

Fuels, nuclear power, renewables and the climate

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

Name: _____ Date: _____ Class: _____

These 20 problems train you to sort energy resources, follow the stages of a power station, calculate efficiency, energy and CO₂ savings, and explain how burning fuels affects the climate. They move from recall to multi-step reasoning and decisions.

The problems suit Grade 8, Year 9 and Class 8 students, and follow NGSS middle school, KS3 and CBSE ideas on energy and human impact. Show your method and write units in every answer.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-ESS3-3

Problem 1 Renewable or not (easy)

Wanjiru in Nairobi lists resources: coal, wind, uranium, tidal, natural gas, biomass.

1. Sort them into renewable and non-renewable.
2. Name the fossil fuels in the list.

Problem 2 How fossil fuels formed (easy)

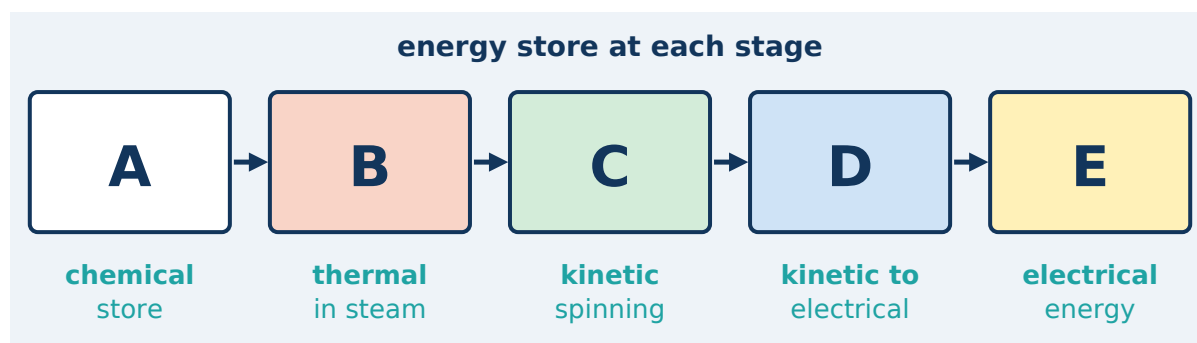
A teacher explains where coal and oil come from.

1. State what fossil fuels formed from.
2. State roughly how long this took.
3. Explain why they are called non-renewable.

Problem 3 Stages of a power station (easy)

Study the flow chart of a thermal power station.

1. Name stages A, B, C, D and E.
2. State what the turbine is turned by.



A thermal power station with the five stages labelled A to E.

Problem 4 Good and bad points (easy)

Match each resource to its main disadvantage: solar, wind, nuclear, coal.

1. Needs wind to blow.
2. Produces radioactive waste.
3. Gives no output at night.
4. Releases a lot of CO₂.

Problem 5 Greenhouse gases (easy)

Emma in Leeds studies climate change.

1. Name two greenhouse gases.
2. State which gas is released when fossil fuels burn.
3. State what greenhouse gases do to infrared radiation.

Problem 6 Simple efficiency (easy)

A machine takes in 200 J of energy and gives out 40 J of useful energy.

1. Write the efficiency formula.
2. Calculate the efficiency as a percentage.
3. Calculate the wasted energy.

Problem 7 Power station efficiency (medium)

A gas station takes in 2400 MJ and delivers 840 MJ of electricity.

1. Calculate the efficiency.
2. Calculate the wasted energy.
3. State where the wasted energy goes.

Problem 8 Energy from a wind turbine (medium)

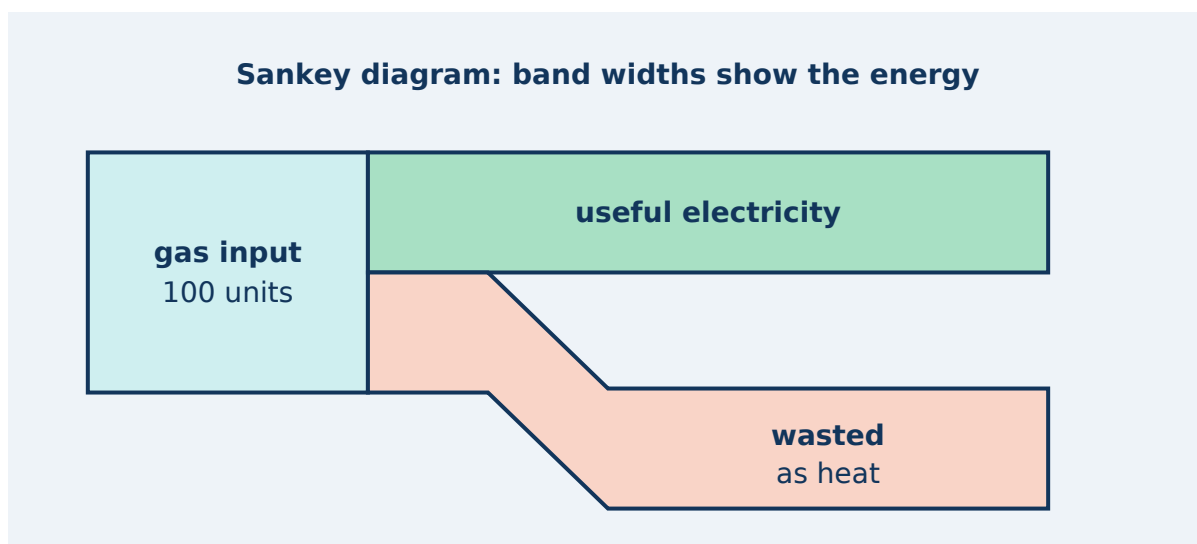
A wind turbine delivers 2.0 MW for 5.0 hours. 1 MW = 1000 kW.

1. Convert 2.0 MW to kW.
2. Calculate the energy in kWh.
3. A home uses 10 kWh a day. Calculate how many homes this could supply for one day.

Problem 9 Reading a Sankey diagram (medium)

Study the Sankey diagram.

1. State the useful output as a number of units.
2. Calculate the wasted energy.
3. Calculate the efficiency.
4. For an input of 1000 MJ, compare the useful output with a coal station of 35 % efficiency.



A Sankey diagram for a gas power station. The input is 100 units of energy.

Problem 10 Solar panels at home (medium)

A roof array in Lahore produces 20 kWh a day. Grid electricity costs \$0.15 per kWh. The system cost \$3600.

1. Calculate the daily saving.
2. Calculate the saving over 30 days.
3. Calculate how many months it takes to pay back the cost.

Problem 11 Carbon dioxide from two fuels (medium)

A family in Texas uses 300 kWh a month. Coal electricity causes 0.90 kg of CO₂ per kWh and gas electricity causes 0.40 kg per kWh.

1. Calculate the CO₂ from coal.
2. Calculate the CO₂ from gas.
3. Calculate the difference.

Problem 12 Wind and solar limits (medium)

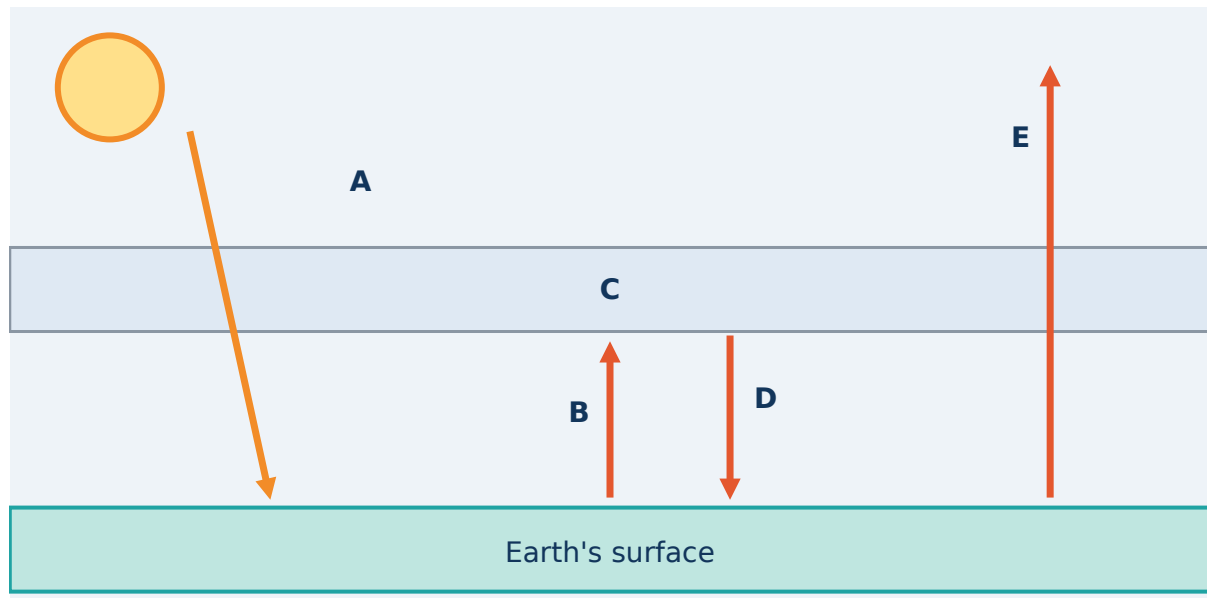
A town plans to use only solar and wind power.

1. Explain why the town may have a power cut at night.
2. Explain why a calm, cloudy day is also a problem.
3. Suggest one solution.

Problem 13 Greenhouse diagram (medium)

Study the diagram of the greenhouse effect.

1. Name the radiation shown by arrow A and by arrow B.
2. Name layer C.
3. State what arrow D shows.
4. State which arrow gets larger if CO₂ increases.



The greenhouse effect with five arrows and layers labelled A to E.

Problem 14 Spot the errors (medium)

Diego writes: (i) Nuclear power stations burn uranium to heat the water. (ii) The hole in the ozone layer causes global warming.

1. Correct statement (i).
2. Correct statement (ii).

Problem 15 Carbon dioxide in the air (medium)

The table shows the average CO₂ level in the air in parts per million (ppm): 1960: 317, 1980: 339, 2000: 369, 2020: 413.

1. Calculate the rise from 1960 to 2020.
2. Calculate the percentage rise, to the nearest whole number.
3. Compare the rate of rise per decade in 1960-1980 with that in 2000-2020.

Problem 16 Hydroelectric dam (hard)

A dam in Uganda lets 5.0×10^6 kg of water fall through 80 m. Use $g = 9.8$ N/kg. The power station is 85 % efficient.

1. Calculate the gravitational potential energy lost by the water, in joules.
2. Calculate the electrical energy produced in joules.
3. Convert it to kWh. $1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$.

Problem 17 A wind farm (hard)

A wind farm in Kenya has 20 turbines rated at 3.0 MW each. Over a year the turbines deliver on average 30 % of their rated power. A year has 8760 hours. One home uses 4000 kWh per year.

1. Calculate the average power of the farm in MW.

2. Calculate the energy delivered in a year in MWh.
3. Calculate how many homes this supplies.

Problem 18 Uranium and coal (hard)

Fissioning 1.0 kg of uranium-235 releases about 8.0×10^{13} J. Burning 1.0 kg of coal releases about 2.4×10^7 J.

1. Calculate how many times more energy the uranium gives.
2. Calculate the mass of coal needed to match 1.0 kg of uranium, in tonnes. 1 tonne = 1000 kg.
3. Suggest one reason why nuclear power is still disputed.

Problem 19 Choosing power for a village (hard)

A remote village in northern Kenya has no grid. It can choose a diesel generator, solar panels with batteries or a small hydroelectric plant on a stream that flows only in the rainy season.

1. Compare the three options for running costs, CO₂ and reliability.
2. Recommend one option, with reasons.

Problem 20 Forest and fossil fuel (hard)

A forest absorbs about 1.0 kg of CO₂ per square metre each year. A school uses 40 000 kWh of coal electricity a year, which causes 0.90 kg of CO₂ per kWh.

1. Calculate the CO₂ released by the school in a year.
2. Calculate the forest area needed to absorb it, in m².
3. Convert the area to hectares. 1 hectare = 10 000 m².