

Why total mass stays the same

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

Full methods are shown for every problem. Check each calculation and unit against yours, and read the explanations carefully: the reasons matter as much as the numbers. The final result of each step is in bold.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS1-5

Problem 1 State the law

1. In a closed system the total mass stays the same during a change, so the mass of the starting substances equals the mass of the final substances.
2. A container from which nothing can escape and into which nothing can enter, such as a stoppered flask.
3. **grams (g)** or kilograms (kg).

Problem 2 Sugar in water

1. $25\text{ g} + 200\text{ g} = \mathbf{225\text{ g}}$.
2. The particles spread out among the water particles. None are lost.
3. **The same:** 225 g before and after.

Problem 3 A melting block

1. **340 g**.
2. Physical change, because no new substance forms.
3. Melting only changes how the particles are arranged, so no particles are lost or gained and the mass stays 340 g.

Problem 4 Reading two balances

1. **No:** both readings are 412.6 g.
2. A closed system.
3. Atoms are rearranged but none are created or destroyed.

Problem 5 Salt in a solution

1. $320\text{ g} - 20\text{ g} = \mathbf{300\text{ g}}$ of water.
2. $250\text{ g} - 30\text{ g} = \mathbf{220\text{ g}}$ of water.

Problem 6 Open or closed?

1. **Stays the same:** the gas cannot leave.
2. **Falls:** carbon dioxide escapes.
3. **Stays the same:** nothing leaves the mug in such a short time.
4. **Falls:** the ash is lighter than the wood because gases and vapour drift away.

Problem 7 Mixing sand and water

1. $2.5 \text{ kg} + 0.75 \text{ kg} = \mathbf{3.25 \text{ kg}}$.
2. $3.25 \times 1000 = \mathbf{3250 \text{ g}}$.

Problem 8 Fizzy drink going flat

1. $612.4 \text{ g} - 610.9 \text{ g} = \mathbf{1.5 \text{ g}}$.
2. Carbon dioxide.
3. The gas left the bottle and took its mass with it. The mass was not destroyed.

Problem 9 Steel wool that gets heavier

1. $10.5 \text{ g} - 8.2 \text{ g} = \mathbf{2.3 \text{ g}}$.
2. Oxygen from the air joined the iron to make a solid, so the solid weighs more.
3. The total would not change, **so the reading stays the same**, because the oxygen taken from the air in the jar is part of the system.

Problem 10 Water in a sealed jar

1. $80.0 \text{ g} + 310.0 \text{ g} = \mathbf{390.0 \text{ g}}$.
2. **390.0 g**, because vapour stays inside the sealed jar.
3. With the lid off, water vapour would escape into the room, so the mass would fall.

Problem 11 A candle burning

1. $45.0 \text{ g} - 41.5 \text{ g} = \mathbf{3.5 \text{ g}}$.
2. No. The wax joined with oxygen to make carbon dioxide and water vapour that escaped into the air.
3. Burn the candle inside a closed jar standing on the balance, so the gases stay in the system.

Problem 12 Mixing two solutions

1. $150 \text{ g} + 100 \text{ g} = \mathbf{250 \text{ g}}$.
2. **250 g**, because the flask is closed.
3. $250 \text{ g} - 6.2 \text{ g} = \mathbf{243.8 \text{ g}}$.

Problem 13 Reading a mass graph

1. Flask X is sealed because its mass stays at 300.0 g.
2. **297.0 g**.
3. $300.0\text{ g} - 296.8\text{ g} = \mathbf{3.2\text{ g}}$, the mass of gas that escaped.

Problem 14 Sports drink

1. $18\text{ g} + 2\text{ g} + 380\text{ g} = \mathbf{400\text{ g}}$.
2. $600\text{ g} - 18\text{ g} - 2\text{ g} = \mathbf{580\text{ g}}$ of water.

Problem 15 Where did the log go?

1. Mass was not destroyed. He weighed only the ash and ignored the gases.
2. The log joined with oxygen from the air and turned into carbon dioxide gas and water vapour, which drifted away. More than 494 g left as gases and vapour, because oxygen was added.
3. **Burn it in a closed container on a balance** and show that the total mass stays the same.

Problem 16 Heating green powder

1. $12.4\text{ g} - 8.0\text{ g} = \mathbf{4.4\text{ g}}$.
2. $4.4 \div 12.4 \times 100 = \mathbf{35.5\%}$.
3. **12.4 g**, because the gas would be part of the weighed system.

Problem 17 Burning magnesium in proportion

1. $2.0\text{ g} - 1.2\text{ g} = \mathbf{0.8\text{ g}}$.
2. Ratio magnesium : oxide = $1.2 : 2.0 = 3 : 5$. Mass of oxide = $4.8 \times 5 \div 3 = \mathbf{8.0\text{ g}}$.
3. Magnesium = $7.5 \times 3 \div 5 = \mathbf{4.5\text{ g}}$.

Problem 18 Four set-ups compared

1. $300.1\text{ g} - 301.6\text{ g} = \mathbf{-1.5\text{ g}}$.
2. In B the carbon dioxide escaped from the open cup. In A, C and D nothing was able to leave (or, in A, only a negligible amount did).
3. $1.5 \div 301.6 \times 100 = \mathbf{0.50\%}$.

Problem 19 Boiling water in a pan

1. $800\text{ g} - 760\text{ g} = \mathbf{40\text{ g}}$.
2. It evaporated and spread into the air as water vapour.
3. Cover the pan with a lid or a cold surface so the vapour condenses and runs back, or weigh a sealed system. The total of liquid plus vapour stays 800 g.

Problem 20 A cake in the oven

1. $250 + 150 + 100 + 200 + 50 = \mathbf{750\text{ g}}$.
2. $750\text{ g} - 690\text{ g} = \mathbf{60\text{ g}}$.
3. $60 \div 750 \times 100 = \mathbf{8.0\%}$.
4. Mostly water vapour (and a little carbon dioxide) that escaped from the hot batter.