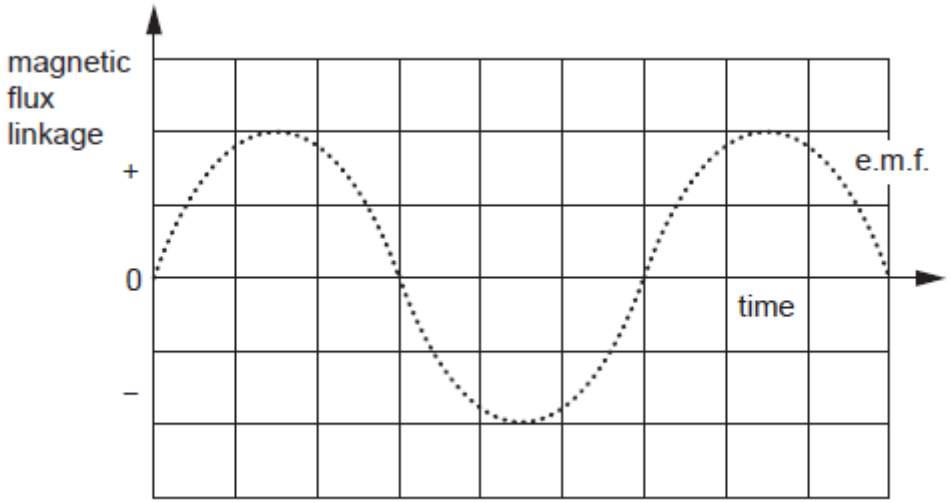

Fig. 5.3

(iii) The coil shown in Fig. 5.1 has 150 turns. The maximum induced e.m.f. V_0 across the coil is 1.2 V when the magnet is rotating at 24 revolutions per second.

Calculate the maximum **magnetic flux** through the coil using the equation

$$V_0 = 2\pi \times \text{(frequency)} \times \text{(maximum magnetic flux linkage)}$$

Give a unit with your answer.

maximum flux = ... unit..... **[2]**

(b)* A student is given a transformer with coils **X** and **Y**, as shown in Fig. 5.4.

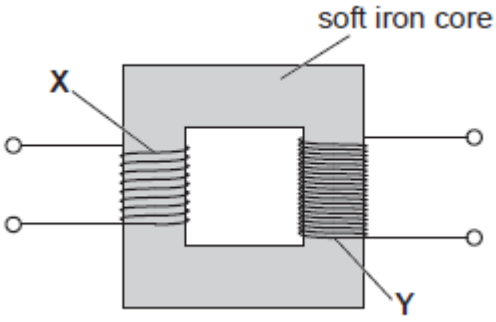

Fig. 5.4

The student is intending to investigate how the maximum induced e.m.f. V_0 in coil **Y** depends on the frequency f of the alternating current in coil **X**.

The changing magnetic flux density in coil **X** induces an e.m.f. in coil **Y**. Faraday's law indicates that the maximum induced e.m.f. V_0 should be directly proportional to f.

Describe how you would investigate the suggested relationship between V_0 and f in the laboratory using these coils. In your description include all of the equipment used and how you would analyse the data collected.

Use the space below to draw a suitable diagram.

[6]

Total Marks for Question Set 11: 11