

Transformations & Transmission of Electrical Energy

Question paper 1

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Alternating Currents
Sub Topic	Transformers & Transmission of Electrical Energy
Paper Type	Theory
Booklet	Question paper 1

Time Allowed: 53 minutes

Score: /44

Percentage: /100

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

- 1 In many distribution systems for electrical energy, the energy is transmitted using alternating current at high voltages.

Suggest and explain an advantage, one in each case, for the use of

- (a) alternating voltages,

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

- (b) high voltages.

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

- 2 (a) A solenoid is connected in series with a resistor, as shown in Fig. 7.1.

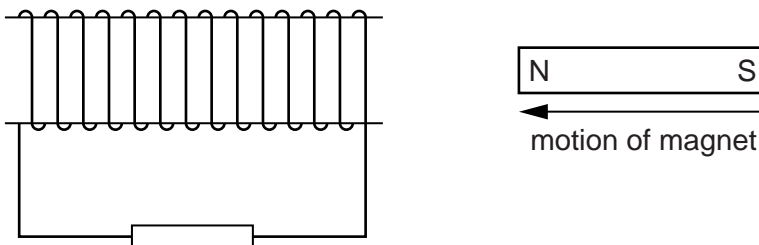


Fig. 7.1

As the magnet is being moved into the solenoid, thermal energy is transferred in the resistor. Use laws of electromagnetic induction to explain the origin of this thermal energy.

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.....[4]

- (b) Explain why the alternating current in the primary coil of a transformer is not in phase with the alternating e.m.f. induced in the secondary coil.

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.....[4]

3 A simple transformer is illustrated in Fig. 6.1.

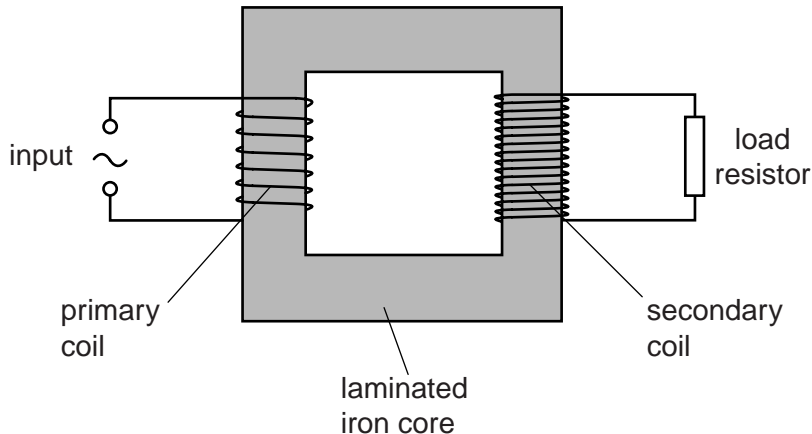


Fig. 6.1

(a) State

(i) why the iron core is laminated,

.....

 [2]

(ii) what is meant by an *ideal* transformer.

.....
 [1]

(b) An ideal transformer has 300 turns on the primary coil and 8100 turns on the secondary coil.

The root-mean-square input voltage to the primary coil is 9.0V.

Calculate the peak voltage across the load resistor connected to the secondary coil.

peak voltage = V [2]

4 (a) State Lenz's law.

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.....[2]

(b) A simple transformer with a soft-iron core is illustrated in Fig. 7.1.

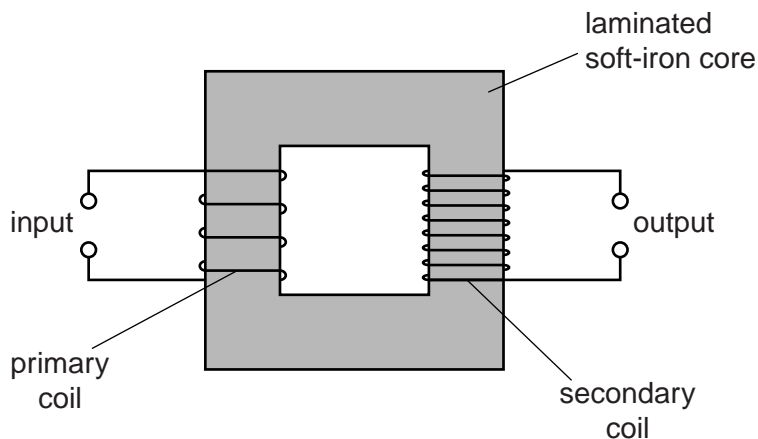


Fig. 7.1

(i) Explain why the core is

1. made of iron,

.....
.....[1]

2. laminated.

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

(ii) An e.m.f. is induced in the secondary coil of the transformer.
Explain how a current in the primary coil gives rise to this induced e.m.f.

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.....[4]

5 A transformer is illustrated in Fig. 6.1.

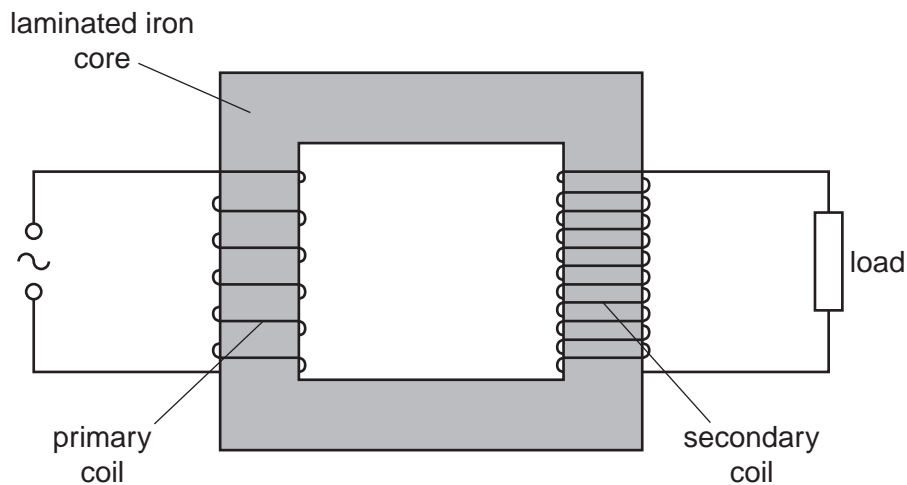


Fig. 6.1

(a) (i) Explain why the coils are wound on a core made of iron.

.....
 [1]

(ii) Suggest why thermal energy is generated in the core.

.....

 [2]

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

.....

 [2]

(ii) Use Faraday's law to explain why the potential difference across the load and the e.m.f. of the supply are not in phase.

.....

 [2]

(c) Electrical energy is usually transmitted using alternating current. Suggest why the transmission is achieved using

(i) high voltages,

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

(ii) alternating current.

.....
.....[1]

6 A simple iron-cored transformer is illustrated in Fig. 6.1.

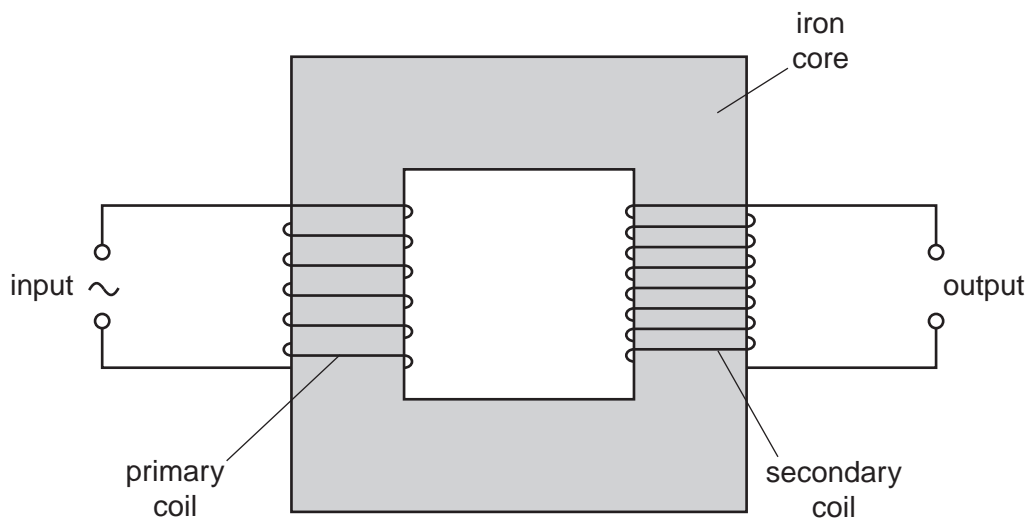


Fig. 6.1

(a) (i) State why the primary and secondary coils are wound on a core made of iron.

.....
.....
.....[1]

(ii) Suggest why thermal energy is generated in the core when the transformer is in use.

.....
.....
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.....[3]

(b) The root-mean-square (r.m.s.) voltage and current in the primary coil are V_P and I_P respectively.
The r.m.s. voltage and current in the secondary coil are V_S and I_S respectively.

(i) Explain, by reference to direct current, what is meant by the *root-mean-square* value of an alternating current.

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

(ii) Show that, for an ideal transformer,

$$\frac{V_S}{V_P} = \frac{I_P}{I_S} .$$

[2]