

Following energy through devices and chains

Grade 7 science (Year 8 · Class 7) · Worksheet

Name: _____ Date: _____ Class: _____

These problems train you to follow energy through a device, to draw and read energy chains and Sankey diagrams, and to calculate wasted energy and efficiency. They begin with naming transfers and end with multi-step reasoning about real devices.

They suit Grade 7, Year 8 and Class 7 learners, and match NGSS middle school and the early stages of GCSE and IGCSE physics.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS3-5

Problem 1 Name the transfer (easy)

For each device, state the main form of energy going in and the useful form coming out.

1. A toaster.
2. A loudspeaker.
3. A solar cell.
4. A candle.

Problem 2 The conservation law (easy)

Copy and complete: "Energy cannot be _____ or _____. It can only be _____ from one store to another."

Problem 3 Phone in a pocket (easy)

Chiamaka in Lagos notices that her phone feels warm after a video call.

1. State the form of energy that makes it warm.
2. State whether this energy is useful or wasted.

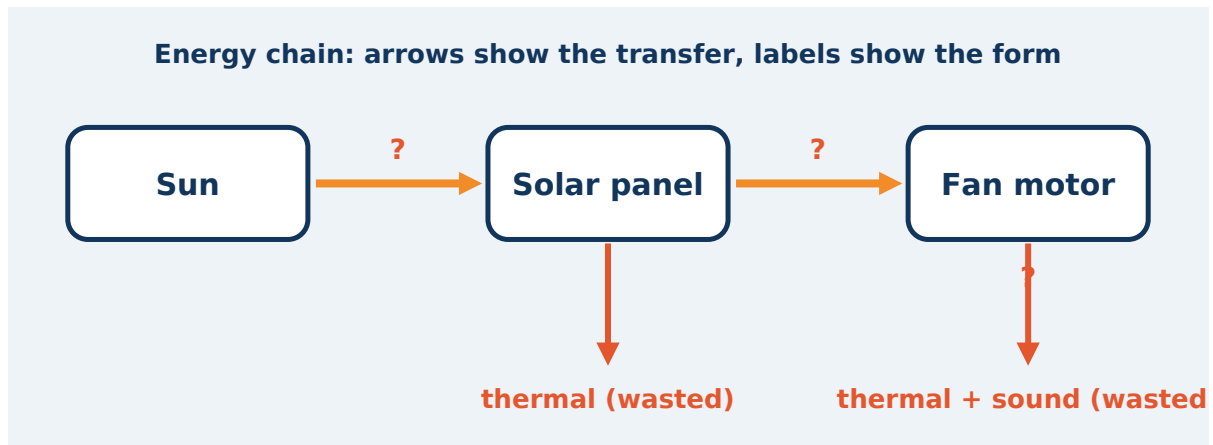
Problem 4 Efficiency of a lamp (easy)

A lamp takes in 100 J of electrical energy and gives out 40 J of light.

1. Write the efficiency formula.
2. Calculate the efficiency of the lamp.

Problem 5 Complete the energy chain (easy)

The diagram shows a solar fan, but the labels on the arrows are missing.



1. Name the form of energy on the first arrow.
2. Name the form of energy on the second arrow.
3. Name the useful form of energy that leaves the fan.

Problem 6 Kilojoules and joules (easy)

Convert each amount.

1. A phone battery stores 18 kJ. Write this in joules.
2. A kettle uses 240 000 J. Write this in kilojoules.
3. A solar panel collects 3.5 kJ. Write this in joules.

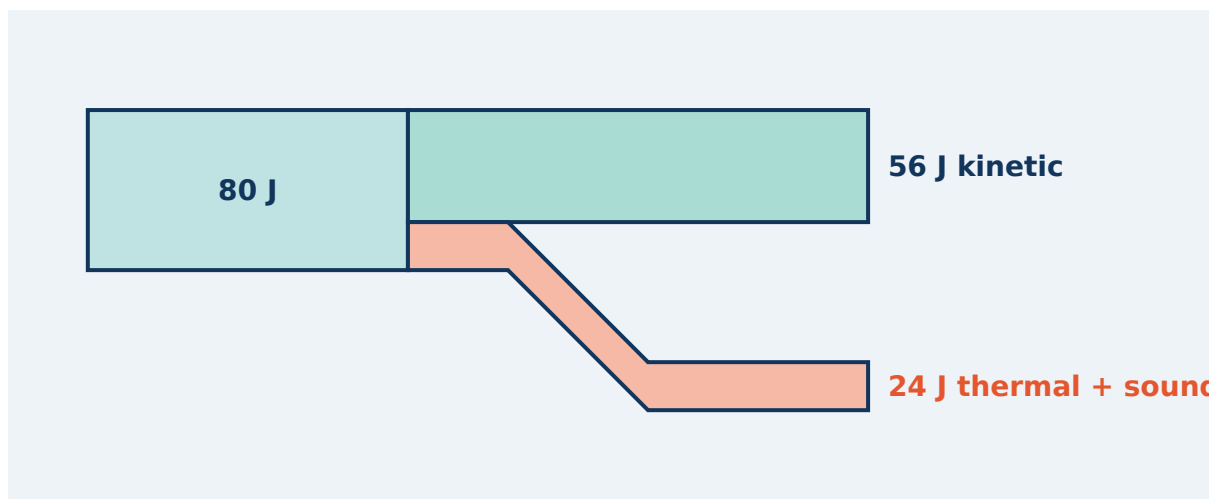
Problem 7 Wasted energy of a bulb (easy)

A small bulb takes in 50 J and gives out 8 J of light.

1. Calculate the wasted energy.
2. Name the form of the wasted energy.

Problem 8 Reading a Sankey diagram (medium)

The Sankey diagram is for an electric motor that lifts goods in a warehouse in Kumasi.



Sankey diagram of the motor.

1. State the useful energy output.
2. State the wasted energy.
3. Calculate the efficiency of the motor.

Problem 9 Two kettles (medium)

Kettle X takes in 150 kJ and transfers 132 kJ to the water. Kettle Y takes in 150 kJ and transfers 120 kJ to the water.

1. Calculate the wasted energy of each kettle.
2. Calculate the efficiency of each kettle.
3. State which kettle is better and why.

Problem 10 Complete the table (medium)

Copy and complete the table.

Fan: input 200 J, useful 120 J, wasted ?, efficiency ?.

Drill: input 500 J, useful ?, wasted 150 J, efficiency ?.

Heater: input 1000 J, useful 950 J, wasted ?, efficiency ?.

Problem 11 A warm charger (medium)

Kofi in Accra leaves a phone charger plugged in and notices the plug is warm.

1. Name the useful energy transfer in the charger.
2. Explain why the plug becomes warm.
3. State where the thermal energy ends up.

Problem 12 Solar panel on a roof (medium)

A solar panel on a house in Nairobi has an efficiency of 20 %. It receives 5000 J of sunlight.

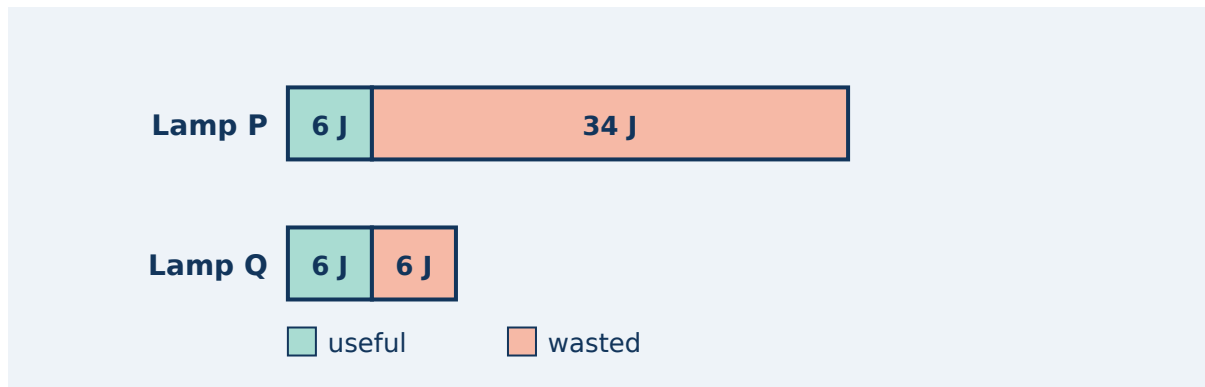
1. Calculate the electrical energy it gives out.
2. Calculate the energy that is wasted.

Problem 13 Bicycle lamp chain (medium)

Wanjiru has a bicycle fitted with a dynamo lamp. Write the energy chain from the food she ate to the light on the road. Include at least one wasted output.

Problem 14 Which lamp is better? (medium)

The bars show two lamps that each give 6 J of light.



Energy input of lamps P and Q.

1. Calculate the efficiency of each lamp.
2. State which lamp is cheaper to run and why.

Problem 15 Find the errors (medium)

Diego in Texas writes: "A kettle takes in 100 J and gives out 110 J of useful thermal energy, so it is 110 % efficient. The extra energy was created by the heating element."

1. Explain why the claim is impossible.
2. Suggest what could really have happened.

Problem 16 Wind turbine in two stages (hard)

A wind turbine in Kenya receives 50 kJ of kinetic energy from the wind each second. The turbine converts 40 % of it to electrical energy. The cable then delivers 90 % of that electrical energy to the village.

1. Calculate the electrical energy produced by the turbine.
2. Calculate the energy delivered to the village.
3. Calculate the overall efficiency.

Problem 17 Replacing school lamps (hard)

A school hall uses 20 filament lamps. Each lamp takes in 60 J every second and gives out 3 J of light every second. The school replaces each one by an LED that gives the same 3 J of light every second and has an efficiency of 30 %.

1. Calculate the efficiency of a filament lamp.
2. Calculate the energy the LED takes in every second.
3. Calculate the energy saved by all 20 lamps in an 8-hour day.

Problem 18 Diesel water pump (hard)

A diesel pump on a farm in Uganda takes in 12 MJ of chemical energy to lift water, which gains 2.4 MJ of gravitational potential energy.

1. Calculate the efficiency of the pump.
2. A better pump is 30 % efficient. Calculate the chemical energy it needs to give the same 2.4 MJ.

3. Calculate the chemical energy saved.

Problem 19 Battery toy car (hard)

A battery in a toy car supplies 900 J. The car gains 540 J of kinetic energy and gives out 90 J as sound. The rest is thermal energy.

1. Calculate the thermal energy.
2. Calculate the efficiency, taking only kinetic energy as useful.
3. State the percentage of the input that becomes thermal energy.

Problem 20 Is a heater wasteful? (hard)

An electric radiator in Leeds takes in 1000 J of electrical energy and transfers 1000 J of thermal energy to the room.

1. Calculate its efficiency as a room heater.
2. Explain why a lamp that gives out mostly thermal energy is called inefficient but this radiator is not.
3. Explain why the energy is still not completely recovered.