7 A magnet rotates inside a shaped soft iron core. A coil is wrapped around the iron core as shown in Fig. 7.1. The coil is connected to an oscilloscope.

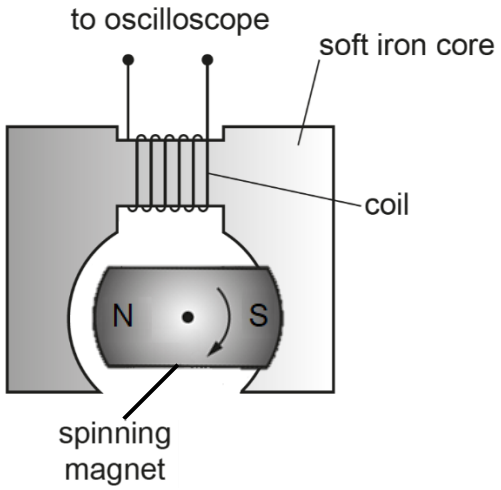

Fig. 7.1

The spinning magnet induces an e.m.f. in the coil.

(a) On Fig. 7.2, sketch a graph of the variation of the e.m.f. induced in the coil against time. The variation of the induced magnetic flux linkage in the coil is shown as a dotted line. [1]

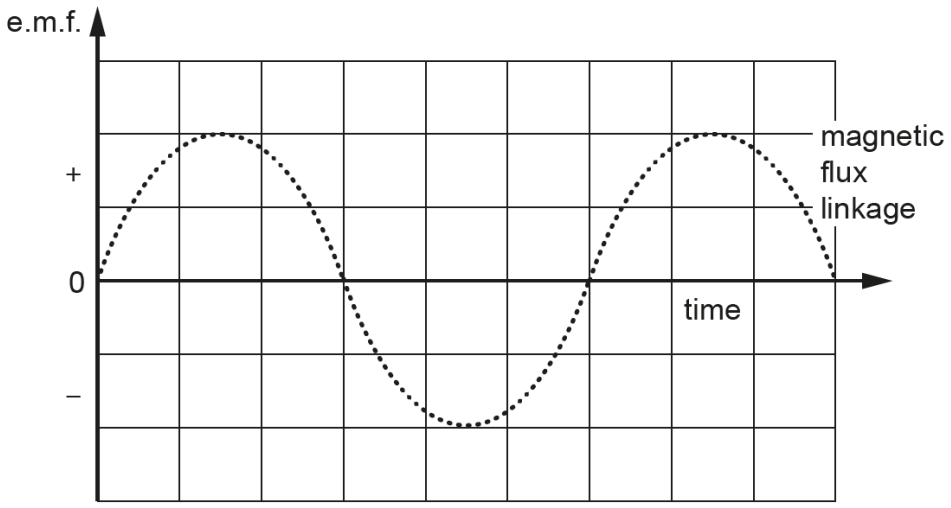

Fig. 7.2

(b) By considering the orientation of the magnet as it spins, explain the variation of the magnetic flux linkage in the coil with time.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[2]

(c) At a certain time t_1 the orientation of the spinning magnet is momentarily as shown in Fig. 7.1. Mark the time t_1 on the time axis of Fig. 7.2. [1]

(d) The coil shown in Fig. 7.1 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.

maximum magnetic flux = ... Wb [2]

[Total: 6]