Oxford Cambridge and RSA

A Level Physics A

H556/02 Exploring physics

Question Set 18

1 Fig. 21.1 shows a coil of a simple generator rotating in a uniform magnetic field.

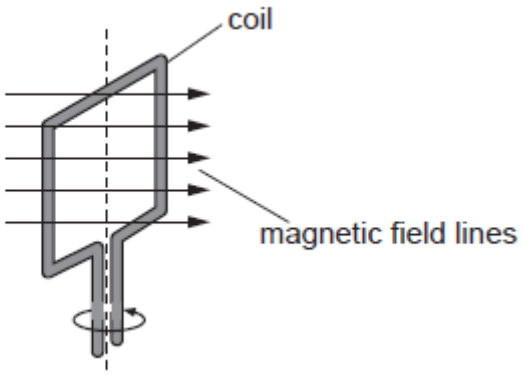


Fig. 21.1

The coil has 85 turns of insulated wire. The cross-sectional area of the coil is 14 cm^2.
Fig. 21.2 shows the variation of magnetic flux density B through the plane of the coil with time t as it rotates.

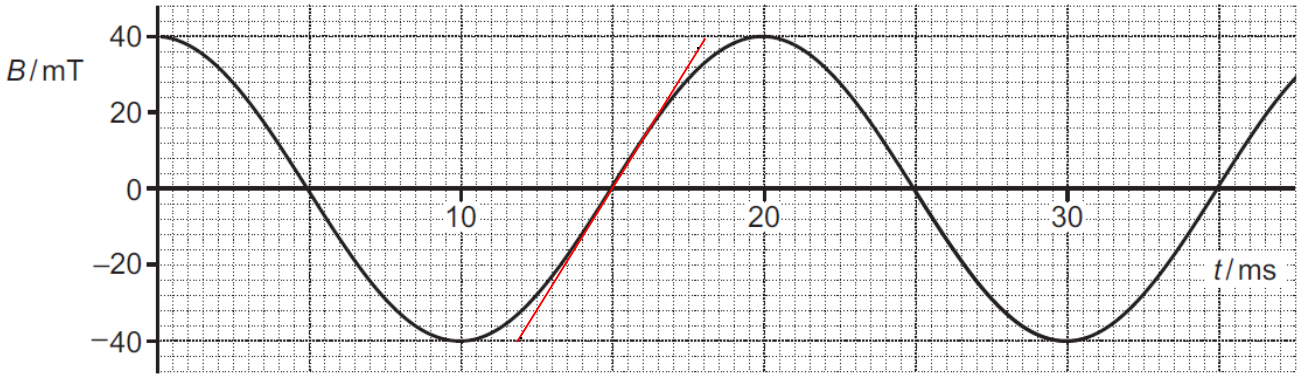


Fig. 21.2

(a) **(i)** Explain why the electromotive force (e.m.f.) induced across the ends of the coil is a **maximum** at the times when $B = 0$.

[1]

This is where there is max rate of change of flux linkage.

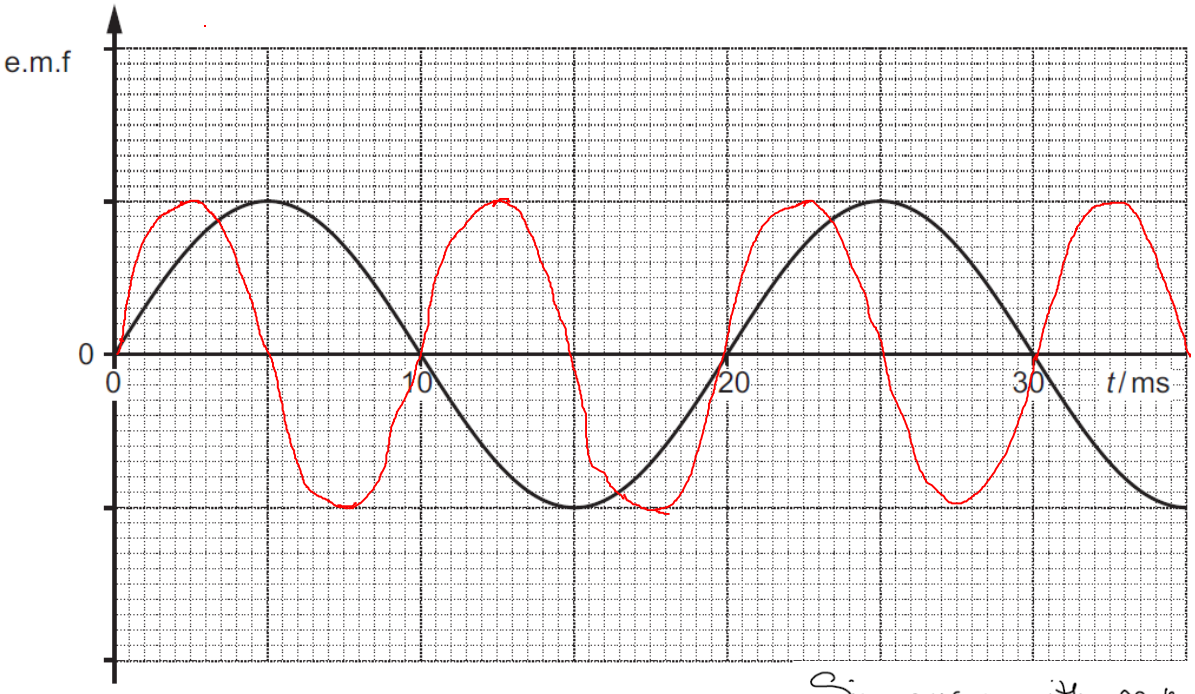
(ii) Draw a tangent to the curve in Fig. 21.2 when $B = 0$, and hence determine the **maximum** e.m.f. induced across the ends of the coil.

gradient = $\frac{80 \times 10^{-3}}{6.5 \times 10^{-3}}$ = 12.3 maximum e.m.f. = 1.5 V **[3]**

$\mathcal{E} = \frac{dB}{dt} NA = 12.3 \times 14 \times 10^{-4} \times 85$

$= 1.5$ V

(b) Fig. 21.3 shows the variation of the e.m.f. induced across the ends of the coil with time *t*.



Sin curve with peak = emf, and period half of given curve.

Fig. 21.3

The magnitude of the magnetic flux density of the uniform field is now halved and the coil is rotated at twice its previous frequency.

On Fig. 21.3 sketch the new variation of the e.m.f. induced with time *t*. **[2]**

$\mathcal{E} \propto \frac{d \cos\theta \times B}{dt}$ so max $\mathcal{E}$ stays constant. However it will have 1/2 the period.

Total Marks for Question Set 18: 6