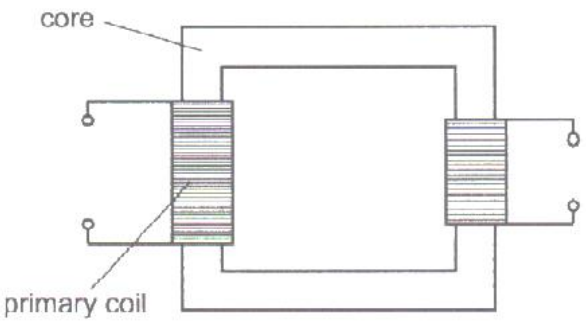
# Electromagnetic Induction – 2022 November IGCSE 0625

**1.** Nov/2022/Paper_21/No.34

The diagram represents a transformer.



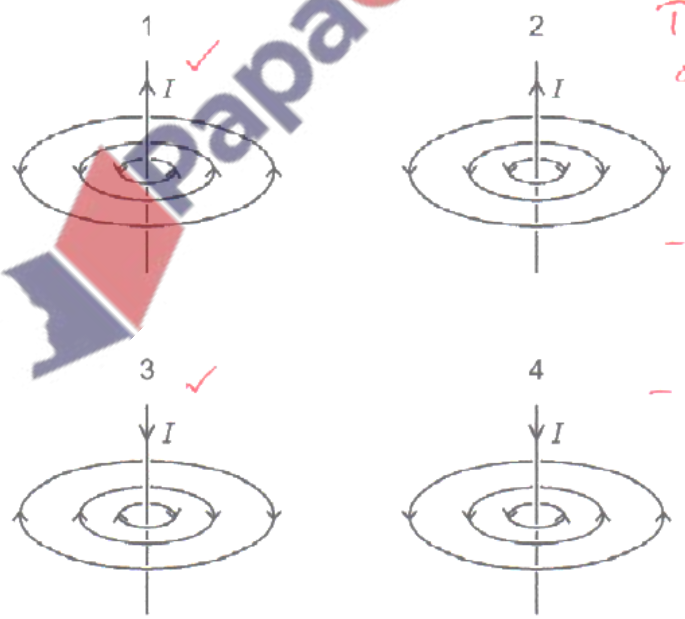

Which row shows materials suitable for making the core and the primary coil?

| | core | primary coil |
|---|---|---|
| A | iron | copper |
| B | iron | plastic |
| C | steel | copper |
| D | steel | plastic |

Core – soft iron
Primary coil – copper wire

**2.** Nov/2022/Paper_21/No.35

The diagrams show the magnetic field lines around a wire carrying a current, $I$.




To identify direction of field use right-hand grip rule.
- Thumb point in direction of current
- Fingers will be in field direction

Which diagrams are correct?

**A** 1 only **B** 2 and 3 **C** 4 only **D** 1 and 3

**3.** Nov/2022/Paper_22/No.35

Transformers are used in the transmission of electrical power to houses.

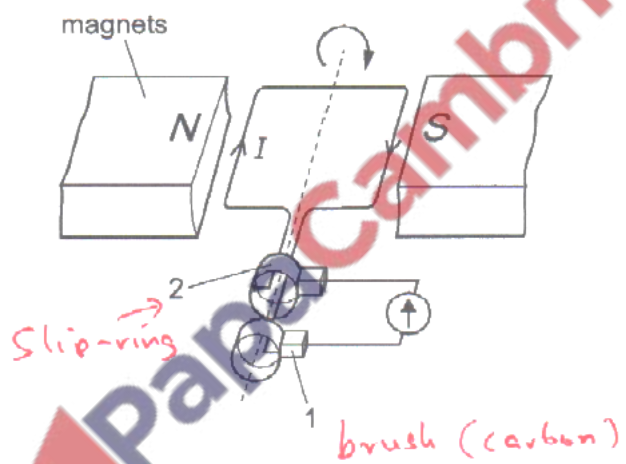
Which type of transformer is used at the power station prior to connection to the power lines and which type is used prior to delivery to the houses?

| | power station | before houses |
|---|---|---|
| A | step-down | step-down ✓ |
| B | step-down | step-up |
| C ✓ | step-up ✓ | step-down ✓ |
| D | step-up ✓ | step-up |

- In power station, it step-up voltage so there is less current for transmission to minimise power loss.
- Before houses, it step-down voltage so to increase current needed to run devices at home.

**4.** Nov/2022/Paper_22/No.36

The diagram shows an a.c. generator rotating in a clockwise direction.




Slip-ring

brush (carbon)

What are the names of parts 1 and 2?

| | 1 | 2 |
|---|---|---|
| A ✓ | brush | slip-ring |
| B | brush | split-ring commutator |
| C | slip-ring | brush |
| D | slip-ring | split-ring commutator |

← These are found in d.c motors

**5.** Nov/2022/Paper_23/No.35

Which metal is used for the core of a transformer?

A aluminium
B copper
C soft iron
D steel

both are non-magnetic material, so not used in core

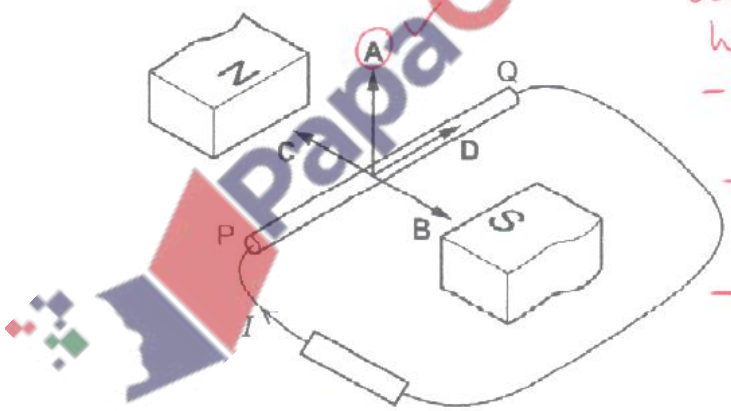
C ✓ — It is easy to magnetise and demagnetise

D — gets magnetised permanently, so not suitable for core.

**6.** Nov/2022/Paper_23/No.36

The diagram shows a conducting metal rod PQ in the magnetic field between the N pole and the S pole. The rod is connected to a resistor in a circuit.

In which direction should rod PQ be moved to induce the current *I* in the direction of the arrow in the circuit?




Use Fleming's right hand
- 1st finger – Field N → S
- 2nd finger – current direction
- Thumb – direction of motion

**7.** Nov/2022/Paper_31/No.9

Fig. 9.1 shows a transformer used on a building site.

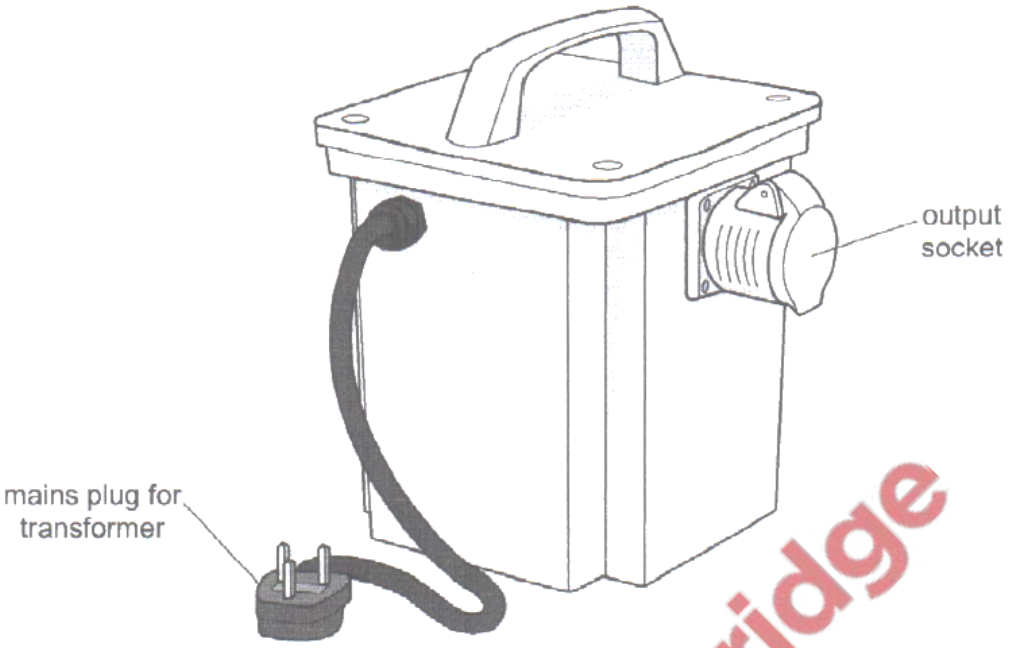



**Fig. 9.1**

**(a)** The mains plug for the transformer contains a fuse.

**(i)** Give a reason why the plug includes a fuse.

fuse protects transformer from overheating [1]

**(ii)** Explain how a fuse works.

– Large current in fuse will make the fuse wire to melt and break the circuit. [2]

**(b)** The mains input (primary) potential difference (p.d.) to the transformer is 230 V a.c.

The number of turns on the input (primary) coil is 314. The number of turns on the output (secondary) coil is 150.

Calculate the output (secondary) p.d. from the transformer.

$\frac{V_s}{V_p} = \frac{N_s}{N_p}$

$V_s = \frac{N_s \times V_p}{N_p}$

$V_p = 230\,V$

$N_p = 314$

$N_s = 150$

$V_s = ?$

$V_s = \frac{150 \times 230}{314}$

$= 110\,V$

output p.d. = 110 V [3]

**(c)** Fig. 9.2 shows an outline of the transformer.

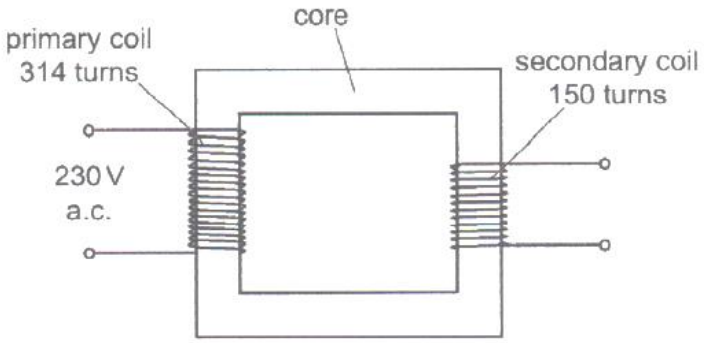



**Fig. 9.2**

**(i)** State a suitable material for the core of the transformer.

Soft iron. [1]

**(ii)** State a suitable material for the primary and secondary coils of the transformer.

Copper wire [1]

**(iii)** Explain how Fig. 9.2 shows a step-down transformer.

there are fewer turns on secondary coil. [1]

[Total: 9]

**8.** Nov/2022/Paper_32/No.9(a_ c)

Fig. 9.1 shows a transformer. An a.c. voltmeter is connected to the output of the secondary coil.

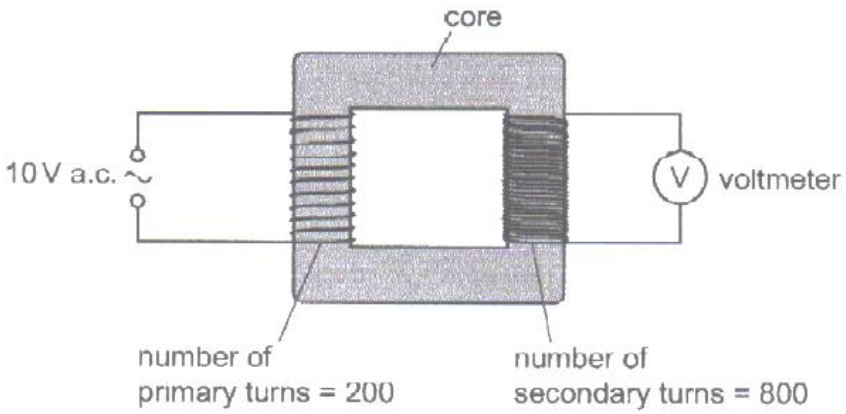



**Fig. 9.1**

**(a)** State the meaning of a.c.

alternating current

..... [1]

**(b)** State the name of the type of transformer shown.

Step-up

..... [1]

**(c)** State a suitable material for the core of the transformer in Fig. 9.1.

Soft iron

..... [1]

**9.** Nov/2022/Paper_32/No.10

**(a)** Fig. 10.1 shows the equipment used by a teacher in a laboratory demonstration.

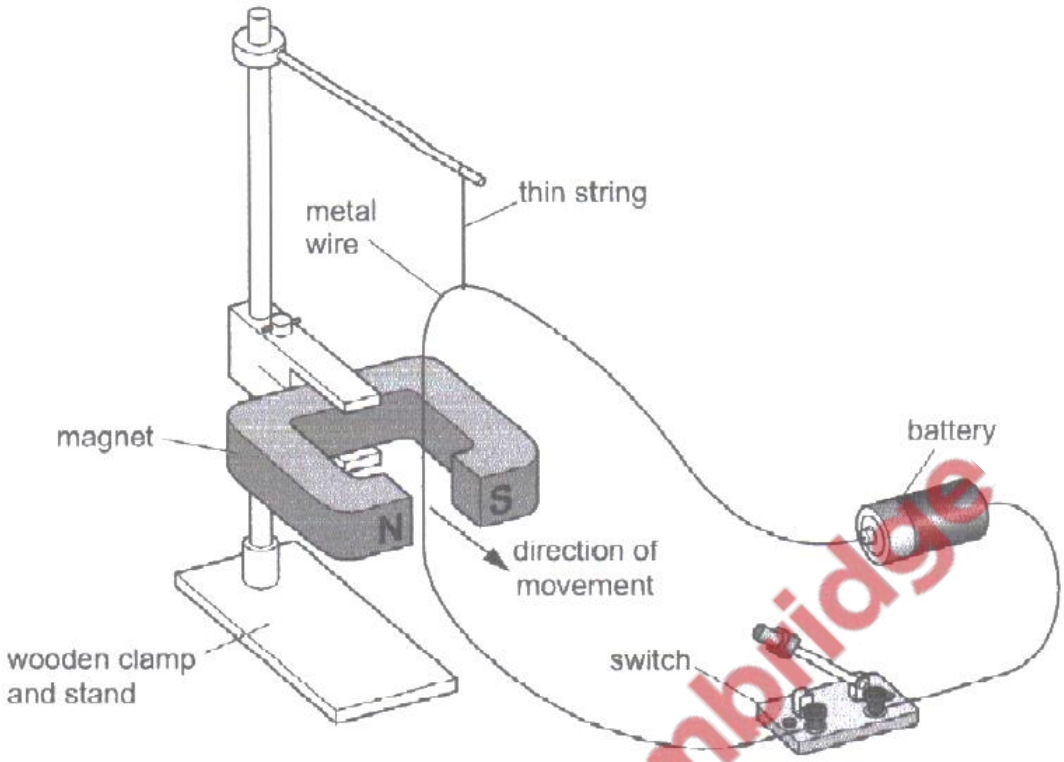



**Fig. 10.1**

The teacher closes the switch and there is a current in the metal wire.
A force acts on the wire. The wire moves in the direction shown in Fig. 10.1.

**(i)** State **two** changes that increase the force on the wire.

1. Increase current (or number of cells) [1]
2. Use a stronger magnet [1]

**(ii)** State **one** change that reverses the direction of the force on the wire.

Reverse the battery or the magnet. [1]

**(b)** Fig. 10.2 shows the poles of the magnet.

Draw the shape and show the direction of the magnetic field in the gap between the poles of the magnet.

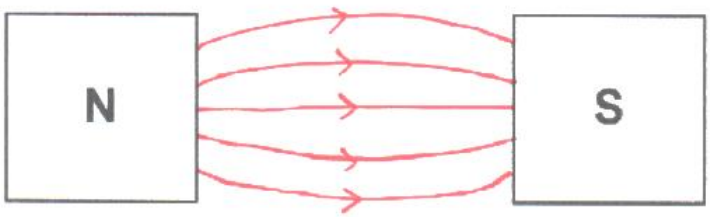



**Fig. 10.2**

[2]

[Total: 5]

**10.** Nov/2022/Paper_41/No.7

The electric starter motor in a car is switched on and off using a relay.

The relay consists of a plastic case and two flexible springy strips, X and Y, which are made of soft iron. These iron strips act as the switch when a circuit is connected between the terminals W and Z.

Fig. 7.1 shows X, Y and the plastic case.

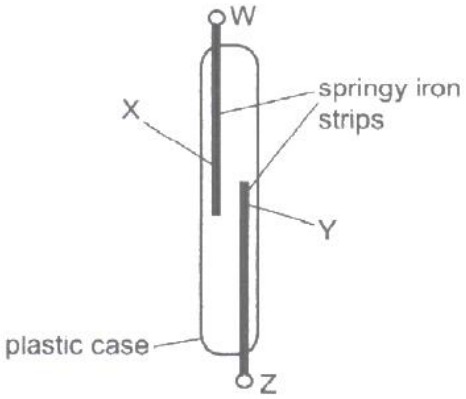



Fig. 7.1

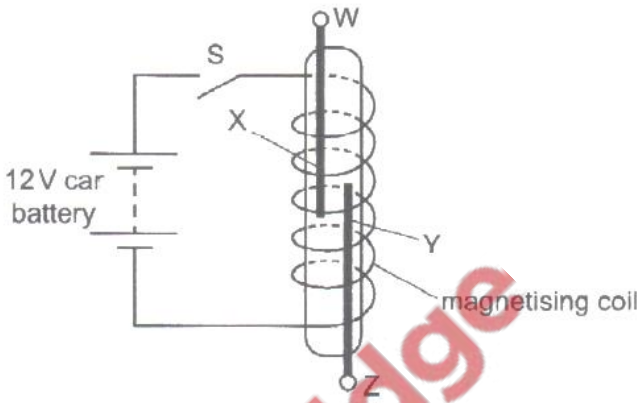



Fig. 7.2

Fig. 7.2 shows the equipment from Fig. 7.1 inside a magnetising coil. The magnetising coil is in series with the 12 V car battery and switch S, which is open.

**(a)** Switch S is now closed.

Explain what happens to the springy iron strips X and Y.

– Both X and Y become magnetised.

– The ends of strips X and Y have opposite magnetic poles so they will attract.

– When they touch, they complete the circuit WZ. [3]

**(b)** The power of the starter motor is 1.8 kW and it is also operated by the car battery.

**(i)** Calculate the current in the starter motor when it is used.

$P = V \times I$ $P = 1.8 \times 10^3$ W, $V = 12$ V

$I = \frac{P}{V}$

$= \frac{1.8 \times 10^3}{12}$

$= 150$ A

current = 150 A [2]

(II) The starter motor circuit is connected between terminals W and Z.

Explain why copper wires with a large cross-sectional area are used for this circuit.

- Thick copper wire have smaller resistance
- So less thermal energy is produced when a current of 150A flow through it. [2]

(c) Fig. 7.3 shows the relay and the symbols for the car battery and the starter motor.

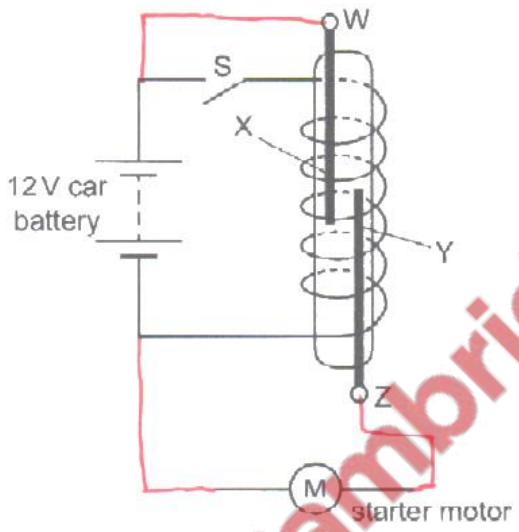



Fig. 7.3

The springy iron strips X and Y act as the switch for the starter motor circuit.

Complete the circuit diagram for the motor circuit. [2]

Both the starter motor and the relay are connected to the same battery.

[Total: 9]

**11.** Nov/2022/Paper_43/No.9

Fig. 9.1 shows a circuit with an alternating current (a.c.) supply, a resistor and a diode.

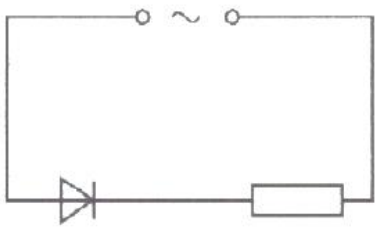


**Fig. 9.1**

The frequency of the power supply is 50 Hz.

**(a)** Calculate the time period (time for one complete cycle) of the a.c. supply.

$T = \frac{1}{f}$ Period = $\frac{1}{\text{frequency}}$

$= \frac{1}{50}$

$= 0.02$ s

time = 0.02 [2]

**(b)** The peak potential difference (p.d.) across the resistor is 340 V.

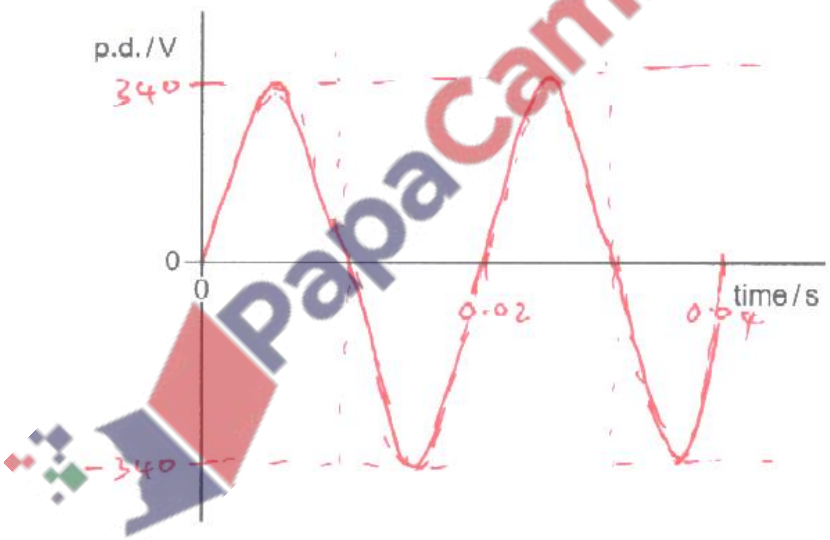



**Fig. 9.2**

On Fig. 9.2:

**(i)** sketch a graph to show how the p.d. across the resistor varies with time for two cycles [2]

**(ii)** label the p.d. axis with the value of p.d. at the peak [1]

**(iii)** label the time axis with two values of time. [2]

[Total: 7]