1)

(a) Define *electromotive force*.

....

.... **[1]**

(b) Define *magnetic flux*.

....

....

.... **[1]**

(c) Fig. 1.1 shows a simple transformer.

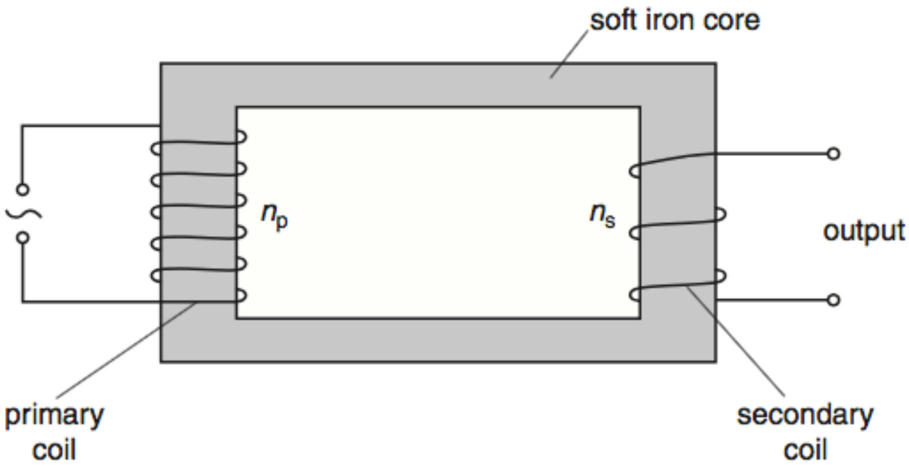


Fig. 1.1

(i) The primary coil is connected to an alternating voltage supply. Explain how an e.m.f. is induced in the secondary coil.

....

....

....

....

....

....

.... **[3]**

(ii) State how you could change the transformer to increase the maximum e.m.f. induced in the secondary coil.

....

....

.... **[1]**

(d) A transformer with 4200 turns in the primary coil is connected to a 230 V mains supply. The e.m.f. across the output is 12 V. Assume the transformer is 100% efficient.

(i) Calculate the number of turns in the secondary coil.

number of turns = ... **[2]**

(ii) The transformer output terminals are connected to a lamp using leads that have a total resistance of 0.35 Ω. The p.d. across the lamp is 11.8 V. Calculate

1 the current in the leads connected to the lamp

current = ... A **[2]**

2 the power dissipated in the leads.

power = ... W **[2]**

[Total: 12]

2)

(a) Define *magnetic flux*.

....

.... **[2]**

(b) Fig. 3.1 shows an experiment to demonstrate electromagnetic induction.

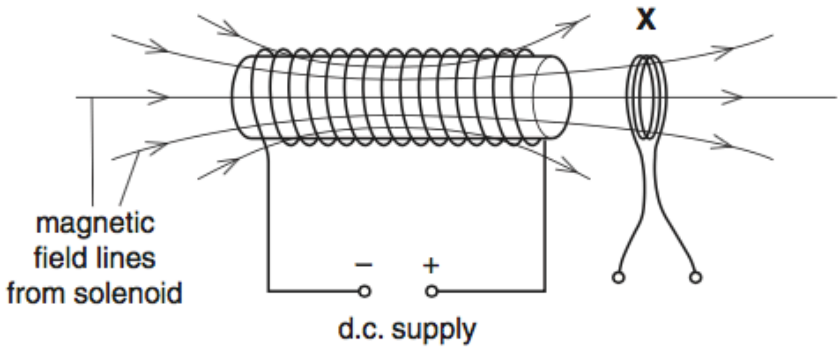


Fig. 3.1

The solenoid is connected to a variable voltage d.c. supply. A coil **X** is placed close to one end of the solenoid. The current in the solenoid is reduced. Fig. 3.2 shows the consequent variation of the magnetic flux density B at right angles to the plane of the coil **X** with time t.

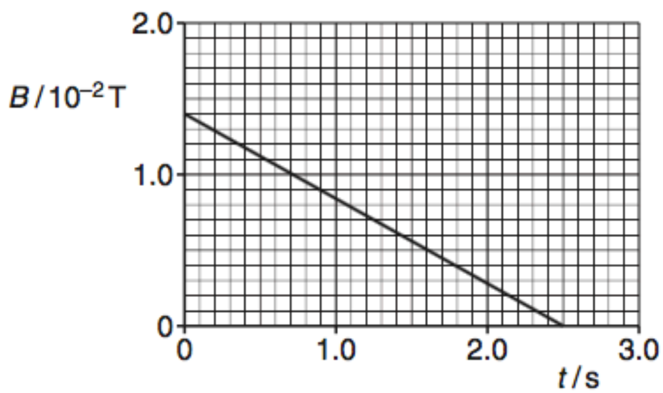


Fig. 3.2

The coil **X** has radius 3.2 cm and 180 turns.

(i) Explain why the induced e.m.f. across the ends of the coil has a constant value from $t = 0$ s to $t = 2.5$ s.

....

....

.... **[1]**

(ii) Calculate the magnitude of the induced e.m.f. across the ends of coil **X** from $t = 0\,\text{s}$ to $t = 2.5\,\text{s}$.

e.m.f. = ... V **[3]**

(c) Fig. 3.3 shows a transformer circuit.

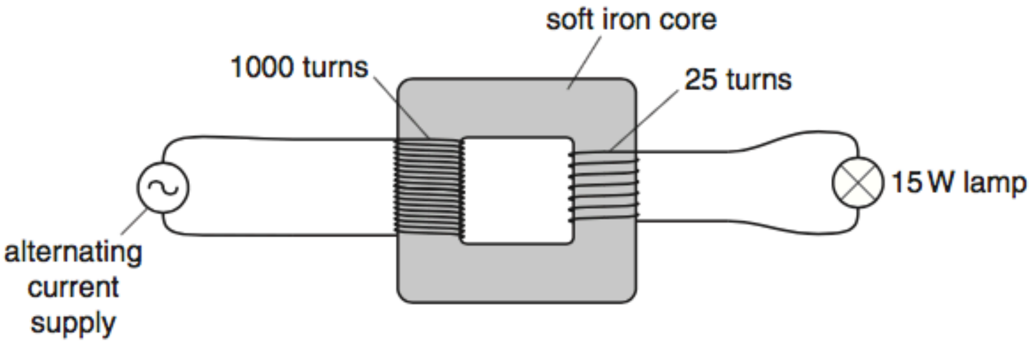


Fig. 3.3

The primary coil has 1000 turns and the secondary coil 25 turns. A lamp is connected to the output of the secondary coil. The potential difference across the lamp is 6.0 V and the lamp dissipates 15 W. The transformer has an efficiency of 100%.

(i) Calculate the current in the primary coil.

current = ... A **[2]**

(ii) The alternating voltage supply is replaced by a battery. Explain why the p.d. across the lamp is zero some time after the battery is connected.

....

....

....

....

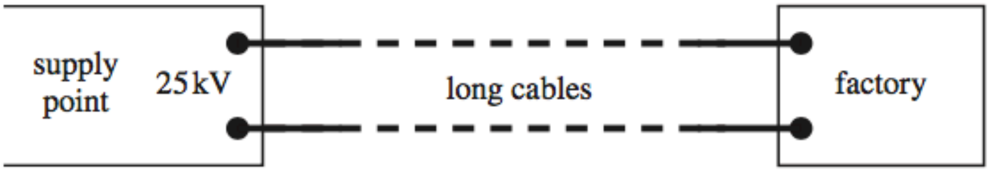
.... **[1]**

[Total: 9]

3)

(a) Long cables are used to send electrical power from a supply point to a factory some distance away, as shown in **Figure 6**. An input power of 500 kW at 25 kV is supplied to the cables.

Figure 6



(a) (i) Calculate the current in the cables.

answer = ...A
(1 mark)

(a) (ii) The total resistance of the cables is 30 Ω. Calculate the power supplied to the factory by the cables.

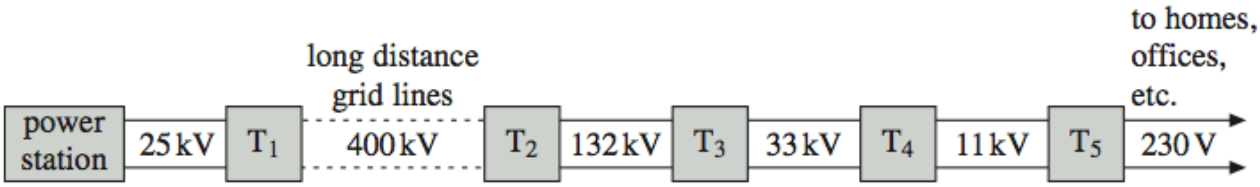
answer = ...kW
(2 marks)

(a) (iii) Calculate the efficiency with which power is transmitted by the cables from the input at the supply point to the factory.

answer = ...%
(1 mark)

(b) In Great Britain, the electrical generators at power stations provide an output at 25 kV. Most homes, offices and shops are supplied with electricity at 230 V. Power is transmitted from the power stations to the consumers by the grid system, the main principles of which are shown in **Figure 7**. In this network, T_1, T_2, T_3, etc, are transformers.

Figure 7



(b) (i) Explain how a step-down transformer differs in construction from a step-up transformer.

....

....

....

....

(1 mark)

(b) (ii) Explain why the secondary windings of a step-down transformer should be made from thicker copper wire than the primary windings.

....

....

....

....

(2 marks)

(c) Discuss the principles involved in high voltage transmission systems, explaining why a.c. is used in preference to d.c. and how the energy losses are minimised.

The quality of your written communication will be assessed in this question.

(6 marks)

For additional transformer questions go to theonlinephysicstutor.com and look for question by topic.

4)
5)
6)
7)
8)
9)
10)
11)
12)
13)
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17)
18)
19)
20)