

Fire, fuels and burning safely

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

Each answer shows the counting or the calculation first, and then the result in bold. Use the working to find exactly where a mistake began.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-PS1-2

Problem 1 The fire triangle

1. A is fuel, B is **oxygen** and C is heat.
2. The fire **goes out**.
3. The fuel is the wax (and the wick).

Problem 2 Putting it out

1. Blanket: stops air, so it removes **oxygen**.
2. Water: cools the log, so it removes **heat**.
3. Closing the valve: removes **fuel**.

Problem 3 Charcoal grill

1. Reactants: carbon and oxygen. Product: carbon dioxide.
2. Left: C 1, O 2. Right: C 1, O 2.
3. **Balanced**.

Problem 4 Limewater test

1. **Carbon dioxide** made tube P milky.
2. The gas in Q is not carbon dioxide because the limewater stayed clear.
3. **Calcium carbonate**.

Problem 5 Complete the sentences

1. True.
2. False: it needs oxygen.
3. True.
4. True. **Statements 1, 3 and 4 are true.**

Problem 6 Blue or yellow flame

1. The air supply is too low, so combustion is incomplete and makes soot and carbon monoxide.

2. **Blue.**

3. Have the stove checked or cleaned so that enough air reaches the flame; do not keep using it in a closed room.

Problem 7 Methane atoms

1. Left: C 1, H 4, O $2 \times 2 = 4$.

2. Right: C 1, H $2 \times 2 = 4$, O $2 + 2 = 4$.

3. **Yes, atoms are conserved.**

Problem 8 Burning hydrogen

1. **$2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$** (H 4/4, O 2/2).

2. Water.

3. Burning hydrogen makes only water, with no carbon dioxide or carbon monoxide.

Problem 9 Camping stove

1. Carbon: 3 CO_2 . Hydrogen: 8 H, so 4 H_2O . Oxygen: $6 + 4 = 10$, so 5 O_2 : **$\text{C}_3\text{H}_8 + 5 \text{O}_2 \rightarrow 3 \text{CO}_2 + 4 \text{H}_2\text{O}$** .

2. Left: C 3, H 8, O 10. Right: C 3, H 8, O $6 + 4 = 10$.

Problem 10 Mass of carbon dioxide

1. $12 + 32 = 44$ g on both sides.

2. $3.0 \div 12 = 0.25$, so $0.25 \times 44 = \mathbf{11 \text{ g}}$ of CO_2 .

3. $0.25 \times 32 = \mathbf{8.0 \text{ g}}$ of oxygen.

Problem 11 Water from methane

1. $4.0 \div 16 = 0.25$; $0.25 \times 36 = \mathbf{9.0 \text{ g}}$ of water.

2. $0.25 \times 64 = \mathbf{16 \text{ g}}$ of oxygen.

3. $0.25 \times 44 = \mathbf{11 \text{ g}}$ of CO_2 . Check: $4.0 + 16 = 20$ g; $11 + 9.0 = 20$ g.

Problem 12 Incomplete combustion

1. Left: C 2, O 2. Right: C 2, O 2. Balanced.

2. Incomplete: 1 O_2 per 2 C, which is 0.5 O_2 per C. Complete: 1 O_2 per C. **Complete combustion needs twice as much oxygen.**

3. With enough air the carbon burns to CO_2 instead of poisonous CO.

Problem 13 Charcoal indoors

1. Reduce risk: **(a), (b) and (d)**. Blocking the vent (c) increases the risk.

2. Carbon monoxide has no smell, colour or taste, so people cannot detect it without an

alarm.

Problem 14 How CO harms the body

1. Haemoglobin carries oxygen. If it is carrying CO there is less room for oxygen, so the body gets **less oxygen**.
2. CO cannot be sensed, so breathing seems normal while oxygen delivery to the brain and heart falls.

Problem 15 Limewater equation

1. Left: Ca 1, O 2 + 2 = 4, H 2, C 1. Right: Ca 1, C 1, O 3 + 1 = 4, H 2. Balanced.
2. **Calcium carbonate**.
3. Many gases other than CO₂ also put out a splint, so it does not prove CO₂.

Problem 16 Butane lighter

1. Start with 13/2 O₂ and double all: **2 C₄H₁₀ + 13 O₂ → 8 CO₂ + 10 H₂O**.
2. Left: C 8, H 20, O 26. Right: C 8, H 20, O 16 + 10 = 26.
3. 2 butane make 8 CO₂, so 1 makes 4: 5 × 4 = **20 molecules**.

Problem 17 Extinguisher choice

1. **CO₂**: it is safe on electrical equipment, and it displaces oxygen around the fire.
2. Oil floats on water and the burning oil can spread, and the water turns to steam violently and throws oil upwards.
3. Turn off the heat and cover with a lid or fire blanket to remove oxygen.

Problem 18 Candle in a jar

1. About **22 s**.
2. $44 \div 1000 = 0.044$ s per mL; $1250 \times 0.044 =$ **55 s**.
3. $0.21 \times 500 =$ **105 mL**.
4. The oxygen is used up; the fuel and heat are still present but oxygen is missing.

Problem 19 Steel wool gets heavier

1. $3.10 - 2.50 =$ **0.60 g**.
2. $0.60 \div 2.50 \times 100 =$ **24 %**.
3. The iron combines with oxygen from the air, so the solid gains the mass of that oxygen. Wood gives off CO₂ and water vapour, which escape, so the solid left weighs less.

Problem 20 Comparing fuels

1. Methane $55 \times 20 = 1100$ kJ; carbon $33 \times 20 = 660$ kJ; ethanol $30 \times 20 = 600$ kJ;

hydrogen $142 \times 20 = \mathbf{2840 \text{ kJ}}$.

2. $2200 \div 55 = \mathbf{40 \text{ g}}$.

3. **Hydrogen**: it has no carbon atoms, so it can only make water.