

From crude oil to plastics and fibres

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

Name: _____ Date: _____ Class: _____

These problems train you to classify materials, follow the route from crude oil to a plastic product and use density to identify plastics. You also practise percentage calculations and weigh the benefits and harm of plastics.

The set suits Grade 8 science, Year 9 and Class 8 students, in line with NGSS MS-PS1-3 and KS3 and IGCSE foundations.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-PS1-3

Problem 1 Natural or synthetic? (easy)

Aarav in Pune sorts six materials for a class display: cotton, nylon, wool, polyester, latex from a rubber tree and PVC.

1. Classify each as natural or synthetic.
2. State the starting resource for most synthetic plastics.

Problem 2 Put the stages in order (easy)

These five stages of making a polythene bag are jumbled: (a) polymerisation, (b) crude oil, (c) bag, (d) separation of ethene at a refinery, (e) polythene.

1. Write the stages in the correct order.
2. Name the stage in which monomers become a polymer.

Problem 3 Key words (easy)

1. Define the word monomer.
2. Define the word polymer.
3. Name the reaction that joins them.

Problem 4 Property to use (easy)

Choose a plastic property for each job: (a) a raincoat, (b) a handle for a hot pan, (c) a water pipe.

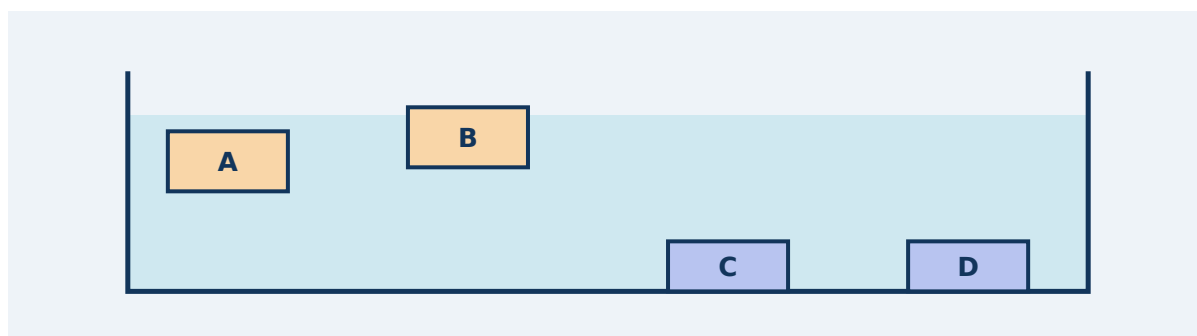
1. Match each job to one needed property from this list: waterproof and flexible; does not melt when heated; strong and does not rot.
2. Say which job needs a thermosetting plastic.

Problem 5 Pros and cons of bottles (easy)

1. State two advantages of plastic drinks bottles.
2. State two environmental problems caused by them.

Problem 6 Float or sink figure (easy)

Mei in Singapore drops four plastic chips into water of density 1.00 g/cm^3 .



Four chips in water.

1. State which chips have a density below 1.00 g/cm^3 .
2. State which chips have a density above 1.00 g/cm^3 .

Problem 7 Density of a chip (medium)

Bilal in Lahore finds that a chip of plastic has a mass of 23 g and a volume of 20 cm^3 .

1. Calculate its density.
2. State whether it floats or sinks in water.
3. Name a plastic from the lesson with a similar density.

Problem 8 Recycling rate (medium)

A school in Nairobi collects 480 kg of plastic bottles during a term and sends 120 kg for recycling.

1. Calculate the percentage recycled.
2. Calculate the mass not recycled.

Problem 9 Mass in a reaction (medium)

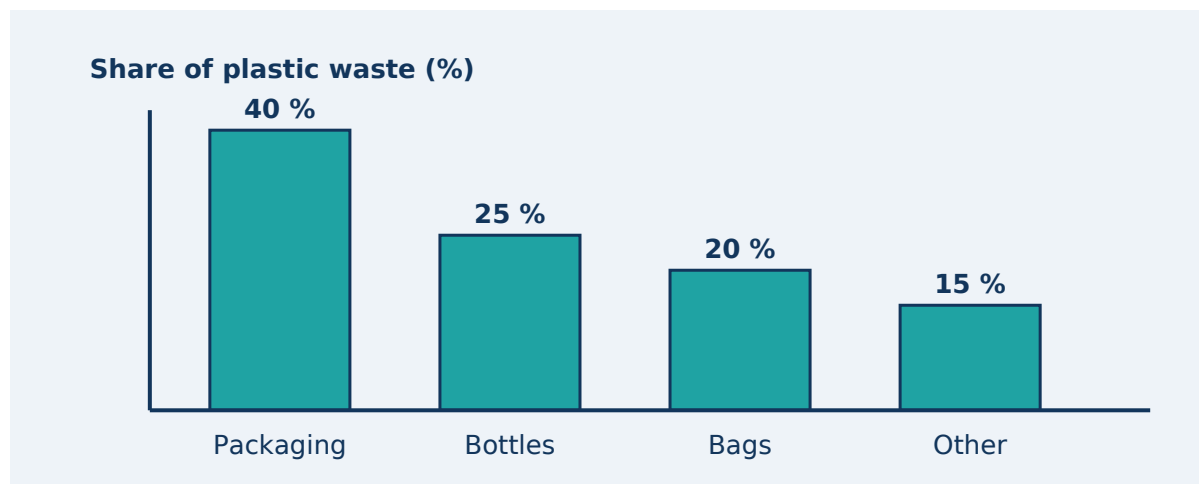
A factory makes polythene from ethene. In one batch 56 g of ethene reacts completely.

1. State the mass of polythene formed and name the law you used.
2. Explain what happens to the atoms during polymerisation.

Problem 10 Waste in a town (medium)

A town in Singapore weighs 800 tonnes of plastic waste in one year. The chart shows the

shares.



Plastic waste by type.

1. State the largest share.
2. Calculate the mass of plastic bags in tonnes.
3. Calculate the mass of bottles and bags together.

Problem 11 Wool or fleece? (medium)

Wanjiru compares a wool sweater with an acrylic fleece jacket for a school trip.

1. State two reasons she might choose the fleece.
2. State one reason she might choose wool.
3. Identify which material comes from a renewable natural source.

Problem 12 Heating plastics (medium)

Imani in Kampala heats two plastic strips gently in a water bath. Strip X softens and can be bent into a new shape. Strip Y stays hard and does not change shape.

1. Identify which strip is a thermoplastic.
2. Identify which would suit a kettle handle.
3. Explain your choice in part 2.

Problem 13 Spot the errors (medium)

Kofi writes: (a) Polythene is a monomer. (b) During polymerisation some atoms disappear, so the polymer weighs less. (c) A big chunk of polythene sinks because it is heavy.

1. Correct each statement.

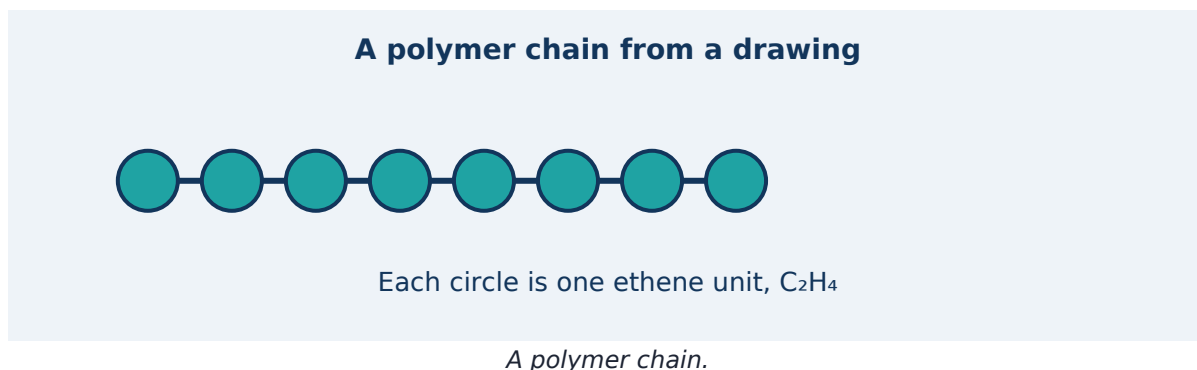
Problem 14 Bag break-even (medium)

In a simplified model, making one reusable cloth bag releases 1.2 kg of carbon dioxide, and making one thin plastic bag releases 0.04 kg.

1. Calculate how many plastic bags release the same carbon dioxide as one cloth bag.
2. State what this means for how often the cloth bag must be used.

Problem 15 Counting chain units (medium)

The drawing shows a short section of a chain of polythene. Each unit is one ethene molecule, and one ethene unit has a mass of 28 atomic mass units ($C = 12$, $H = 1$).



1. Count the units.
2. Calculate the mass of the section.
3. Calculate the mass of a real chain of 1 000 units.

Problem 16 Plant output (hard)

A plant in Texas feeds 7.0 tonnes of ethene per hour into reactors and runs 24 hours a day. All the ethene becomes polythene.

1. Calculate the mass of polythene made per day.
2. Each carrier bag has a mass of 8.0 g. Calculate how many bags can be made per day.

Problem 17 Shed fibres (hard)

In a model, one wash of a polyester jacket releases 0.4 g of fibres. A family washes the jacket three times per week for a whole year (52 weeks).

1. Calculate the mass released in one year.
2. A town has 50 000 identical jackets used the same way. Calculate the mass released per year in tonnes.
3. Suggest one way to reduce this.

Problem 18 Separating a mixture of plastics (hard)

Chiamaka has a mixture of chips of five plastics. Densities (g/cm^3): PP 0.91, PE 0.95, PS 1.05, PET 1.38, PVC 1.40. She has water ($1.00 g/cm^3$) and a salt solution of density $1.20 g/cm^3$.

1. State which chips float in water.
2. State which sinking chips float in the salt solution.
3. State which pair stays together and explain why density cannot separate them.

Problem 19 Bag ban (hard)

A class in Accra counts 200 litter items on a beach. They find 124 are plastic and 31 of those plastic items are bags. The council plans to ban single-use plastic bags.

1. Calculate the percentage of items that are plastic.
2. Calculate the percentage of the plastic items that are bags.
3. Evaluate the plan using this evidence and one other factor.

Problem 20 Choosing a bottle plastic (hard)

Emma must choose a plastic for a sports bottle used in hot weather. Option P: density 0.95 g/cm^3 , softens at 120°C , flexible. Option Q: 1.38 g/cm^3 , softens at 80°C , clear and stiff. Option R: 1.05 g/cm^3 , softens at 90°C , brittle.

1. Calculate the mass of a 40 cm^3 wall of each option.
2. State which option you would choose and justify it using three properties.