Transformers

Name _____ Class _____ Date _____

Transformers change the size of an alternating potential difference. They are essential to the National Grid.

KEY EQUATIONS

$V_p \div V_s = n_p \div n_s$
p.d. ratio = turns ratio

$V_s \times I_s = V_p \times I_p$
for a 100% efficient transformer (power in = power out)

Section A · Recall

Grade 5–6

1 Describe the structure of a basic transformer. [2]

A primary coil and a secondary coil

wound on an iron core.

2 Why is the core made of iron? [1]

Iron is easily magnetised.

3 What is the difference between a step-up and a step-down transformer? [2]

Step-up: Vs > Vp (more turns on the secondary).

Step-down: Vs < Vp (fewer turns on the secondary).

Section B · Calculate

Grade 6–7

4 A transformer has 200 turns on the primary and 1000 turns on the secondary. The primary p.d. is 12 V. Calculate the secondary p.d. [2]

Vs = Vp × ns ÷ np = 12 × 1000 ÷ 200

Vs = 60 V

5 Complete the table. [3]

Vp (V)	Vs (V)	np	ns
230	11.5	2000	**100**
12	**240**	50	1000
400 000	25 000	32 000	2000

Section C · Stretch

Grade 7+

6 Explain how a transformer works. [4]

An alternating current in the primary coil

produces a changing magnetic field in the iron core.

This changing field passes through the secondary coil,

inducing an alternating p.d. across it.

7 Explain why a transformer does not work with a direct current supply. [2]

Direct current produces a steady (unchanging) magnetic field,

so no p.d. is induced in the secondary coil.

Exam-style question

AQA style

8 A power station generates electricity at 25 000 V. A step-up transformer increases this to 400 000 V for the National Grid.

a The current in the primary coil is 2000 A. Assuming the transformer is 100% efficient, calculate the current in the secondary coil. [3]

Vp × Ip = Vs × Is

25 000 × 2000 = 400 000 × Is

Is = 125 A

b Explain why transmitting at a high p.d. reduces the energy wasted in the cables. [2]

For the same power, a high p.d. means a low current;

a lower current means less heating of the cables ($P = I^2R$).

Total: _____ / 21

How confident am I?	Not yet	Nearly	Got it
I can describe how a transformer works	☐	☐	☐
I can use Vp/Vs = np/ns	☐	☐	☐
I can use Vs × Is = Vp × Ip	☐	☐	☐