

GCSE Physics: Challenge Calculations

Using $P = IV$ and $E = Pt$ (2 Step Calculations)

These questions require you to combine the equations $P = IV$ and $E = Pt$. You will need to decide which equation to use first and may need to rearrange equations, convert units and compare different electrical appliances. The questions become progressively more demanding and are designed to develop Higher Tier GCSE problem-solving skills.

1. A phone charger operates at 5 V and draws a current of 2 A for 45 minutes. Calculate the energy transferred.
2. A bicycle light operates at 6 V and draws a current of 0.8 A for 90 minutes. Calculate the energy transferred.
3. A laptop charger operates at 20 V and draws a current of 3 A for 1 hour. Calculate the energy transferred in kJ.
4. A television operates at 230 V and draws a current of 0.35 A for 5 hours. Calculate the energy transferred in MJ.
5. A microwave oven draws a current of 5 A from a 230 V supply. It is used to heat food for 150 seconds. Calculate the energy transferred.
6. A kettle operates at 230 V and draws a current of 10 A. It transfers 690000 J of energy. Calculate how long the kettle was switched on for.
7. A hairdryer transfers 883200 J of energy while operating at 230 V and drawing a current of 8 A. Calculate how long it was used for.
8. An air fryer operates at 230 V and draws a current of 7 A. It is used for 18 minutes. Calculate:
 - a) the power of the air fryer
 - b) the energy transferred in MJ
9. A washing machine completes a cycle in 75 minutes and transfers 4347000 J of energy. The machine operates from a 230 V supply. Calculate the current drawn.
10. An electric shower transfers 4140000 J of energy in 7.5 minutes while connected to a 230 V supply. Calculate the current drawn.

11. A patio heater draws a current of 13 A from a 230 V supply and is used for 40 minutes. Calculate:

a) the power of the heater

b) the energy transferred in MJ

12. A floodlight transfers 10350000 J of energy in 6 hours while connected to a 230 V supply. Calculate the current drawn.

13. A factory machine draws a current of 32 A from a 400 V supply and operates for 2 hours. Calculate:

a) its power output

b) the energy transferred in MJ

14. A rapid electric vehicle charger transfers 108000000 J of energy in 45 minutes while connected to a 400 V supply. Calculate the current drawn.

15. Two kettles are used to boil the same amount of water.

Kettle A operates at 230 V and 8 A and is used for 5 minutes.

Kettle B operates at 230 V and 12 A and is used for 3 minutes.

Calculate the energy transferred by each kettle and determine which transfers more energy.

16. A family uses:

- A kettle operating at 230 V and 10 A for 4 minutes.
- An air fryer operating at 230 V and 7 A for 20 minutes.
- A television operating at 230 V and 0.4 A for 5 hours.
- A microwave operating at 230 V and 5 A for 8 minutes.

Calculate the total energy transferred by all four appliances in MJ.

17. A camping battery stores 6.0 MJ of energy.

During a weekend trip it powers:

- A lamp operating at 12 V and 1.5 A for 10 hours.
- A portable fridge operating at 12 V and 4 A for 6 hours.
- A phone charger operating at 12 V and 1 A for 4 hours.

Calculate:

- a) the energy transferred by each device
- b) the total energy used
- c) the energy remaining in the battery
- d) whether the battery would last for another identical day