

power - practice problems

1. A power bill charges for kilowatt hours. Is a kilowatt hour a unit of power or a unit of energy?
2. A small oil-filled radiator heater is warming a room. This type of heater takes longer to heat up, but it provides quiet, steady warmth after it gets hot. If it transfers 1800 J of energy to the air in 3.0 s, what is its power use?
3. A phone charger with a 1.8 m cable transfers energy at 12 W for 15 minutes while a phone is below 20% battery. How many joules of energy does it transfer?
4. A 1500 W space heater runs under a desk for 2.5 hours on a cold morning. The room is 3.0 m wide, but the energy use depends on power and time. How much energy does it use in kWh?

5. Electricity costs 18 cents for each kWh. How much would the 3.75 kWh from the heater in the previous example cost?

6. A roof solar panel is about 1.7 m tall and 1.0 m wide. On a clear day it averages 420 W for 6.0 hours. How much energy does it produce in kWh?

7. A battery adds energy to a small circuit at 9.0 V while the current is 0.095 A. The circuit board is labeled for a science fair display, but the label does not affect the calculation. What power does the battery provide?

8. A device runs for 12 minutes on a 9.0 V battery. How much energy does it use?

9. A 12 V LED strip under a shelf draws 0.75 A. The strip is 2.0 m long and has many small LEDs, but treat it as one device. How much power does it use, and how much energy does it convert in 5.0 minutes?

10. A 60 W light bulb is connected to 120 V. What current does it draw?

11. A laptop charger label says it can accept 100-240 V from the wall. On its output side, it provides 65 W at 20 V. What current does it provide to the laptop?

12. The resistance of a resistor stays the same. If the voltage across it doubles, what happens to the power dissipated by the resistor?

13. A $30\ \Omega$ resistor has 0.20 A through it. How much power does it dissipate?

14. A $240\ \Omega$ resistor has 12 V across it during a lab test. The resistor is rated for 0.25 W, but first calculate the power it would dissipate.

15. A $2.0\ \text{k}\Omega$ resistor has 15 mA through it. How much power does it dissipate?

16. A small heating element for a cup warmer should use 48 W when connected to 24 V. The metal plate is 8 cm across, but the resistance is set by the electrical values. What resistance should it have?

17. A 12 V motor rated for 36 W spins a small fan in a desk cooler. The fan has three blades, but model the motor as one electrical device. What current does it draw, and what is its effective resistance while running?

18. A $150\ \Omega$ resistor is connected across 9.0 V for 10 minutes inside a simple timing circuit. The plastic case is 6 cm long, but ignore temperature changes in the resistor. How much energy does it convert to heat?