**5** Fig. 5.1 shows two identical circular coils X and Y that are fixed in position. The planes of both coils are parallel and their centres lie along a common axis PQ.

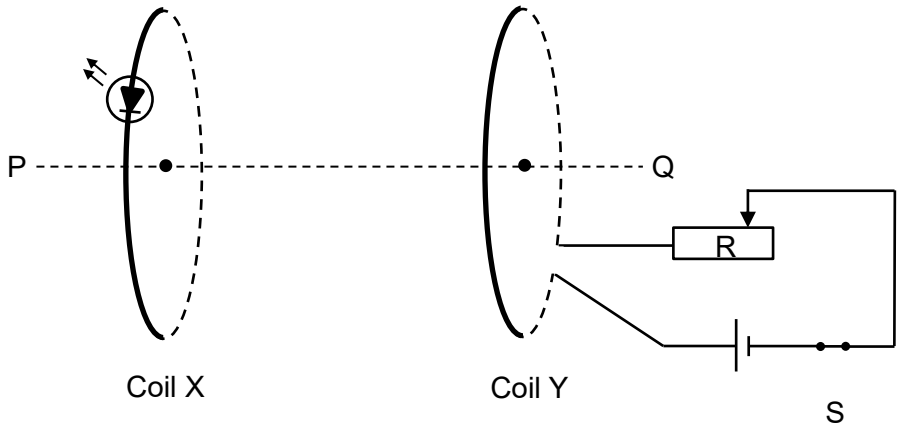


**Fig. 5.1**

Coil Y is connected to a cell, a switch S and a variable resistor R. S is closed and R is set to its maximum value.

A light emitting diode (LED) is connected to coil X and it is not lit up.

**(a)** Based on the laws of electromagnetic induction, describe and explain what would be observed about the LED when the following changes are made independently:

**(i)** S is opened.

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..... [3]

**(ii)** The resistance of R is decreased.

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[3]

**(b)** The cell is now replaced by an alternating voltage source. The sinusoidal current flowing through coil Y is represented by the equation $I_Y = I_0 \sin(100\pi t)$. Current flowing in the clockwise direction, when the coils are viewed from Q, is taken as positive.

**(i)** On the axes of Fig. 5.2, sketch at least 2 cycles of the variation with time *t* of the current $I_Y$ flowing through coil Y.

Indicate relevant values on the horizontal axis.


**Fig. 5.2**

[2]

**(ii)** On the axes of Fig. 5.3, sketch at least 2 cycles of the variation with time *t* of the current $I_X$ flowing through coil X.

Indicate relevant values on the horizontal axis.

**Fig. 5.3**

[2]