

Physics Questions for GCSE on the electric kettle

Every day, electric kettles use electricity to heat water for drinks and cooking. They involve many GCSE Physics topics including electricity, power, resistance, energy transfers, efficiency, specific heat capacity and the cost of energy. The questions below become progressively more challenging.

1. When an electric kettle is switched on, what useful energy transfer takes place?
2. Explain why the heating element in a kettle gets hot when an electric current passes through it.
3. A kettle is labelled 3000 W. What does this tell you about the kettle?
4. A 3000 W kettle is switched on for 30 seconds. Calculate the energy transferred.
5. A 2200 W kettle is used for 2.5 minutes. Calculate the energy transferred in Joules.
6. A kettle transfers 450000 J of energy in 180 s. Calculate its power.
7. A 3000 W kettle is connected to a 230 V mains supply. Calculate the current drawn by the kettle.
8. A kettle draws a current of 11 A from a 230 V supply. Calculate its power.
9. Explain why the plastic handle of a kettle stays cooler than the metal body.
10. A kettle heats 0.50 kg of water from 20°C to 100°C. Calculate the energy gained by the water. Use a specific heat capacity of 4200 J/kg°C.
11. A kettle heats 1.20 kg of water from 15°C to 100°C. Calculate the energy needed.
12. A kettle transfers 336000 J of useful energy to 0.80 kg of water. The water starts at 20°C. Calculate the final temperature of the water.
13. A kettle uses 500000 J of electrical energy. Only 425000 J is transferred to the water. Calculate the efficiency of the kettle.

14. The heating element has a resistance of $20\ \Omega$ and is connected to a $230\ \text{V}$ supply.

a) Calculate the current in the element.

b) Calculate the power of the kettle.

15. A kettle is used for a total of 15 minutes each day. It has a power rating of $3000\ \text{W}$.

a) Calculate the energy used each day in kWh.

b) Calculate the energy used in one week.

16. Electricity costs 30 p per kWh. Using your answer to Question 15, calculate the weekly cost of running the kettle.

17. A $3000\ \text{W}$ kettle heats $0.75\ \text{kg}$ of water from 18°C to 100°C .

a) Calculate the energy needed by the water.

b) If the kettle is 90% efficient, calculate the total electrical energy required.

c) Calculate how long the kettle must be switched on for.