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AQA, OCR

A Level

A Level Physics

Electromagnetism 2

Name:

MME

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Total Marks: /30

1. This question explores the implications of Faraday's law.

Total for Question 1: 18

(a) State the requirement for an emf to be induced in a circuit that lacks a power supply. [2]

(b) A coil with 500 turns as a core with a radius of 2 cm. It is placed in a field of 0.6 T such that there is an angle of 30°between the field and the normal to the cross-sectional area. Calculate the magnetic flux and the magnetic flux linkage. [4]

(c) State Faraday's law, both in words and mathematically. [2]

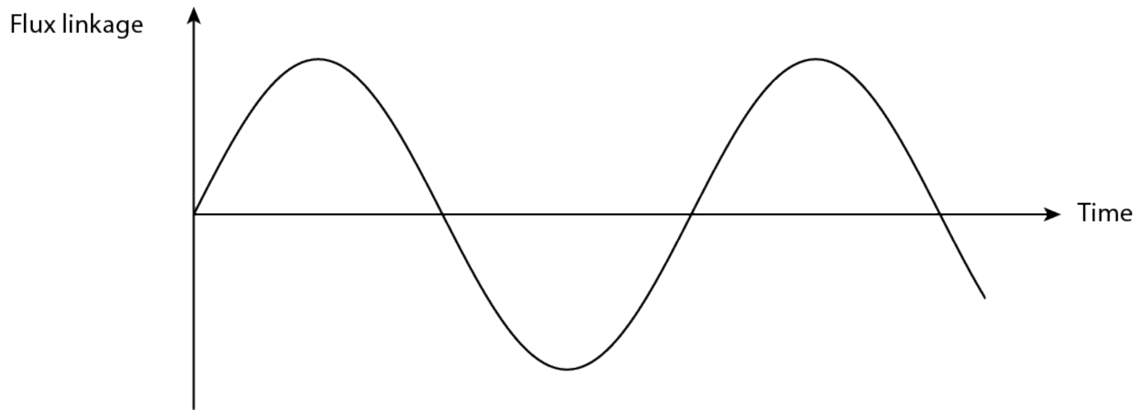
(d) A search coil has 4000 turns and a cross-sectional area of 1 cm^2. Given that it induces an emf of 2 V when removed from the field in 1 ms, calculate the flux density. [4]

(e) State Lenz's law and explain why it is a statement of energy conservation. [3]

(f) Explain, using Faraday's law, why large current-carrying coils can be dangerous if the current is suddenly switched off. [3]

2. AC generators can be understood using Faraday's law. The graph below shows how the flux linkage varies sinusoidally as a square coil with 1000 turns and a side length of 20 cm is rotated in a uniform field of flux density 0.8 T.

Total for Question 2: 6



(a) On the same set of axes, sketch the variation of the induced emf. [3]

(b) The coil rotates by 15° in 2 s. Calculate the induced emf. [3]

3. Without transformers the national grid would be much less efficient. However, they are not complex and can be understood using ideas developed above.

Total for Question 3: 6

(a) State two mechanisms of undesirable power dissipation in a transformer. [2]

(b) State the purpose of the core. [1]

(c) Design a transformer that steps down the voltage by a factor of four. [1]

(d) An ideal transformer has 100 primary coils and 400 secondary coils. Given that the current in the secondary coil is 3 A, calculate the current in the primary coil. [2]