

Solids, liquids and gases explained

Grade 6 science (Year 7 · Class 6) · Worksheet answers

Check each answer against the full method. Where a problem asks you to explain, use the words particles, spaced, touching, vibrate or slide, and make sure units are written after every number.

Level: Grade 6 science (Year 7 · Class 6) · **Curriculum:** MS-PS1-4

Problem 1 Sorting everyday items

1. Solids: brick, pencil, coin. Liquids: orange juice, milk. Gases: helium, the air in the football.
2. **Solid** has a fixed shape.

Problem 2 Shape and volume

1. **Solid** (fixed shape and fixed volume).
2. **Liquid** (fixed volume, takes the shape of its container).
3. **Gas** fills the whole container.

Problem 3 Reading particle diagrams

1. A is a solid, B is a liquid, C is a gas.
2. The particles of B are close together, touching, and slide past one another.
3. **Box C** has the particles furthest apart.

Problem 4 Pouring juice

1. 300 mL in the glass.
2. **300 mL** in the bowl, because liquids keep their volume.
3. Only the **shape** of the juice changes.

Problem 5 Cooking oil bottles

1. $1.5 \text{ L} \times 1000 = \mathbf{1500 \text{ mL}}$.
2. $1500 \text{ mL} \div 250 \text{ mL} = \mathbf{6 \text{ bottles}}$.
3. The volume of oil stays the same; only its shape changes.

Problem 6 Describing particle motion

1. **Vibrate** on the spot.
2. **Slide** past one another.
3. **Fly** in all directions.

Problem 7 Why a brick does not pour

1. In the brick the particles are packed in fixed positions and can only vibrate, so the brick keeps its shape.
2. **Water particles slide past one another**, so water flows and takes the shape of any container.

Problem 8 Squeezing air in a syringe

1. $50 \text{ mL} - 20 \text{ mL} = \mathbf{30 \text{ mL}}$.
2. $20 \div 50 = 2/5 = \mathbf{0.4}$ (40 %).
3. **No**, the number of particles is the same; they are only closer together.

Problem 9 Squeezing water in a syringe

1. The reading stays about **50 mL**.
2. Water particles are already touching, so there is no empty space for them to move into. A liquid cannot be compressed.

Problem 10 Pumping a bike tyre

1. $400 \div 100 = \mathbf{4 \text{ times}}$.
2. After pushing, the particles are much closer together than before.
3. The pump contains **the same number** of particles.

Problem 11 A smell spreading

1. The further from the bottle, the longer the smell takes to arrive.
2. $22 \text{ s} - 4 \text{ s} = \mathbf{18 \text{ s}}$ longer.
3. Vinegar particles move and mix with the air particles (diffusion) until they reach noses.
4. In a cold room the particles move more slowly, so the times would be **longer**.

Problem 12 Is sand a solid?

1. **Solid**.
2. Each grain is a small solid with fixed shape. The grains can slide over one another, so the heap flows, but the particles inside each grain stay fixed.

Problem 13 Spot the errors

1. Solid particles do move: they **vibrate** around fixed positions.
2. The weakness is the idea of "lighter". Gas particles are far apart because they have enough energy to move freely and are not held together.

Problem 14 Same gas, two boxes

1. **Box Q** has the particles further apart.
2. $6\text{ L} \div 2\text{ L} = \mathbf{3\text{ times}}$ larger.
3. The particles would be pushed closer together; the gas is compressed.

Problem 15 Why a balloon stays inflated

1. The particles move quickly and randomly in all directions.
2. They keep hitting the inside of the rubber and pushing it outwards, so **the balloon stays inflated**.

Problem 16 Filling juice bottles

1. $99\text{ L} \times 1000 = \mathbf{99\ 000\ mL}$.
2. $99\ 000 \div 330 = \mathbf{300\ bottles}$.
3. $300 \div 6 = \mathbf{50\ cartons}$.
4. Liquid has a fixed volume. Air would spread out and fill any container, so its volume depends on the container.

Problem 17 Flowing sand timer

1. $120\text{ g} \div 240\text{ s} = \mathbf{0.5\ g/s}$.
2. Mass gone = $0.5 \times 100 = 50\text{ g}$, so $120\text{ g} - 50\text{ g} = \mathbf{70\ g}$ left.
3. Sand is made of tiny separate solid grains that can slide past each other and fall through the neck one by one.

Problem 18 Scuba tank

1. $1800 \div 12 = \mathbf{150\ times}$.
2. The gaps between the particles became much smaller.
3. The number of particles did not change.
4. Water particles already touch, so there are no gaps to squeeze.

Problem 19 Design a fair comparison

1. Two identical syringes, one with air and one with water, blocked tips.
2. Keep the start volume (for example 40 mL), the tip seal and the force used the same.
3. Measure the volume on the syringe scale after pushing.
4. **Air** volume falls a lot; **water** volume stays almost unchanged.

Problem 20 Evaluating a human model

1. Tight rows wobbling = solid (vibrating in fixed places); walking shoulder to shoulder = liquid; running around = gas.
2. It shows how close the particles are and how they move.

3. **Weakness:** real particles are not people; they do not choose to move and they do not hold hands, and they are much smaller.