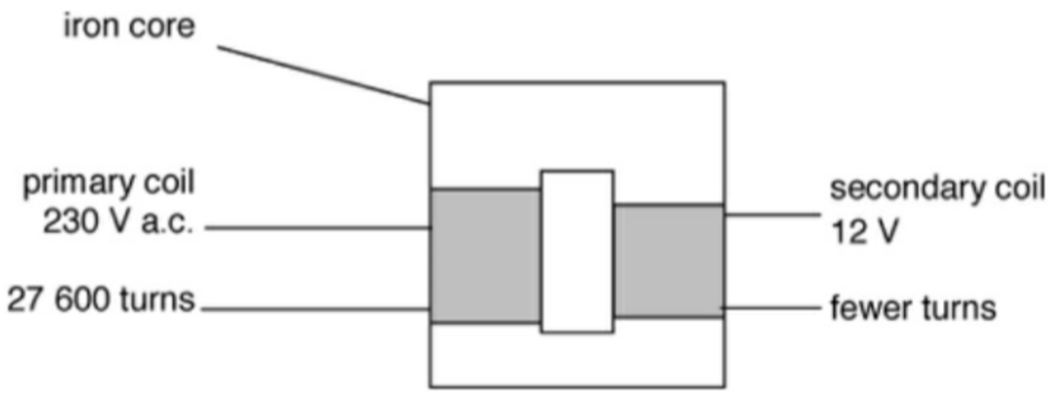
GCSE Physics A (Gateway)

J249/04 Physics A P5-P8 and P9 (Higher Tier)

Question Set 22

22 The diagram below shows the structure of a transformer.



(a) The alternating current in the secondary coil is greater than in the primary coil.

Explain why.

There is more coils in the primary coil than the secondary coil ∴ the voltage decreases from the primary coil to the secondary coil.
As the transformer is assumed to be 100% efficient, the power in the primary coil is equal to the power in the secondary coil. Due to the equation P=IV, if voltage decreases in the secondary coil, the current must increase.
∴ ac in secondary is greater than in primary coil

[3]

(b) The secondary coil produces an output of 12 V.

Calculate the number of turns in the secondary coil.

Show your working.

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

Number of turns = 1440

[2]

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

$$\frac{12}{230} \times 27600$$

$$= 1440$$

(c) A transformer is used to increase voltage from 25 000 V up to 400 000 V before transmission through the National Grid. Therefore, the voltage increases by 16 times.

(i) Explain how this increase in voltage would affect the current, assuming that the power remains constant.

∴ $P = IV$, if voltage increases, current must decrease by 16 times in order for P to remain constant. **[2]**

(ii) The formula to work out power is:

power = current^2 × resistance

Explain, without using a calculation, why this increase in voltage is important to power loss in transmission cables.

As current decreases, the power loss therefore decreases (due to resistance remaining the same). **[2]**

eg. If current halves, then power loss quarters. ($P \propto I^2$)

The increase in voltage, decreases the current ∴ decreases power loss.

Total Marks for Question Set 22: 9

Equations in physics

$(\text{final velocity})^2 - (\text{initial velocity})^2 = 2 \times \text{acceleration} \times \text{distance}$

change in thermal energy = mass × specific heat capacity × change in temperature

thermal energy for a change in state = mass × specific latent heat

energy transferred in stretching = 0.5 × spring constant × $(\text{extension})^2$

potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil

Higher tier only –

force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density × current × length