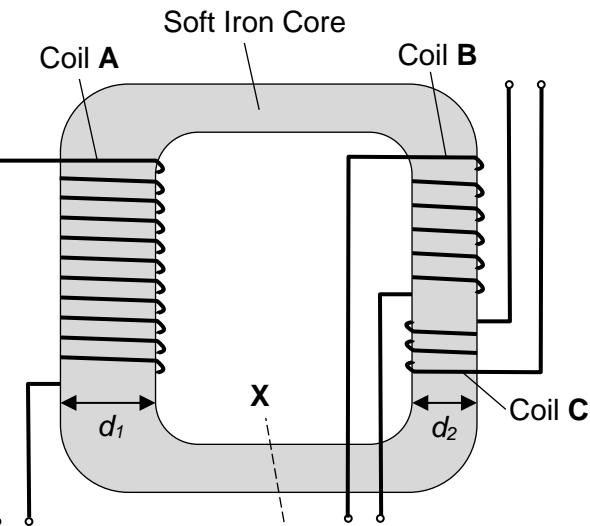


- 5 Electrical transformers are widely used in industries. Fig. 5.1 illustrates a version of a transformer.



**Fig. 5.1**

The terminals of coil **A** is connected to a 240 V r.m.s. alternating current source. The ratio of the number of turns of wire in the coils of coil **A** : **B** : **C** is 11 : 6 : 3. The thickness  $d_1$  is twice of  $d_2$ .

- (a) (i) Define magnetic flux.

..... [1]

- (ii) The magnetic flux produced by coil **A** is  $\phi_A$  and the magnetic flux through coil **B** is  $\phi_B$ . State the relation between  $\phi_A$  and  $\phi_B$ .

..... [1]

- (iii) Explain why an induced e.m.f. is produced in the terminals of coil **B**.

.....  
.....  
.....  
..... [2]

- (iv) Determine the induced e.m.f.  $\mathcal{E}_B$  in coil **B**.

induced e.m.f.  $\mathcal{E}_B = \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots$  V [2]

- (b) Due to an impact on the transformer, a gap is formed in the soft iron core along the dashed line labelled **X** as shown in Fig. 5.1.  
State and explain how the gap affects the maximum e.m.f. induced in coil **C**.

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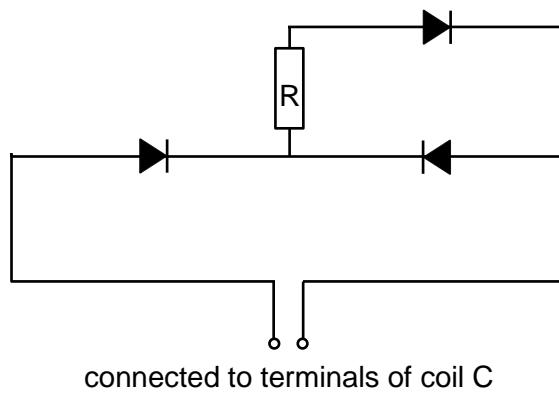
[2]



- (c) Before the impact, the e.m.f. induced in coil C is given by the expression

$$\mathcal{E}_C = \mathcal{E}_0 \cos\left(\frac{2\pi}{T} t\right)$$

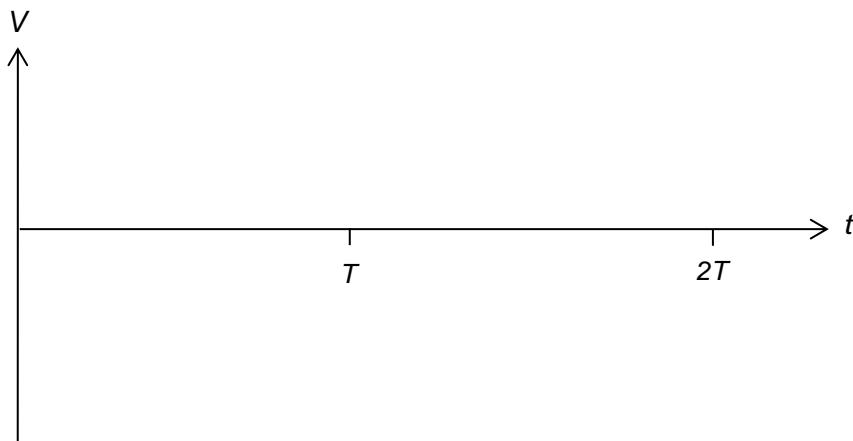
Fig. 5.2 below shows the terminals of coil C connected to three diodes and a resistor R.



**Fig. 5.2**

On the axes given below, sketch and label the voltage-time graph of the resistor for two cycles when all three diodes are in use.

Numerical values are not required.



[2]

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