Electromagnetic Induction - 2020 A2

1. Nov/2020/Paper_41/No.9

(a) Define *magnetic flux*.

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..... [2]

(b) A simple transformer consists of two coils of wire wound on a soft-iron core, as illustrated in Fig. 9.1.

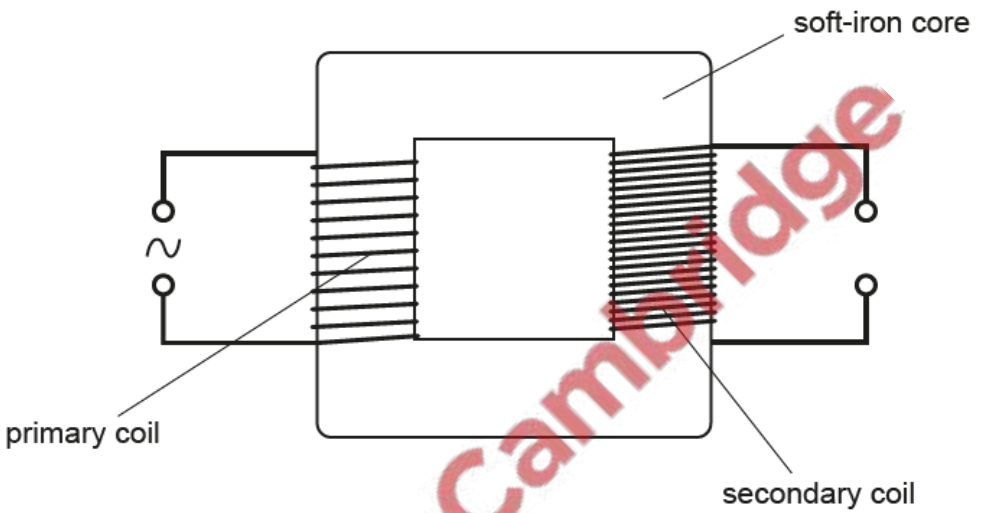

Fig. 9.1

There is a sinusoidal current in the primary coil.

Explain:

(i) how this current gives rise to an induced electromotive force (e.m.f.) in the secondary coil

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..... [3]

(ii) why the e.m.f. induced in the secondary coil is not constant.

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(c) Explain why the soft-iron core in **(b)** is laminated.

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[Total: 9]

2. Nov/2020/Paper_42/No.9

(a) A small coil is placed close to one end of a solenoid connected to a power supply. The plane of the small coil is normal to the axis of the solenoid, as illustrated in Fig. 9.1.

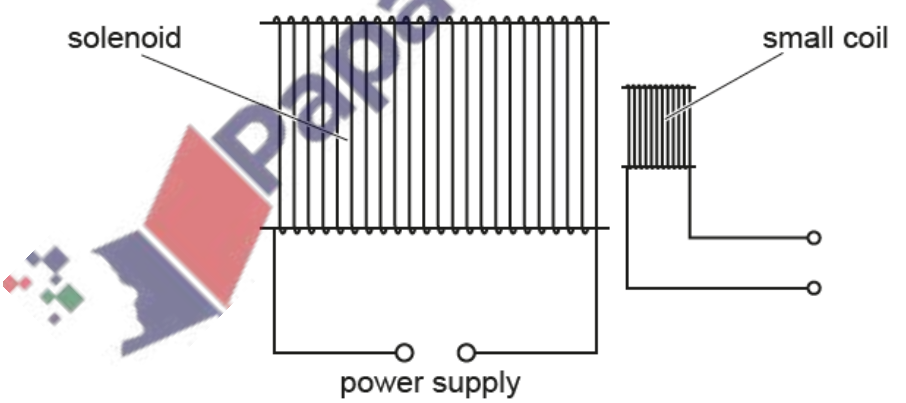

Fig. 9.1

The power supply causes the current I in the solenoid to vary with time t as shown in Fig. 9.2.

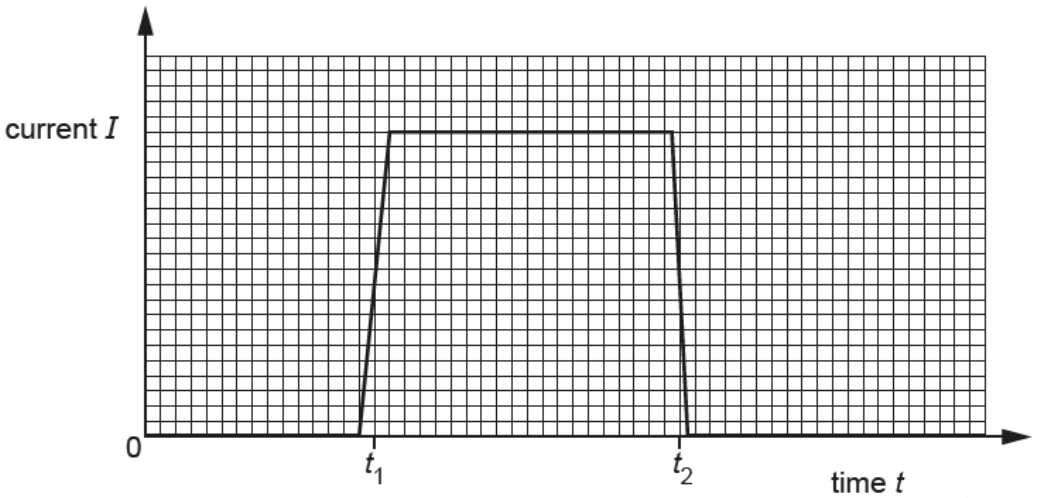

Fig. 9.2

(i) State Faraday's law of electromagnetic induction.

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(ii) On the axes of Fig. 9.3, sketch a graph to show the variation with time t of the electromotive force (e.m.f.) induced in the small coil.

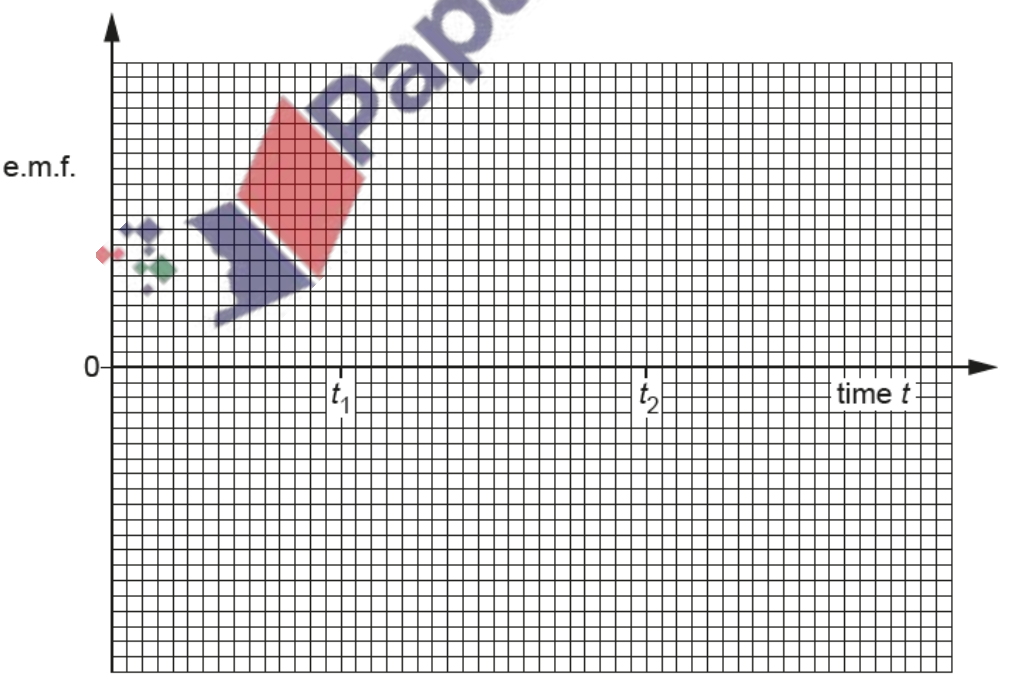

Fig. 9.3

[4]

(b) The small coil in **(a)** is now replaced by a Hall probe.

The Hall probe is positioned so that the reading for the probe is a maximum.

The current I in the solenoid varies again as shown in Fig. 9.2.

On the axes of Fig. 9.4, sketch a graph to show the variation with time t of the reading V_H of the probe.

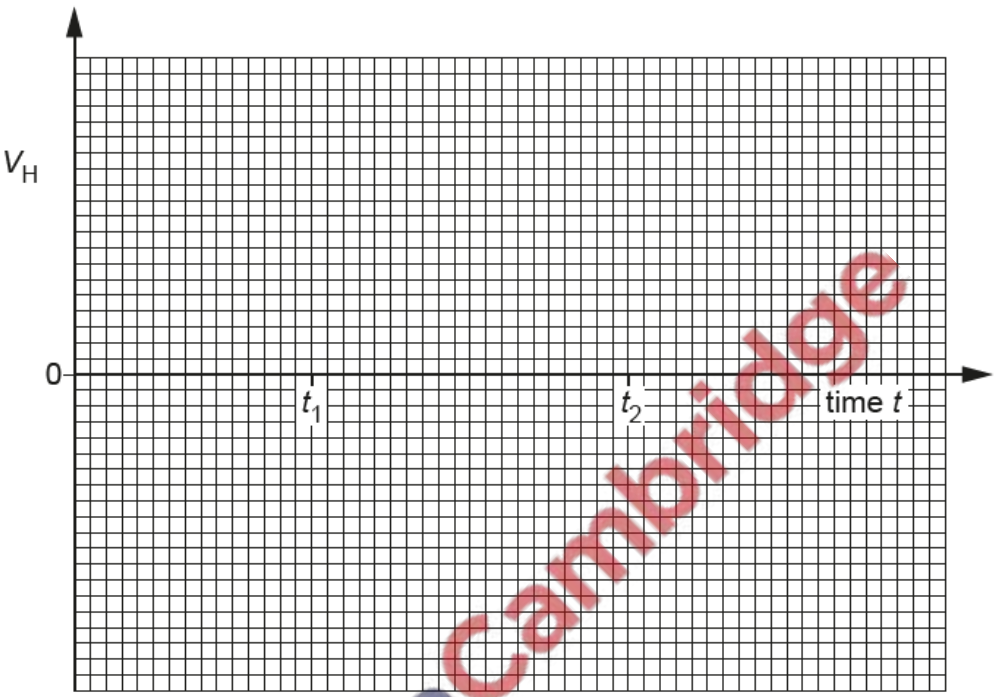

Fig. 9.4

[2]

[Total: 8]

3. June/2020/Paper_41/No.9

(a) A coil of wire is situated in a uniform magnetic field of flux density B.
The coil has diameter 3.6 cm and consists of 350 turns of wire, as illustrated in Fig. 9.1.

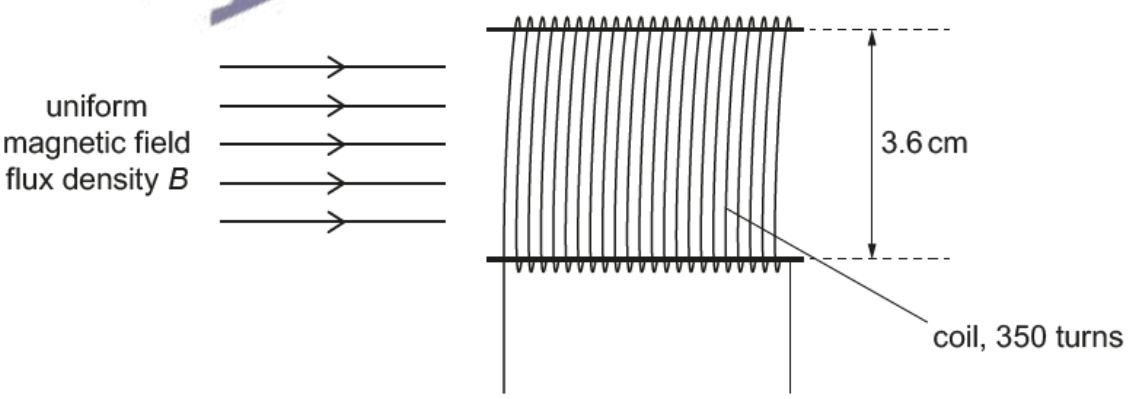

Fig. 9.1

The variation with time t of B is shown in Fig. 9.2.

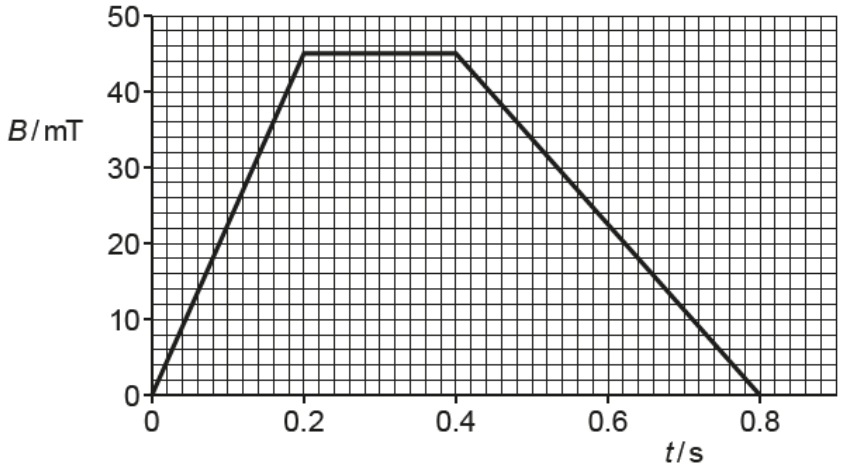

Fig. 9.2

(i) Show that, for the time $t = 0$ to time $t = 0.20\,s$, the electromotive force (e.m.f.) induced in the coil is 0.080 V.

[2]

(ii) On the axes of Fig. 9.3, show the variation with time t of the induced e.m.f. E for time $t = 0$ to time $t = 0.80\,s$.

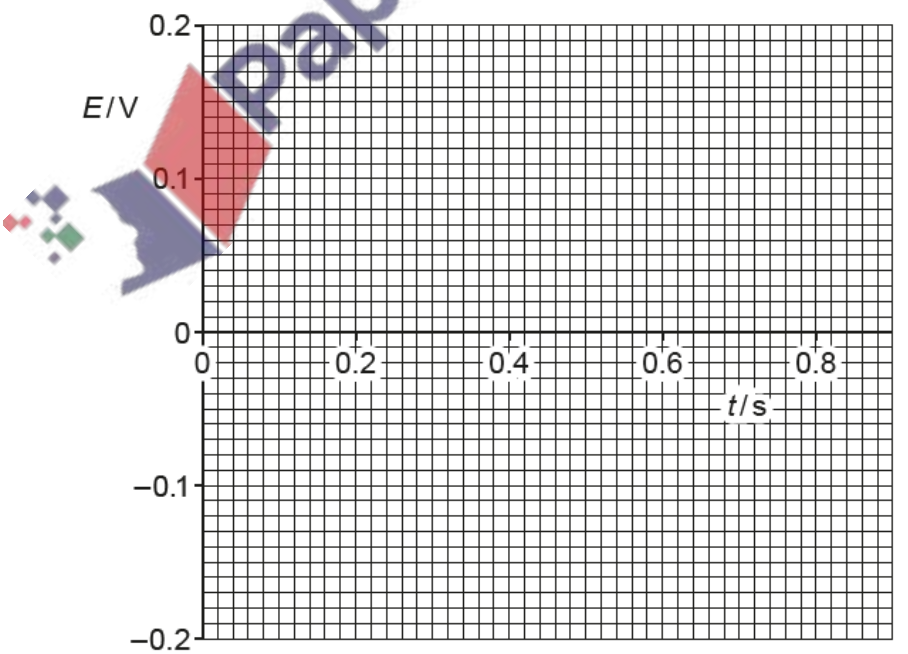

Fig. 9.3

[4]

(b) A bar magnet is held a small distance above the surface of an aluminium disc by means of a rod, as illustrated in Fig. 9.4.

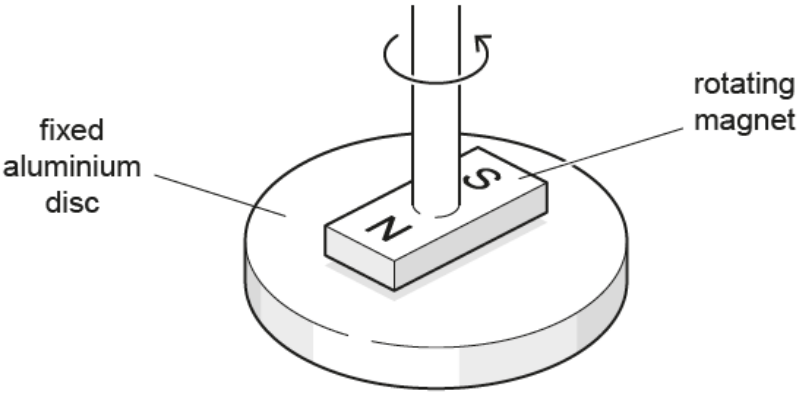

Fig. 9.4

The aluminium disc is supported horizontally and held stationary.

The magnet is rotated about a vertical axis at constant speed.

Use laws of electromagnetic induction to explain why there is a torque acting on the aluminium disc.

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[Total: 10]

4. June/2020/Paper_42/No.10

(a) State Faraday's law of electromagnetic induction.

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(b) A simple iron-cored transformer is illustrated in Fig. 10.1.

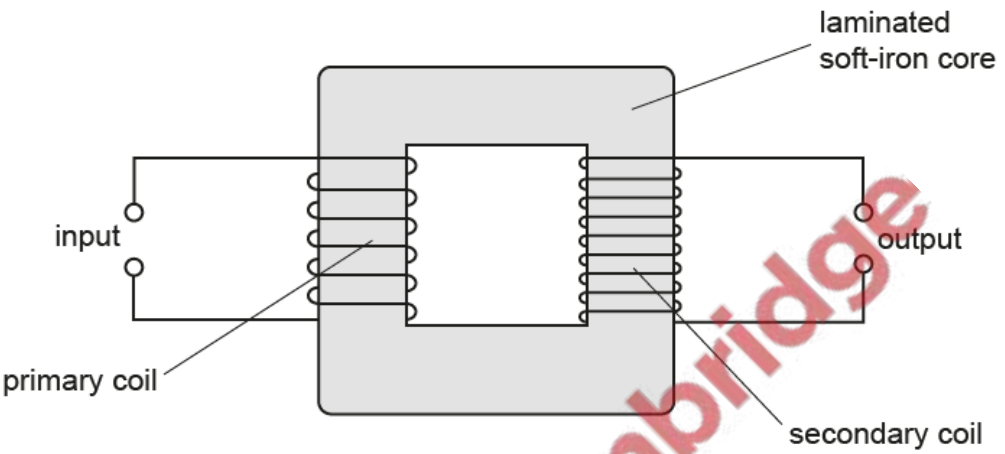

Fig. 10.1

(i) State **one** function of a transformer.

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(ii) A sinusoidal alternating current in the primary coil gives rise to a varying magnetic flux linking the secondary coil.

Use Faraday's law to explain why the output from the transformer is an electromotive force (e.m.f.) that is alternating.

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(iii) State why the soft-iron core of the transformer is laminated.

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[Total: 7]