6 **(a)** Two long wires **X** and **Y**, separated by a distance r = 3.0 m, are at right angles to the plane of the paper. **X** has current I_1 = 5.0 A and **Y** has current I_2 = 7.0 A, both pointing out of the plane of the paper as shown in Fig. 6.1.

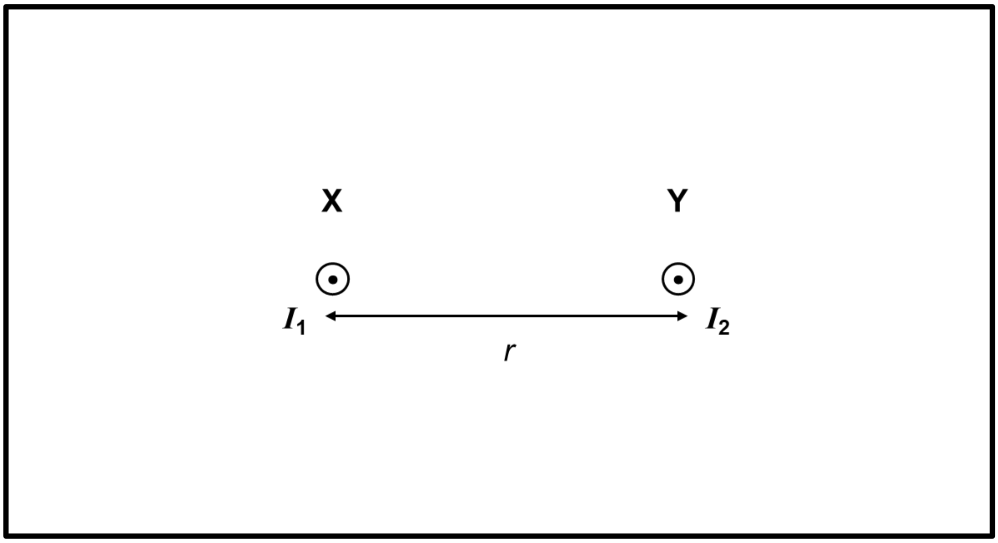

Fig. 6.1

(i) Show on Fig. 6.1 the direction of the magnetic field ***B*** which I_1 causes at **Y**. Label it ***B***. [1]

(ii) Show on Fig. 6.1 the direction of the force ***F*** which I_1 causes on wire **Y**. Label it ***F***. [1]

(iii) Determine the value of the force per unit length of wire which I_1 causes on wire **Y**.

force per unit length = ………………….. N m^{-1} [2]

(b) State Faraday's Law.

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………………………… [1]

Wires X and Y are now coiled into a solenoid, of 10-turns per cm, and search coil, respectively. The current-carrying solenoid is placed near to the search coil as shown in Fig. 6.2.

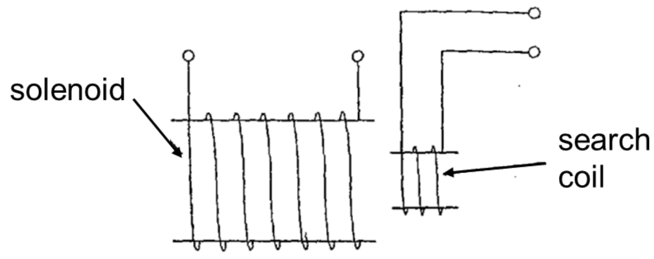

Fig. 6.2

The variation with time t of the current I in the solenoid is shown in Fig. 6.3.

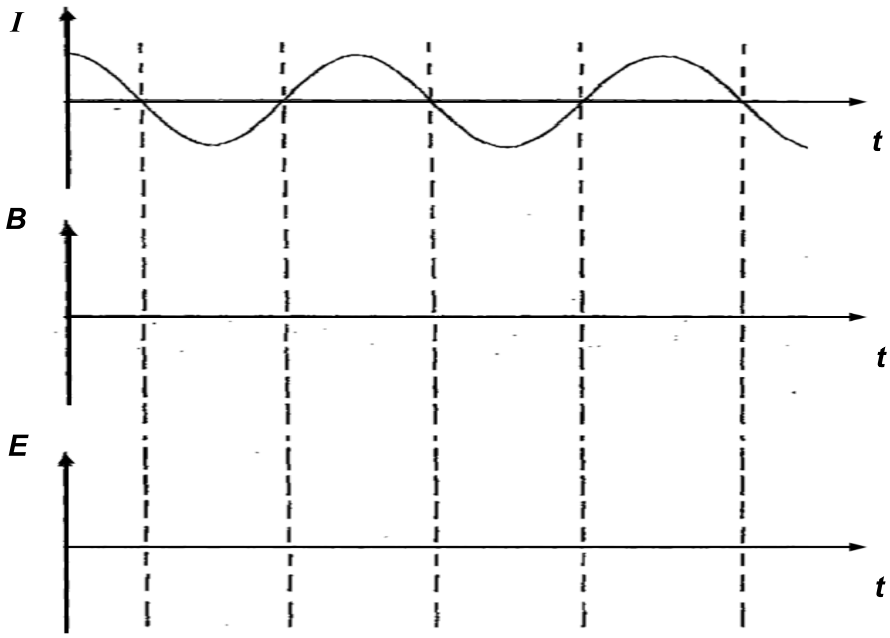

Fig. 6.3

(i) Sketch on Fig. 6.3 the variation with t of the magnetic flux density B in the solenoid. [1]

(ii) Sketch on Fig. 6.3 the variation with t of the e.m.f. E induced in the search coil. [1]

(iii) Calculate the current flowing in the solenoid to generate a maximum magnetic flux density B of 1.0 mT.

current = ………………….. mA [2]