1 **(a)** Fig. 8.1 shows a bar magnet suspended by a spring over a coil. The coil is connected to a sensitive centre-zero millivoltmeter.

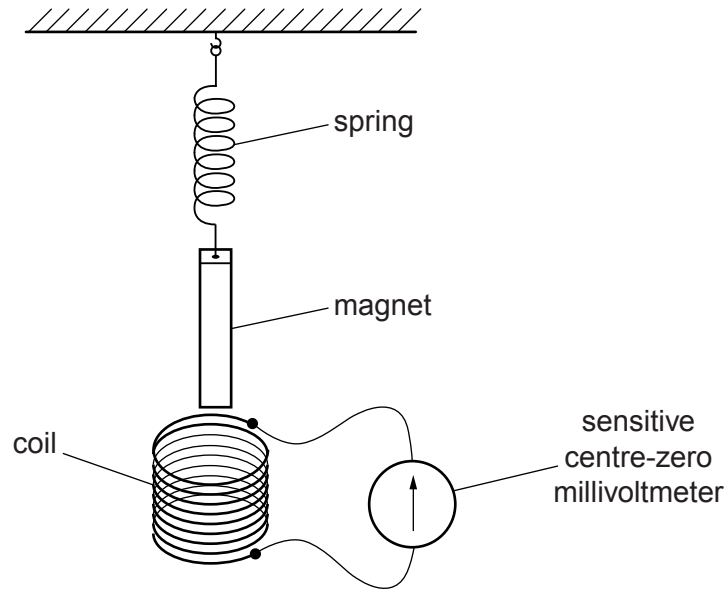
Fig. 8.1

(i) The lower end of the magnet is pushed down into the upper end of the coil and held at rest.

During the movement, an e.m.f. is induced in the coil. The meter shows a deflection to the right and then returns to zero.

Explain why this e.m.f. is induced.

....

.... [1]

(ii) State what happens to the needle of the meter when

1. the magnet is released from rest and is pulled up by the spring,

.... [1]

2. the magnet continues to oscillate up and down, moving in and out of the coil with each oscillation.

.... [1]
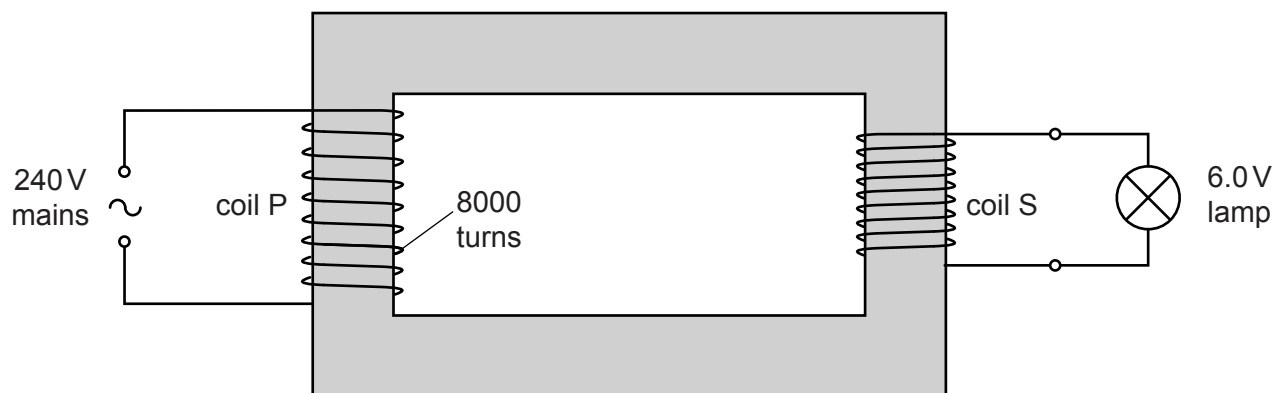
(b) Fig. 8.2 shows a transformer.

Fig. 8.2

The primary coil P, connected to the 240V mains supply, has 8000 turns. The secondary coil S supplies 6.0V to a lamp.

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

number of turns = ... [2]

(ii) **1.** The current in the primary coil is 0.050A.

Calculate the power input to the transformer.

power = ... [1]

2. 90% of the power input to the transformer is transferred to the lamp.

Calculate the current in the lamp.

current = ... [2]
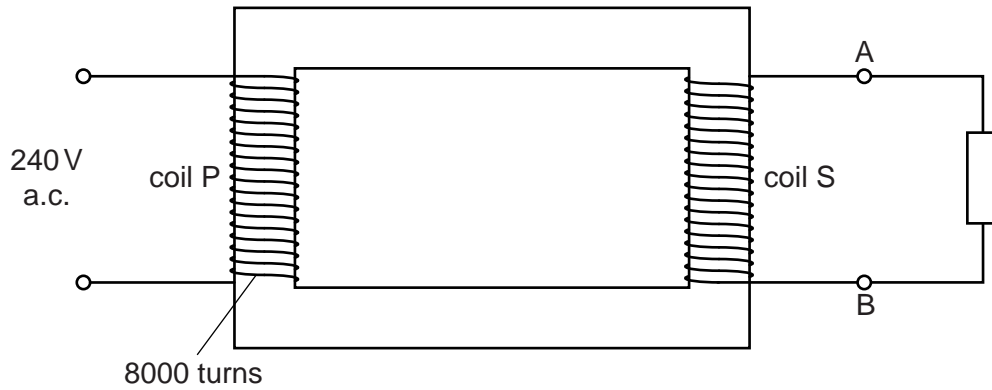
[Total: 8]

2 Fig. 9.1 represents a transformer.

Fig. 9.1

(a) (i) Name the process by which a changing current in the primary coil P causes a changing current in the secondary coil S.

....[1]

(ii) Suggest a material used for the coils. Explain why this material is used.

....

....

....[2]

(b) The input to the primary coil P is 240 V. This coil has 8000 turns of wire. The voltage obtained between terminals A and B is 12 V.

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

number of turns = ...[2]

(ii) The resistor connected between the terminals A and B is replaced by four 12 V lamps connected in parallel. The current in each lamp is 1.5 A.

Calculate the current in coil P. Assume the transformer is 100% efficient.

current = ...[3]

[Total: 8]

3 A solenoid is held in a vertical position. The solenoid is connected to a sensitive, centre-zero ammeter.

A vertical bar magnet is held stationary at position X just above the upper end of the solenoid as shown in Fig. 10.1.
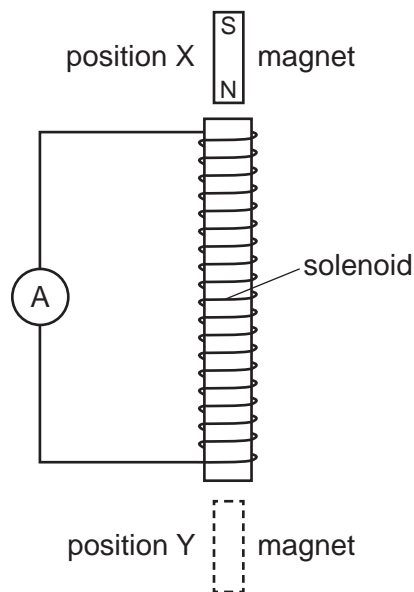

Fig. 10.1

The magnet is released and it falls through the solenoid. During the initial stage of the fall, the sensitive ammeter shows a small deflection to the left.

(a) Explain why the ammeter shows a deflection.

....

....[1]

(b) The magnet passes the middle point of the solenoid and continues to fall. It reaches position Y.

Describe and explain what is observed on the ammeter as the magnet falls from the middle point of the solenoid to position Y.

....

....

....

....

....

....[4]

(c) Suggest **two** changes to the apparatus that would increase the initial deflection of the ammeter.

1. ....

....

2. ....

....

[2]

[Total: 7]

4 Fig. 9.1 shows two separate coils of wire wound around an iron core.
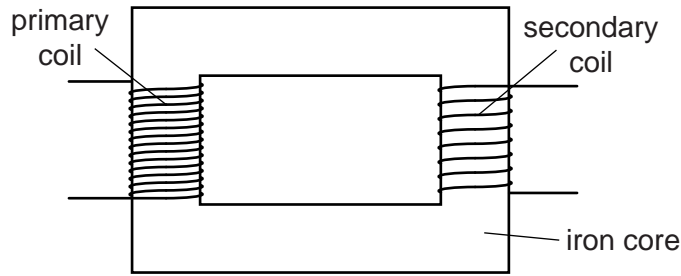

Fig. 9.1

An a.c. supply is connected across the primary coil and a 12V lamp is connected across the secondary coil. The lamp glows with normal brightness.

(a) State the name of the device shown in Fig. 9.1.

....[1]

(b) Explain why there is a current in the lamp.

....

....

....

....

....[4]

(c) (i) The coil connected to the lamp has 450 turns. The e.m.f. of the a.c. supply is 240V.

Calculate the number of turns on the coil connected to the a.c. supply.

number of turns = ...[2]

(ii) A 240V d.c. supply is used instead of the 240V a.c. supply. Tick **one** box to indicate what happens to the lamp.

☐ glows more brightly

☐ glows with the same brightness

☐ glows less brightly [1]

☐ does not glow [Total: 8]

5 **(a)** Fig. 10.1 shows the gap between the N-pole and the S-pole of a magnet.

N

S

Fig. 10.1

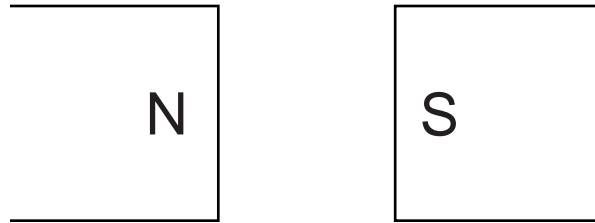The magnetic field in the gap is uniform.

On Fig. 10.1, draw four field lines to show the pattern and direction of the magnetic field in the gap. [2]

(b) Fig. 10.2 shows a horizontal copper wire PQ between two opposite magnetic poles.
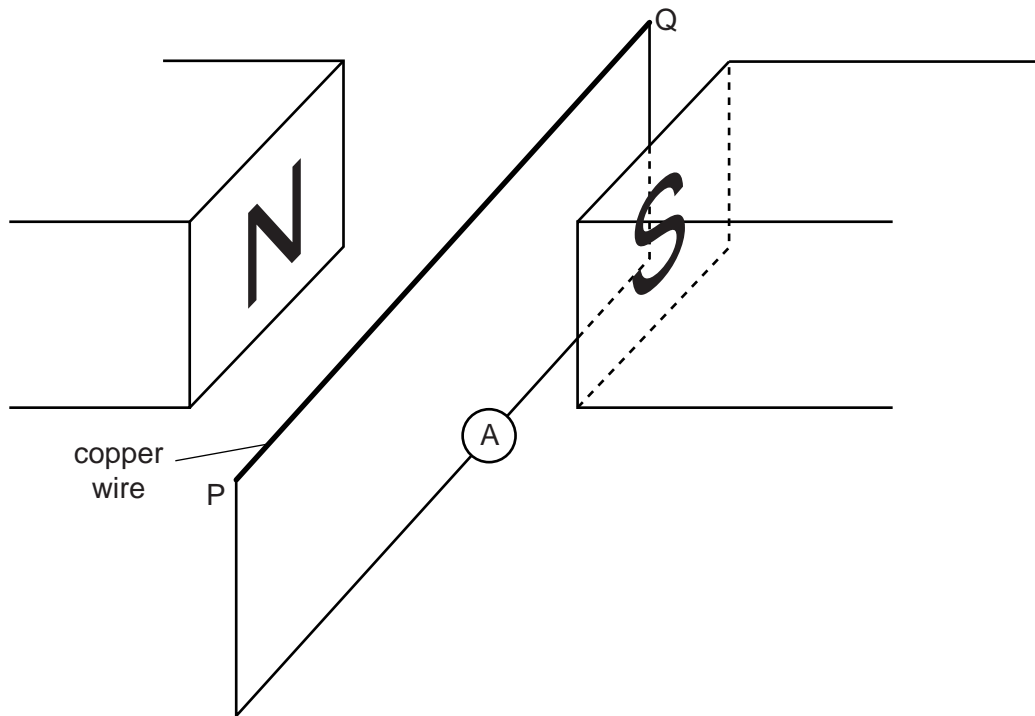
Q

N

S

A

copper
wire   P

Fig. 10.2

A circuit is made by connecting a sensitive digital ammeter between P and Q. The wire PQ is then moved vertically downwards.

(i) State and explain what is observed on the ammeter.

....

....

....

....[3]

(ii) State what is observed on the ammeter when PQ is moved

1. vertically downwards at a greater speed,

....[1]

2. vertically upwards at the same speed as in **1**.

....[1]

[Total: 7]

6 The output of an a.c. generator in a power station is 5000 V.

A transformer increases the voltage to 115 000 V before the electrical power is transmitted to a distant town.

(a) State and explain, using a relevant equation, one advantage of transmitting electrical power at a high voltage.

....

....

....

....

....[3]

(b) The transformer contains two coils, the primary coil and the secondary coil.

(i) State the other main component of a transformer and the material from which it is made.

....

....[1]

(ii) State the component in the transformer to which the a.c. generator is connected.

....

....[1]

(iii) There are 400 turns on the primary coil of the transformer.

Calculate the number of turns on the secondary coil.

number of turns = ...[2]

(c) Transformers within the town reduce the voltage to 230 V.

Suggest one reason for this.

....

....[1]

[Total: 8]