

GCSE Combined Science: Trilogy

Worksheet: The National Grid

TIME 25 min	TOTAL 25 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: The National Grid

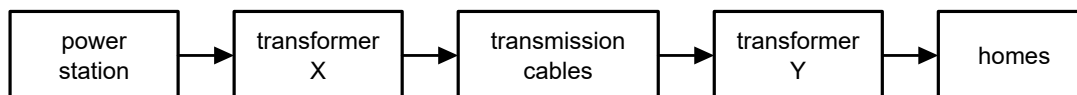
NAME _____ **CLASS** _____ **DATE** _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Figure 1 shows how electricity is transferred from a power station to homes using the National Grid.

Figure 1



0 1 . 1

What is the National Grid?

Tick (✓) **one** box.

a system of cables and transformers linking power stations to consumers

☐

a network of power stations that all use the same fuel

☐

a set of batteries that store energy for homes

☐

the wiring inside a house

☐

[1 mark]

0 1 . 2

What type of transformer is transformer X?

Tick (✓) **one** box.

step-down transformer

☐

step-up transformer

☐

[1 mark]

0 1 . 3

What does transformer Y do to the potential difference?

Tick (✓) **one** box.

decreases it

☐

increases it

☐

keeps it the same

☐

[1 mark]

0 1 . 4

The potential difference in the transmission cables is very high.

Give **one** reason why.

.....

.....

[1 mark]

0 2

A transmission cable carries a current of 1900 A at a potential difference of 275 000 V.

0 2 . 1

Calculate the power transmitted.

Use the equation:

power = potential difference × current

.....

.....

.....

.....

Power = W

[2 marks]

0 3

0 3 . 1

Which type of transformer increases potential difference?

Tick (✓) **one** box.

Step-down

☐

Step-up

☐

[1 mark]

0 3 . 2

State **one** reason step-down transformers are needed before electricity reaches homes.

[1 mark]

0 4

0 4 . 1

Why is an alternating potential difference, rather than a direct one, used for the National Grid?

Tick (✓) **one** box.

Transformers only work with an alternating potential difference

☐

Alternating current is cheaper to generate

☐

Direct current cannot travel long distances at all

☐

Power stations can only produce alternating current

☐

[1 mark]

0 4 . 2

State **one** advantage of transmitting electricity at a very high potential difference.

[1 mark]

0 5

0 5 . 1

Explain how using step-up transformers makes the National Grid an efficient way to transfer energy.

[3 marks]

0 6

A power station transmits 840 MW of power at a potential difference of 400 kV, through cables of total resistance 5Ω .

0 6 . 1

Calculate the power lost in the cables.
Give your answer in MW.

Power lost = MW

[4 marks]

0 7

Electrical power is transferred from power stations to consumers using the National Grid.

0 7 . 1

Explain why electrical power is transmitted through the National Grid cables at a very high potential difference.

[3 marks]

0 7 . 2

Explain why step-down transformers are used before the electricity reaches homes.

[2 marks]

0 7 . 3

A power station transfers 500 MW through transmission cables at a potential difference of 400 kV.
Calculate the current in the cables.

Current = A

[3 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: The National Grid · 25 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: a system of cables and transformers linking power stations to consumers

01.2 [1 mark]

Correct: step-up transformer

01.3 [1 mark]

Correct: decreases it

01.4 [1 mark]

Answer: To reduce the current, so less energy is lost by heating the cables (more efficient).

- to reduce the current / to reduce energy losses (by heating) in the cables / to make the transfer more efficient (1)
-

Question 2 (2 marks)

02.1 [2 marks]

Answer: 522 500 000 W

- $P = 275\,000 \times 1900$ (1)
 - $P = 522\,500\,000$ (W) (1)
-

Question 3 (2 marks)

03.1 [1 mark]

Correct: Step-up

03.2 [1 mark]

Answer: To reduce the very high transmission potential difference to a safe level (230 V) for domestic use.

- to reduce the (very high) transmission potential difference to a safe level (230 V) for domestic use (1)
-

Question 4 (2 marks)

04.1 [1 mark]

Correct: Transformers only work with an alternating potential difference

04.2 [1 mark]

Answer: It reduces the current needed for a given power, which reduces the energy dissipated (wasted) by heating in the cables.

- reduces the current (for a given power), which reduces the energy dissipated / wasted by heating in the cables (1)
-

Question 5 (3 marks)

05.1 [3 marks]

Answer: Step-up transformers increase the potential difference for transmission; for the same power this reduces the current in the cables; a smaller current means much less energy is dissipated by heating the cables.

- step-up transformers increase the potential difference (from the power station to the transmission cables) (1)
 - for the same power transmitted, this reduces the current in the cables ($P = V \times I$) (1)
 - a smaller current means less energy is dissipated by heating the cables (power lost = $I^2 \times R$), so less energy is wasted (1)
-

Question 6 (4 marks)

06.1 [4 marks]

Answer: 22.05 MW

- $I = 840\,000\,000 \div 400\,000$ (1)
- $I = 2100$ (A) (1)
- $P_{\text{lost}} = 2100^2 \times 5$ (= 22 050 000 W) (1)
- $P_{\text{lost}} = 22.05$ (MW) (1)

Notes: Not converting MW and kV to W and V scores at most 1 mark.

Question 7 (8 marks)

07.1 [3 marks]

Answer: For a given power, a higher pd means a smaller current; a smaller current means less energy is dissipated by heating in the cables, so the transfer is more efficient.

- for a given power, increasing the potential difference reduces the current (1)
- a smaller current means less energy is dissipated / transferred by heating in the cables (1)
- so the National Grid is more efficient / less energy is wasted (1)

07.2 [2 marks]

Answer: To decrease the potential difference to a much lower value (230 V), because very high potential differences would be dangerous in homes.

- to decrease the potential difference to a much lower value / 230 V (1)
- because a very high potential difference would be dangerous (for domestic use) / appliances are designed for 230 V (1)

07.3 [3 marks]

Answer: 1250 A

- $500\,000\,000 = 400\,000 \times I$ (1)
- $I = 500\,000\,000 \div 400\,000$ (1)
- $I = 1250$ (A) (1)

Notes: An answer of 1.25 (A) (MW and kV not converted consistently) scores 2 marks.
