

National Grid

GCSE Physics · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Describe what the National Grid is. (2 marks)

Step 1 · Parts

A nationwide system of cables and transformers.

Step 2 · Job

It links power stations to consumers, so electricity generated anywhere can be supplied anywhere in the country.

Answer: Cables and transformers linking power stations to consumers

Check: Name both cables and transformers.

2. Now try one with the steps

Explain why the National Grid transmits electricity at a very high potential difference. (4 marks)

Step 1 · Same power

Step 2 · Heating

Step 3 · Energy

Step 4 · Conclusion

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Describe the National Grid. [2]

2. State what a step-up transformer does to the potential difference. [1]

3. Explain why step-down transformers are used before electricity reaches homes. [1]

4. Put these in the order energy passes through them: step-down transformer, power station, homes, transmission cables, step-up transformer. [2]

5. Explain why electricity is transmitted at a high potential difference. [3]

6. 100 MW is transmitted at 400 kV. Calculate the current in the cables, in amperes. [2]

7. Explain why the National Grid needs some power stations that can start up quickly. [2]

8. State one reason why overhead cables are used for most long-distance transmission instead of underground cables. [1]

9. A current of 250 A flows through cables with a resistance of $2.0\ \Omega$. Calculate the power lost by heating, in MW. [2]

10. The same 100 MW is sent at 25 kV through the same $2.0\ \Omega$ cables. Calculate the power lost, in MW. [3]

11. The current in a cable is halved. State the fraction of the original power that is now lost by heating, decimal. [1]

12. A transformer has a primary p.d. of 25 kV and a primary current of 400 A. The secondary p.d. is 400 kV. Assuming 100% efficiency, calculate the secondary current, in amperes. [3]

13. Calculate the percentage of the 100 MW lost in question 9. Give your answer to 2 significant figures. [2]

14. A student says, 'Step-up transformers reduce the resistance of the cables.' Explain why this is wrong and give the correct reason that less energy is wasted. [2]

4. Before you hand it in

"High voltage reduces the resistance of the wires."

High p.d. means a low current for the same power; low current means less heating.

"High voltage makes the electricity travel faster."

The reason is efficiency: less energy is dissipated by heating the cables.

Thinking step-down transformers are used to save energy

Step-up saves energy in transmission; step-down makes the supply safe to use at 230 V.

Forgetting to square the current in $I^2 R$

Doubling the current makes the power loss four times