

GCSE Physics B (Twenty First Century Science)
J259/02 Depth in physics (Foundation Tier)

Question Set 3

1 The generator in a power station is connected to the National Grid through a transformer.

Near a town, other transformers are used to transfer power into homes.

Fig. 1.1 is a simplified diagram showing just one transformer near the homes

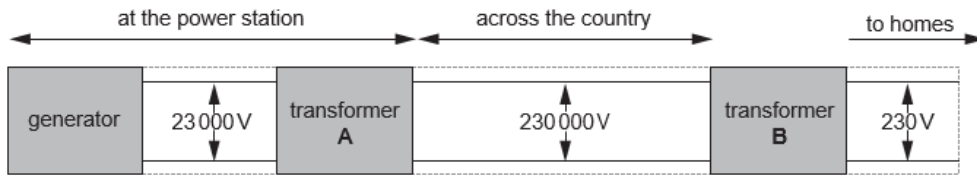


Fig. 1.1

(a) The generator produces an alternating voltage, not a direct voltage.

Explain the difference between these two types of voltage.

Alternating means direction of voltage keeps swapping direction and direct means the direction stays the same. [2]

(b) (i) Using Table 1.1 calculate the output current for transformer B.

Use the equation:

$$\text{Input potential difference} \times \text{Input current} = \text{Output potential difference} \times \text{Output current}$$

Transformer A has already been completed.

Transformer	Input potential difference (V)	Input current (A)	Output potential difference (V)	Output current (A)
A	23000	3000	230000	300
B	230000	300	230	300000

Table 1.1

[3]

(ii) Use the input data for transformer A to show that the output power of the generator is more than 60 megawatts (MW).

$$1 \text{ MW} = 1\,000\,000 \text{ W}$$

$$P = IV = 300 \times 230,000 = 69,000,000 \text{ W} \\ = 69 \text{ MW}$$

$$69 \text{ MW} > 60 \text{ MW}$$

$$\text{Output power} = \dots\dots\dots 69 \dots\dots\dots \text{ MW} \quad [3]$$

(iii) A typical home needs a power of 10 kilowatts (kW).

$$1 \text{ kW} = 1000 \text{ W.}$$

Calculate the number of homes that this power station could supply.

Use your answer to (b)(ii).

$$\frac{69,000,000}{10,000} = 6,900 \text{ homes}$$

$$\text{Number of homes} = \dots 6900 \dots \quad [2]$$

(c) All power stations use step-up transformers like transformer A between the generator and the National Grid power cables.

Explain how using 230000V instead of 23000V for the cables across the country makes energy transfer more efficient. [2]

A higher voltage means a smaller current as $P = IV$ and power remains the same. A smaller current means less energy is lost as heat. Energy is dissipated as current heats the power cables.

Total Marks for Question Set 3: 12

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