

Power, energy and electricity bills

Grade 8 science (Year 9 · Class 8) · Worksheet

Name: _____ Date: _____ Class: _____

These problems train you to use $P = V \times I$ and $E = P \times t$, to convert between watts, kilowatts, joules and kilowatt-hours, and to work out the cost of electricity. They start with units and one-step calculations and finish with multi-step cases.

They suit Grade 8, Year 9 and Class 8 students meeting energy and power for the first time, in line with middle school physical science and KS3 courses.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-PS3

Problem 1 Watts and kilowatts (easy)

Bilal in Lahore is reading the labels on his family's appliances.

1. State the unit of power and its symbol.
2. Convert 3.5 kW to W.
3. Convert 450 W to kW.

Problem 2 Two power formulas (easy)

Write down the formulas asked for.

1. State the formula linking power, voltage and current, with the unit of each quantity.
2. State the formula linking energy, power and time when energy is in joules.
3. State the unit used on an electricity bill.

Problem 3 Torch bulb (easy)

A torch bulb works on 6.0 V and a current of 0.50 A.

1. Write the formula needed.
2. Calculate the power of the bulb.

Problem 4 Hair dryer energy (easy)

A hair dryer has a power of 1500 W and is used for 2 minutes.

1. Convert 2 minutes to seconds.
2. Calculate the energy transferred in joules.

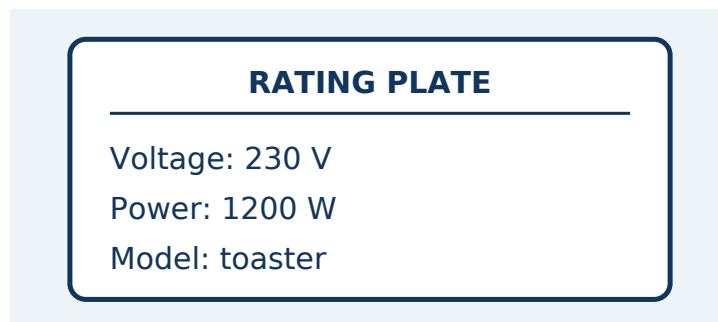
Problem 5 Oven in kilowatt-hours (easy)

An oven of power 3 kW runs for 2 hours.

1. State the formula for energy in kWh.
2. Calculate the energy transferred in kWh.

Problem 6 Read the rating plate (easy)

Aarav in Pune looks at the rating plate of a toaster.



Rating plate of an appliance.

1. State the power of the toaster.
2. Convert this power to kW.
3. Calculate the energy in kWh used when it runs for half an hour.

Problem 7 Rice cooker current (medium)

A rice cooker is rated 700 W and plugged into a 230 V supply.

1. Rearrange $P = V \times I$ to make I the subject.
2. Calculate the current, to 2 significant figures.

Problem 8 Heater element voltage (medium)

The element of a heater draws 8.0 A and has a power of 1840 W.

1. Write the formula that gives the voltage.
2. Calculate the voltage across the element.

Problem 9 A fan overnight (medium)

Kofi in Accra keeps a 40 W fan running for 5 hours.

1. Calculate the energy used in kWh.
2. Calculate the same energy in joules.
3. Check that your two answers agree, using $1 \text{ kWh} = 3\,600\,000 \text{ J}$.

Problem 10 Cost of ironing (medium)

Kofi's iron has a power of 1.5 kW. He uses it for 2 hours each week. One kWh costs 1.20 cedis.

1. Calculate the energy used in one week in kWh.
2. Calculate the weekly cost of ironing.

Problem 11 Reading the meter (medium)

Aarav's electricity meter in Pune read 7408 kWh on 1 June and 7470 kWh on 1 July. The price is 18 rupees per kWh.

1. Calculate the energy used in the month.
2. Calculate the bill for the month.

Problem 12 LED against filament lamp (medium)

Emma in Leeds compares two lamps that give the same amount of light: an LED of 9 W and a filament lamp of 60 W. Each is on for 5 hours a day for 30 days.

1. Calculate the energy used by each lamp in the 30 days, in kWh.
2. Find how much more energy the filament lamp uses.
3. Calculate the saving in pence if 1 kWh costs 20 pence.

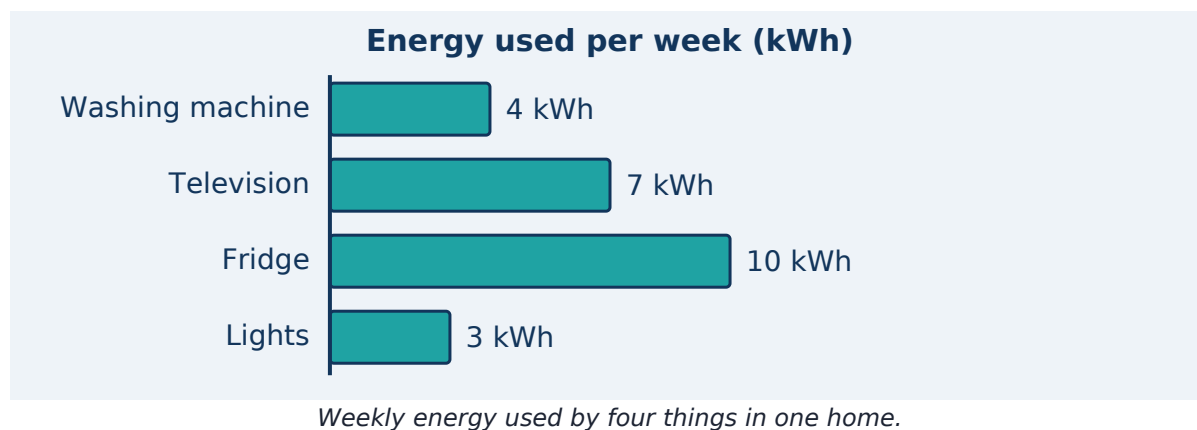
Problem 13 How long will it run? (medium)

A 2.0 kW heater is connected to a meter that has 10 kWh of prepaid energy left.

1. Rearrange $E = P \times t$ to make t the subject.
2. Calculate how long the heater can run.

Problem 14 Weekly energy chart (medium)

Diego in Texas draws a bar chart of the energy used in his home in one week.



1. Name the item that uses the most energy.
2. Find the total energy used in the week.
3. Calculate the weekly cost at 14 cents per kWh.
4. Calculate the percentage of the total used by the television, to the nearest whole number.

Problem 15 Fast kettle, slow kettle (medium)

Chiamaka in Lagos owns a 2300 W kettle and an 800 W kettle. Both heat the same mass of water to boiling.

1. Explain why the 2300 W kettle is faster.

2. Calculate how many times longer the 800 W kettle takes if both transfer the same energy to the water (ignore heat losses).
3. Explain why electricity companies charge in kWh and not in joules.

Problem 16 Air conditioner season (hard)

Mei in Singapore runs an air conditioner of power 1.2 kW for 8 hours every night for 30 nights. One kWh costs S\$0.30. A newer unit has a power of 0.9 kW.

1. Calculate the energy used by the old unit in kWh.
2. Calculate the cost of running it.
3. Calculate the money saved over the 30 nights if the new unit is used instead.

Problem 17 Choosing a fuse (hard)

A mains plug may hold a fuse of 3 A, 5 A or 13 A. The supply is 230 V. Use the smallest fuse that is larger than the working current.

1. Calculate the current of a 60 W lamp, a 920 W toaster and a 2.4 kW heater.
2. Choose the fuse for each appliance.
3. Explain why a fuse that is much too large for an appliance is unsafe.

Problem 18 Solar panel savings (hard)

A solar panel on Chiamaka's roof in Lagos delivers 18 V at 5.0 A for 6 hours each day (assume the output stays steady). Grid electricity costs 60 naira per kWh.

1. Calculate the power of the panel.
2. Calculate the energy produced each day in kWh.
3. Calculate the money saved in 30 days.

Problem 19 Spot the errors (hard)

A student writes two answers in a test.

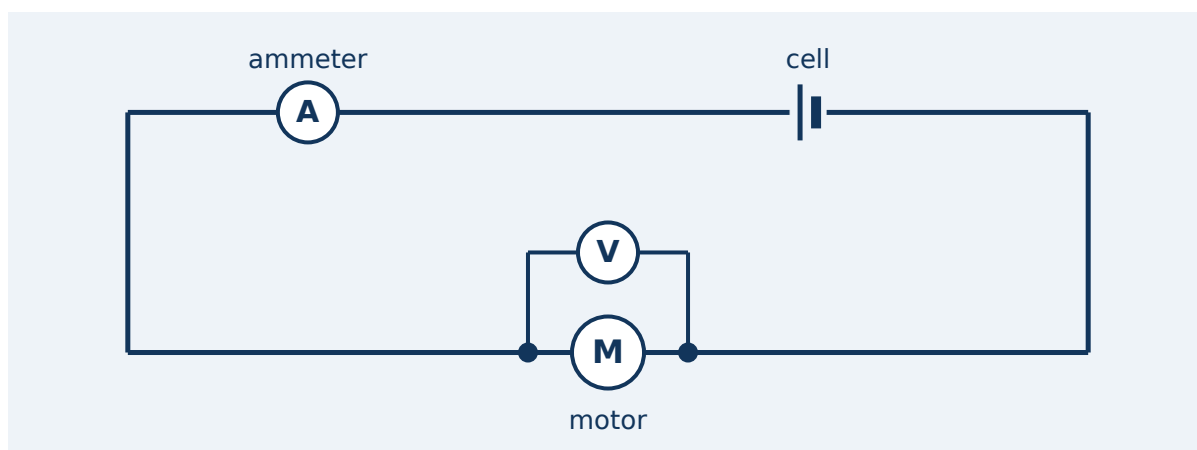
(A) A 2 kW heater is used for 90 minutes, so $E = 2 \times 90 = 180$ kWh.

(B) A 30 W lamp is on for 2 hours, so its power is $30 \times 2 = 60$ W.

1. Identify the mistake in (A) and give the correct energy.
2. Identify the mistake in (B) and give the correct energy in kWh.
3. Calculate the cost of the correct answer to (A) at 22 pence per kWh.

Problem 20 Motor at three settings (hard)

Mei tests a small motor in the circuit below at three voltage settings and records the results.



A motor with an ammeter in series and a voltmeter in parallel.

Voltage (V)	Current (A)
3.0	0.20
6.0	0.45
9.0	0.80

1. Calculate the power at each setting.
2. Calculate how many times greater the power is at 6.0 V than at 3.0 V.
3. Calculate the energy transferred in 20 s at 9.0 V.
4. Explain why the power rises faster than the voltage.