

- 4 A teacher demonstrates magnetic screening. When a magnet is placed near a small cardboard box, paper clips on the other side of the box are picked up, as shown in Fig. 4.1.

When a small piece of soft iron is placed inside the box as shown in Fig. 4.2, the paper clips fall off.

Magnetic field lines in each diagram are shown as thin lines.

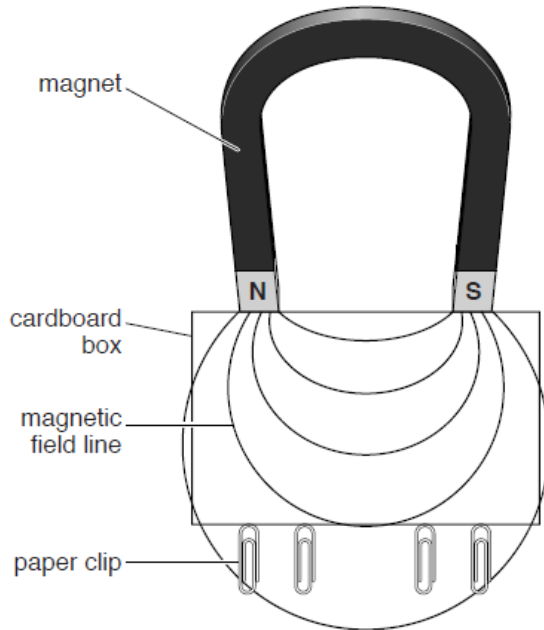


Fig. 4.1

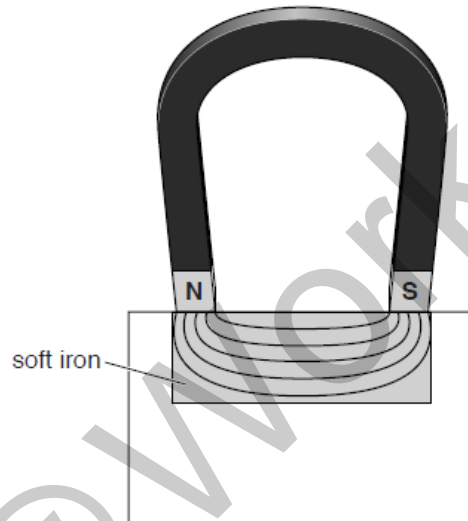


Fig. 4.2

- (a) On Fig. 4.1, mark an arrow on each of the magnetic field lines to show its direction. [1]  
(b) Explain why placing the soft iron inside the box causes the paper clips to fall off.

- (b) Explain why placing the soft iron inside the box causes the paper clips to fall off.

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

- (c) Explain why it is sensible to have magnetic screening around the tube of a cathode-ray oscilloscope.

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

6 Fig. 6.1 shows a coil of wire connected by flexible leads to a switch and a battery.

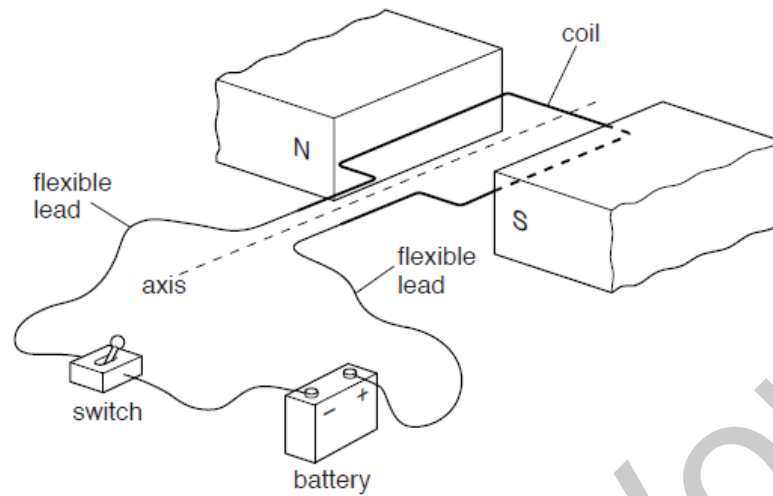


Fig. 6.1

The coil is placed between the poles of a permanent magnet and is free to turn about the axis.

When the switch is closed, forces due to the current act on the sides of the coil. The coil starts to turn.

(a) On Fig. 6.1, draw arrows to show the directions of the forces. [2]

(b) The coil stops when it is vertical. Explain why the turning effect of the forces is zero at this position.

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

(c) In order for the coil to rotate continuously, a split-ring commutator is connected between the battery and the coil.

Explain how the split-ring commutator enables the coil to rotate continuously. Include a diagram in your answer.

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.....  
.....  
..... [4]

- 8 (a) Describe an experiment that shows how a magnet can be used to produce a current in a solenoid by electromagnetic induction. Sketch and label the arrangement of apparatus you would use.

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

- (b) Fig. 8.1 represents a transformer with primary coil P and secondary coil S, wound on an iron core.

There is an alternating current in coil P.

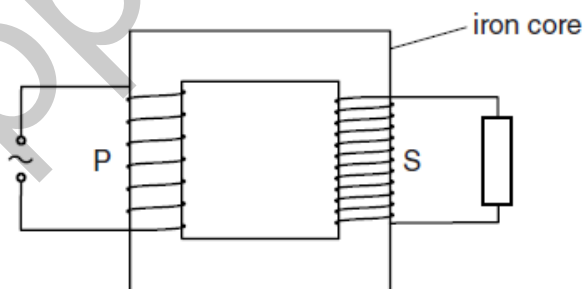


Fig. 8.1

- (i) State what happens in the iron core as a result of the alternating current in P.

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



(ii) Tick the box next to the correct description of the current in S.

higher frequency a.c.

same frequency a.c.

lower frequency a.c.

rectified d.c.

constant d.c.

[1]

(iii) Coil P has 50 turns of wire, an applied voltage of 12V, and a current of 0.50A. Coil S has 200 turns.

Calculate the current in S. Assume the transformer is 100% efficient.

current = ..... [3]

[Total: 9]

- 10 (a) Fig. 10.1 shows an electron beam travelling, in a vacuum, towards the space between a pair of oppositely-charged parallel plates.

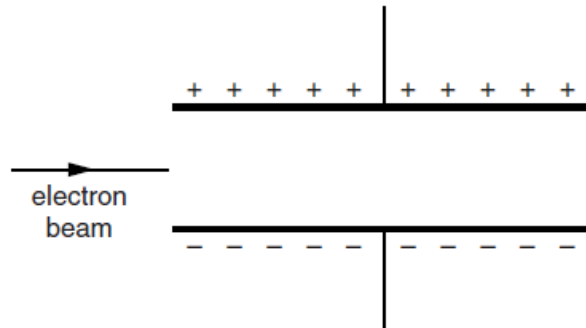


Fig. 10.1

On Fig. 10.1, draw carefully the path of the beam between the plates and in the space to the right of the plates. [2]

- (b) The screen of a cathode-ray oscilloscope (c.r.o.) has a grid of 1 cm squares. Fig. 10.2 shows the trace of an alternating voltage on this screen.

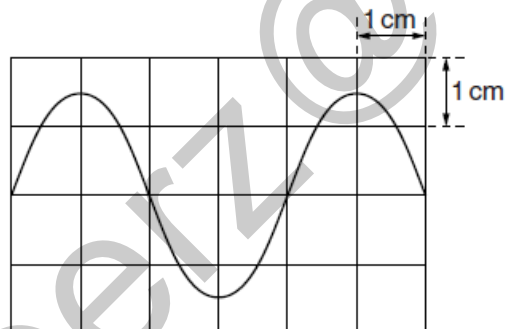


Fig. 10.2

- (i) A potential difference of 5.0V across the Y-plates of the oscilloscope moves the spot on the screen a vertical distance of 1.0 cm.

Use Fig. 10.2 to determine the maximum p.d. across the Y-plates.

maximum p.d. = ..... [1]



- (ii) The spot on the screen takes 1.0ms to move 1.0 cm horizontally.

From Fig. 10.2, determine the time for 1 cycle of the waveform on the screen, and use this time to find the frequency of the alternating voltage.

frequency = ..... [3]

[Total: 6]

11 (a) Describe the action of

- (i) a NOT gate,

..... [1]

- (ii) a thermistor.

..... [1]

(b) Fig. 11.1 shows a circuit that switches on a warning lamp when the temperature in an oven falls below a set value.

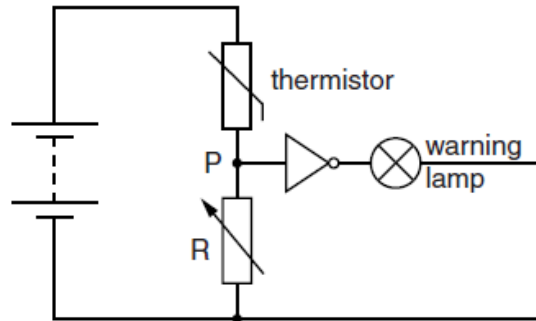


Fig. 11.1

Explain, with reference to the components in the circuit and point P,

(i) why the warning lamp is on when the temperature in the oven is below the set value,

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.....  
.....  
.....  
.....  
.....  
..... [4]

(ii) the effect of changing the resistance of R.

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

[Total: 7]



8 (a) A piece of wire has a resistance of  $0.45\ \Omega$ .

Calculate the resistance of another piece of wire of the same material with a third of the length and half the cross-sectional area.

resistance = ..... [3]

(b) Fig. 8.1 shows a circuit with three resistors, a power supply and four voltmeters.

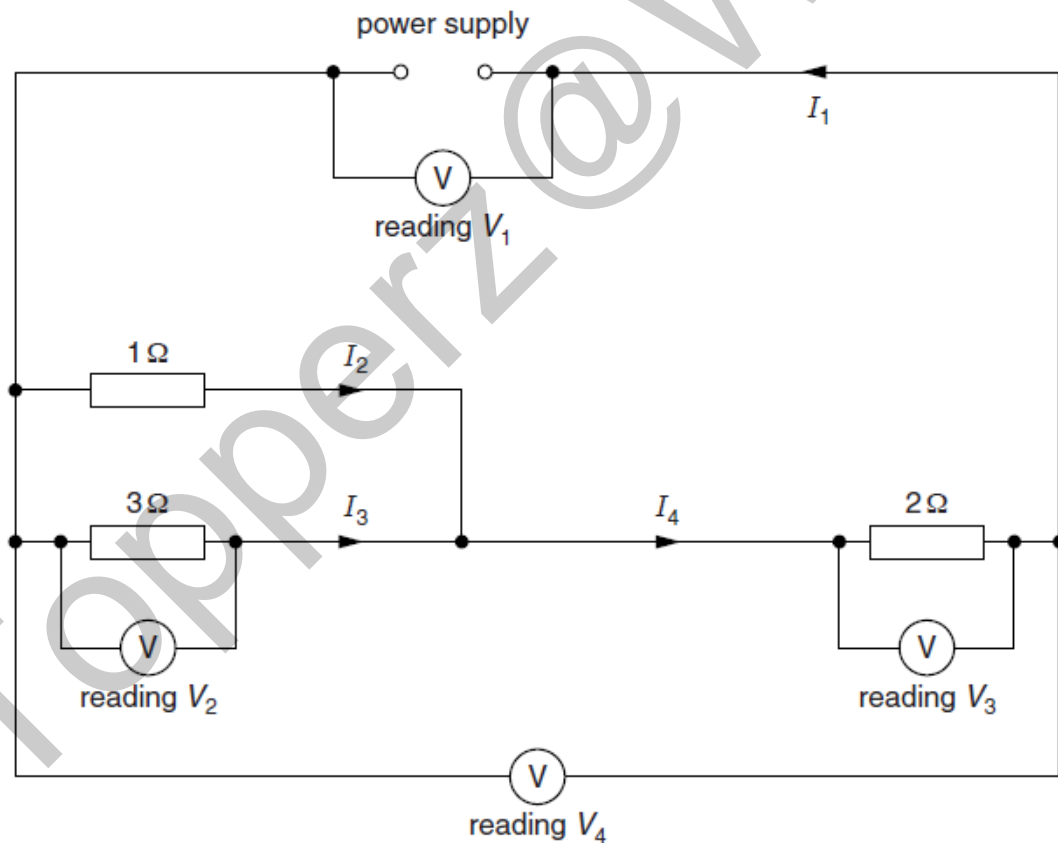


Fig. 8.1





- (i) Calculate the combined resistance of the three resistors.

resistance = .....[3]

- (ii) Write down two relationships for the currents in the circuit.

[2]

- (iii) Write down two relationships for the voltmeter readings in the circuit.

[2]

[Total: 10]

- 8 An a.c. power supply is connected in series with a metal-filament lamp. A cathode-ray oscilloscope (c.r.o.) is in parallel with the lamp, as shown in Fig. 8.1.

Fig. 8.2 is the trace seen on the c.r.o. screen.

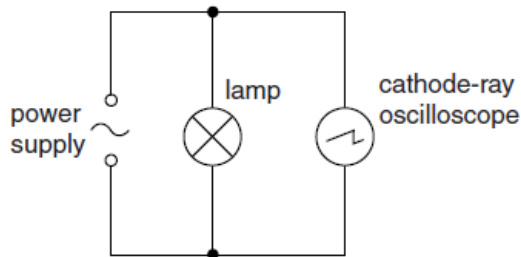


Fig. 8.1

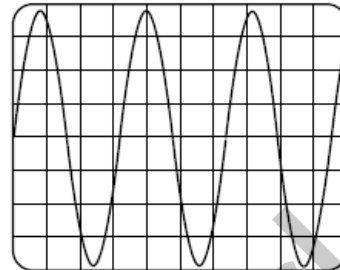


Fig. 8.2

A diode is inserted in the circuit, as shown in Fig. 8.3.

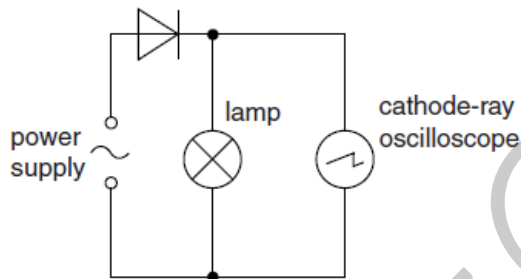


Fig. 8.3

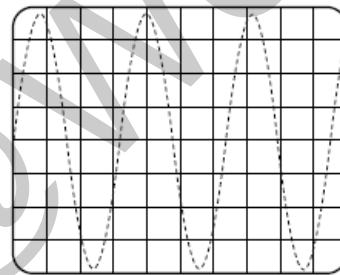


Fig. 8.4

- (a) (i) On Fig. 8.4, draw the shape of the trace now seen on the screen. [2]  
(ii) Suggest a device that uses a diode in this way.

..... [1]

- (b) State and explain the effect on the lamp of inserting the diode into the circuit.

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

[Total: 5]



9 The a.c. supply from a power station is connected to the primary coil of a transformer. The secondary coil is connected to long-distance transmission cables.

(a) The output voltage of the transformer is greater than the input voltage.

Explain how a transformer produces this output voltage.

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.....  
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.....  
..... [4]

(b) There are energy losses in the transmission cables.

(i) Explain why the energy losses become greater when the length of the transmission cables is greater.

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..... [2]

(ii) Discuss the advantages and disadvantages of using transmission cables of greater cross-sectional area.

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..... [2]

Topperz @ Work

10 Fig. 10.1 shows a variable resistor (rheostat) and a solenoid (long coil) connected to a battery.

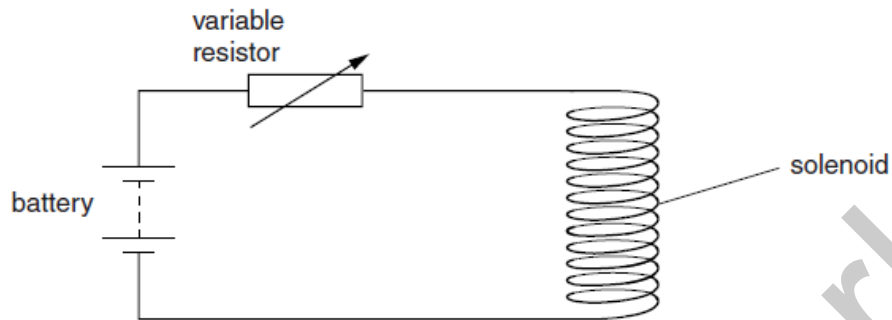


Fig. 10.1

The current in the solenoid produces a magnetic field.

- (a) (i) On Fig. 10.1, draw lines to show the pattern of the magnetic field due to the current. [2]
- (ii) State the feature of the pattern of the magnetic field lines that indicates the strength of the magnetic field at particular points.

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

- (b) State and explain the effect on the magnetic field of increasing the resistance of the variable resistor.

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