Oxford Cambridge and RSA

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

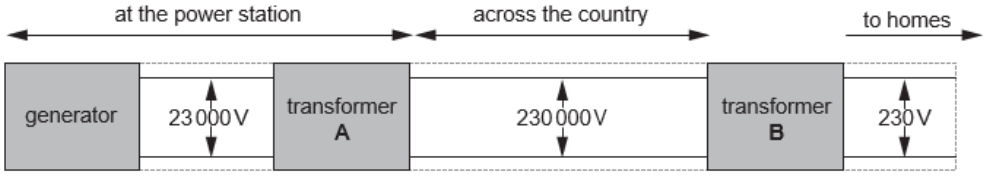

Fig. 1.1

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

Explain the difference between these two types of voltage.

[2]

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

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

Use the equation:
Input potential difference × Input current = Output potential difference × 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 MW = 1 000 000 W

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

$= 69\ MW$

$69\ MW > 60\ MW$

Output power = 69 MW [3]

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

1 kW = 1000 W.

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

Use your answer to **(b)(ii)**.

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

Number of homes = 6900 **[2]**

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

Explain how using 230 000 V instead of 23 000 V 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