

Telling pure substances from mixtures

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

Name: _____ Date: _____ Class: _____

These 20 problems help you decide whether a material is a pure substance or a mixture, use melting and boiling points as evidence, read heating curves and apply simple water tests. They begin with sorting and recall and end with data analysis and planning.

They suit Grade 7 science students, NGSS middle school classes, Year 8 in the UK and Class 7 in India. Write units in every calculation and explain your reasoning in full sentences.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS1-2

Problem 1 Pure or mixture (easy)

Classify each material as a pure substance or a mixture.

1. Distilled water
2. Sea water
3. A copper wire
4. Brass
5. Air in a tyre

Problem 2 True or false (easy)

Decide whether each statement is true or false and correct the false ones.

1. A pure substance contains only one kind of particle.
2. Mineral water from a spring is a pure substance.
3. A mixture always has the same properties.

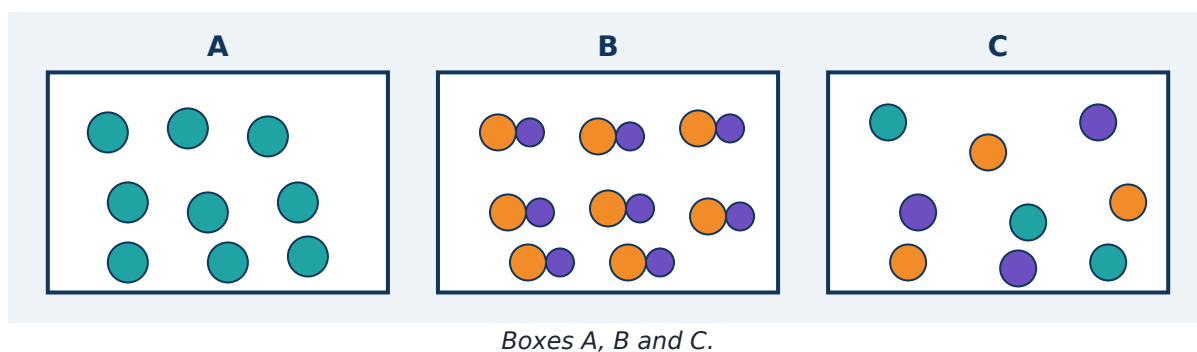
Problem 3 Fixed points of water (easy)

State the melting point and the boiling point of pure water at normal air pressure, in °C.

1. Give the melting point.
2. Give the boiling point.
3. State what happens to the boiling point when salt is dissolved in water.

Problem 4 Reading particle boxes (easy)

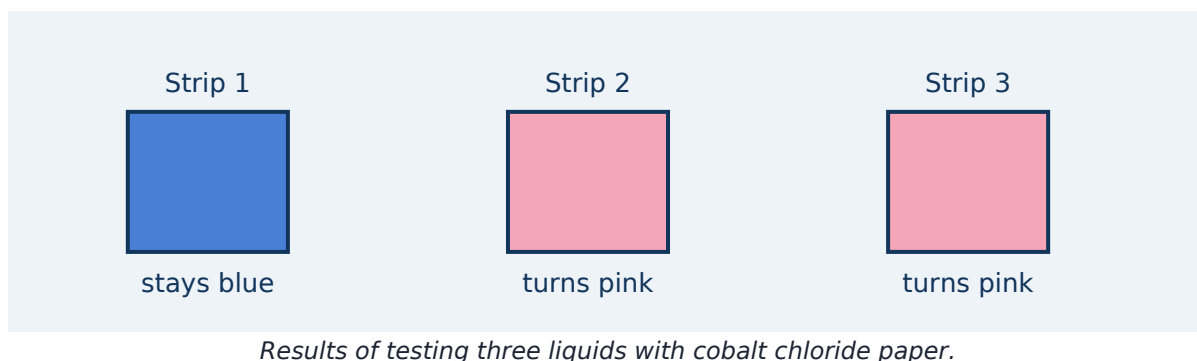
Use the figure.



1. Identify which box shows a mixture.
2. Identify which box shows a pure compound and give a reason.
3. Identify which box shows a pure element.

Problem 5 Colour test results (easy)

Zainab tests three liquids with cobalt chloride paper.



1. State what the colour change from blue to pink shows.
2. Identify which strips were tested with a liquid that contains water.
3. Explain why strip 1 stays blue.

Problem 6 Residue on a watch glass (easy)

Tomás evaporates 20 mL of distilled water and 20 mL of tap water on two clean watch glasses over a hot water bath. One leaves a white ring, the other leaves nothing.

1. Predict which glass has the white ring.
2. Explain what the white ring is.
3. Decide which of the two samples is closer to a pure substance.

Problem 7 Name the solid (medium)

A melting point table is given: sulfur 115 °C, urea 133 °C, tin 232 °C, lead 327 °C. Aarav measures a sample that melts sharply at 133 °C.

1. Decide whether the sample is pure.
2. Identify the substance.

3. State what he would have seen if the sample were a mixture.

Problem 8 Melting ranges (medium)

Three samples were heated. Sample X melted between 61.0 °C and 61.5 °C. Sample Y melted between 55 °C and 64 °C. Sample Z melted between 80.0 °C and 80.5 °C.

1. Calculate the melting range of each sample.
2. Identify which sample is a mixture.
3. Explain your choice.

Problem 9 Ethanol and water (medium)

A mixture of ethanol (boiling point 78 °C) and water (boiling point 100 °C) is heated slowly.

1. Predict which liquid boils off first.
2. Explain why the thermometer reading rises steadily instead of staying fixed.
3. State why a pure liquid would show a steady reading.

Problem 10 Salty soup (medium)

Zainab in Kano boils salty water and finds that it boils at 103 °C at sea level.

1. Decide whether the liquid is pure water.
2. Explain your decision.
3. Predict whether this solution would freeze at above or below 0 °C.

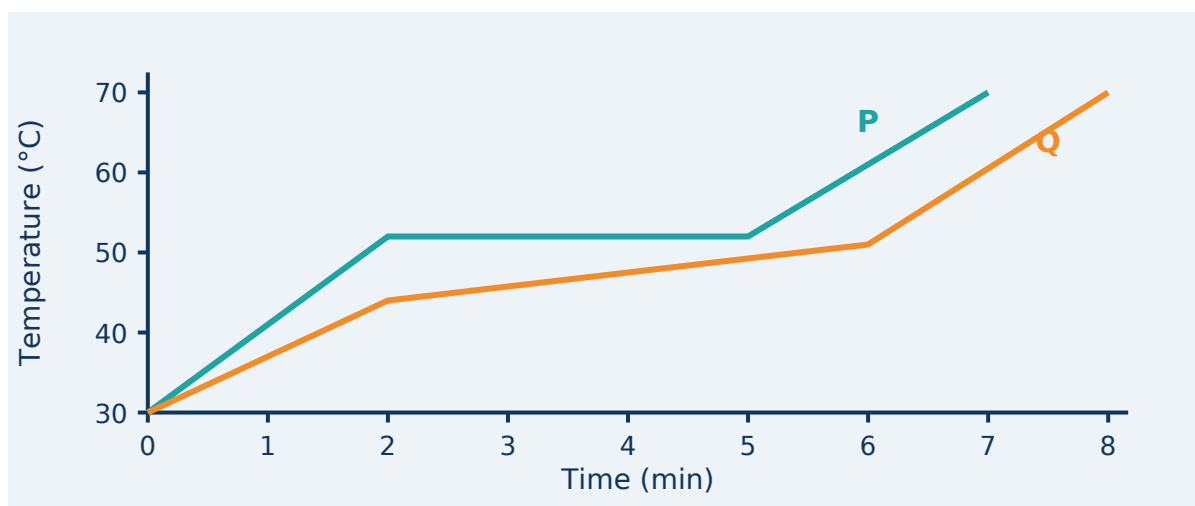
Problem 11 Gold jewellery (medium)

A ring has a mass of 15.0 g and is made of 22-carat gold, which means 22 parts out of 24 are pure gold.

1. Calculate the fraction of gold in the ring as a percentage.
2. Calculate the mass of gold in the ring.
3. Calculate the mass of the other metals.

Problem 12 Samples P and Q (medium)

The figure shows two heating curves for the same white solid.



Heating curves of samples P and Q.

1. State the melting point of sample P.
2. State the temperature range over which Q melts.
3. Identify which sample is purer and explain how you know.

Problem 13 Spot the error (medium)

Kofi says: 'My bottle says pure spring water, so it is a pure substance. A blue-to-pink paper test proves it.'

1. Identify the first mistake in his sentence.
2. Identify the second mistake.
3. Write a correct statement.

Problem 14 Water test limits (medium)

Copper sulfate powder turns from white to blue when a drop of orange juice falls on it.

1. State what this test shows.
2. Explain why it does not show that the juice is pure water.
3. Name one measurement that would show whether a liquid is pure water.

Problem 15 Brass bells (medium)

A foundry in Kumasi makes a brass bell of mass 250 g. The brass is 65 % copper by mass and the rest is zinc.

1. Explain why brass is a mixture.
2. Calculate the mass of copper in the bell.
3. Calculate the mass of zinc in the bell.

Problem 16 Which liquid boils? (hard)

Boiling points: propanone 56 °C, ethanol 78 °C, water 100 °C, ethanoic acid 118 °C. A clear liquid boils steadily at 78 °C. A second clear liquid starts to boil at 79 °C and its thermometer

reading climbs to 96 °C.

1. Identify the first liquid.
2. Describe what the second result shows.
3. Explain why the reading climbs for the second liquid.
4. Suggest what the second liquid might contain.

Problem 17 Reading a bottle label (hard)

A label on a 1.5 L bottle of mineral water says 'total dissolved solids 340 mg/L'.

1. Calculate the mass of dissolved solids in the whole bottle in mg and in g.
2. Calculate the mass left after a 200 mL glass is evaporated completely, in mg.
3. Explain why this water is not a pure substance.
4. Suggest one measurement that would show the water is purer after distillation.

Problem 18 Impurity and melting point (hard)

Lina adds a small amount of an impurity to pure lauric acid (melting point 44.0 °C) and measures the melting point:

Impurity (%)	Melting point (°C)
0	44.0
5	41.5
10	39.0
20	35.2

1. Calculate how far the melting point falls for 5%, 10% and 20% impurity.
2. Describe the pattern.
3. Estimate the melting point for 15% impurity.

Problem 19 Plan a purity test (hard)

Diego has one bottle of distilled water and one of tap water, both clear. He is told to find out which is purer.

1. Describe a test based on evaporation and list the variables he must keep constant.
2. Describe a test based on boiling point.
3. Predict the results for each water.
4. Explain why one measurement is not enough to be certain.

Problem 20 Rock salt purity (hard)

Mei dissolves 4.00 g of rock salt in water. The salt dissolves, leaving 0.16 g of sand that does not dissolve.

1. Calculate the mass of salt in the sample.

2. Calculate the percentage of salt in the sample.
3. Calculate the mass of salt in a 250 g bag of this rock salt.
4. Explain why rock salt is a mixture, not a pure substance.