6 **(a)** A small coil C has 64 turns and cross-sectional area 0.71 cm^2. The coil is placed inside a solenoid as shown in Fig. 6.1.

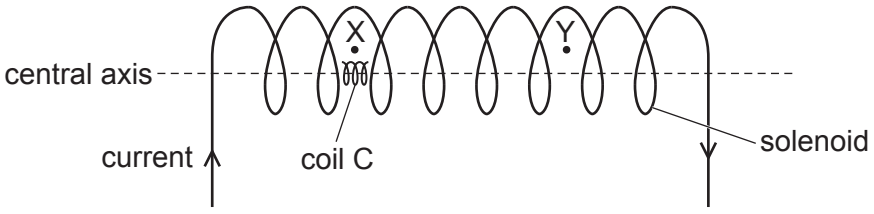

Fig. 6.1

The centre of coil C is on the central axis of the solenoid.

(i) There is a constant current in the solenoid.
Coil C is moved through the solenoid from position X to position Y.

On Fig. 6.2, sketch a line to show the variation of the magnetic flux linkage in coil C with position as it moves from X to Y.

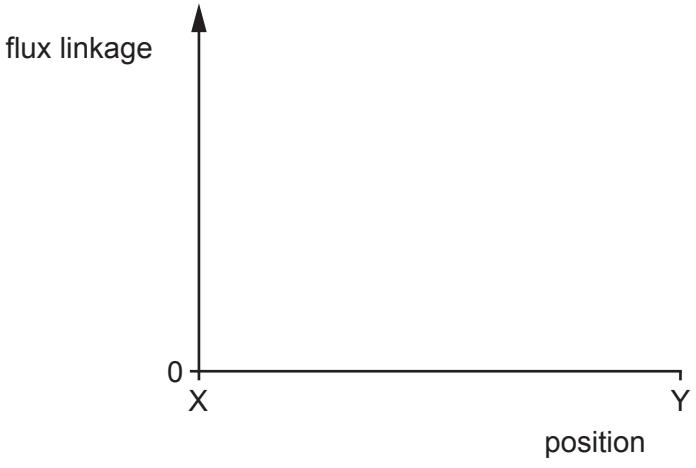

Fig. 6.2

[1]

(ii) Explain the shape of your line in **(a)(i)**.

.....

.....

.....

..... [2]

(iii) Coil C is now held stationary at X. The current in the solenoid varies so that the magnetic flux density *B* at X varies from time 0 to time 4*t* as shown in Fig. 6.3.

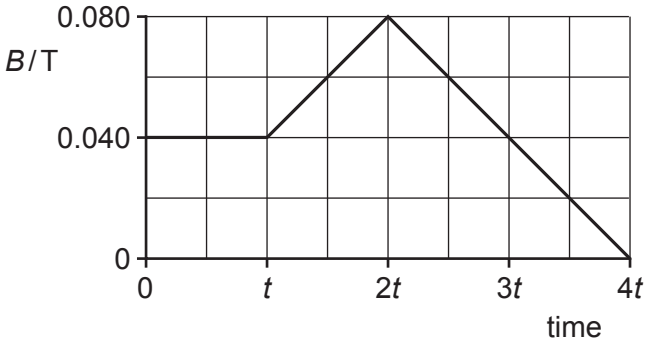

Fig. 6.3

Calculate the maximum magnetic flux linkage in coil C.

flux linkage = ... Wb [2]

(iv) On Fig. 6.4, sketch a line to show the induced electromotive force (e.m.f.) *E* in coil C from time 0 to time 4*t*.

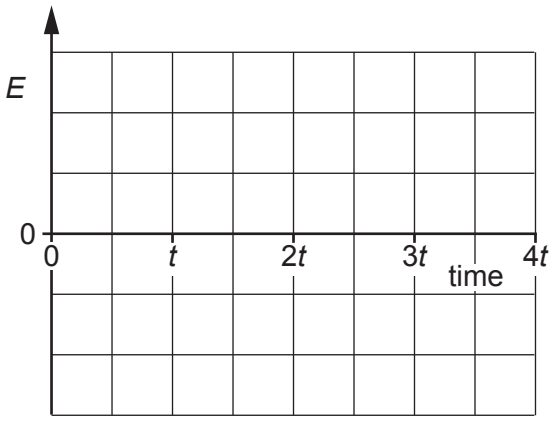

Fig. 6.4

[3]

(b) A metal spring rests on a smooth table. The turns of the spring are equally spaced. The ends of the spring are connected to a d.c. power supply, as shown in Fig. 6.5.

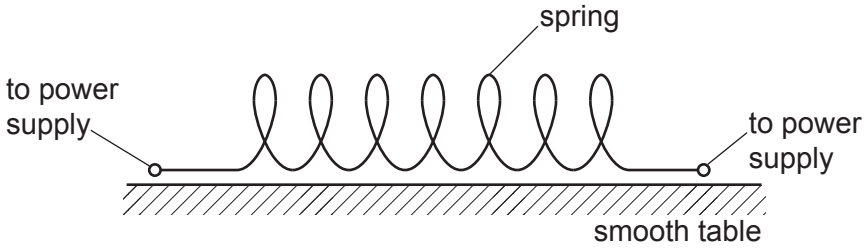

Fig. 6.5

The spring is connected to the d.c. power supply using flexible leads. The spring is not under tension.

With reference to magnetic fields, describe and explain the change in the distance between the turns of the spring when the power supply is first switched on.

.....

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.....

.....

..... [3]

[Total: 11]