

Fire, fuels and burning safely

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

Name: _____ Date: _____ Class: _____

These problems train you to explain combustion with the fire triangle, write and balance burning equations, use the limewater test and judge the dangers of carbon monoxide. They move from recall to multi-step calculations and data analysis.

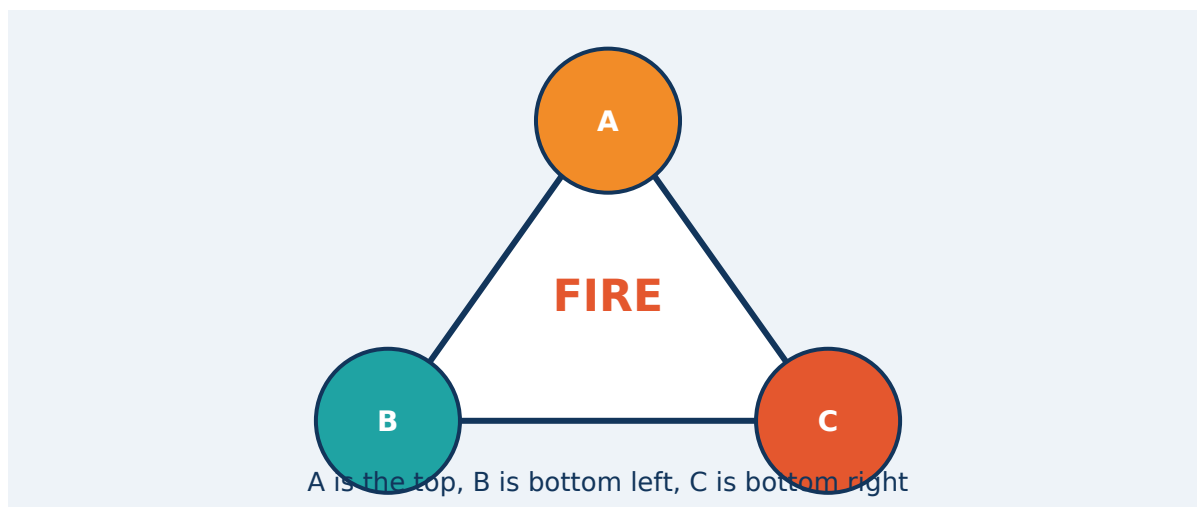
They match standard MS-PS1-2 and suit Year 9, KS3 and Class 8 students.

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

Problem 1 The fire triangle (easy)

Look at the triangle in the figure.

1. State the three things represented by A, B and C if A is the fuel and C is the heat.
2. State what happens if you remove any one corner.
3. Name the fuel in a birthday candle.



The triangle for Problem 1.

Problem 2 Putting it out (easy)

Match each action with the corner of the triangle it removes.

1. Placing a fire blanket on a burning pan.
2. Spraying water on a burning log.
3. Closing the valve of a leaking gas cylinder.

Problem 3 Charcoal grill (easy)

Charcoal (carbon) burns on a grill in Nairobi: $C + O_2 \rightarrow CO_2$.

1. Name the reactants and the product.
2. Count the atoms on each side.
3. State whether the equation is balanced.

Problem 4 Limewater test (easy)

A student bubbles two different gases into limewater.

1. Identify the gas that made tube P milky.
2. State what the other result tells you about the gas in Q.
3. Name the white solid that makes the liquid cloudy.



Limewater after two gases were bubbled through (Problem 4).

Problem 5 Complete the sentences (easy)

Decide true or false and correct any false sentence.

1. Combustion gives out energy.
2. Combustion needs nitrogen.
3. Burning is an exothermic reaction.
4. Combustion of a carbon fuel can make carbon dioxide.

Problem 6 Blue or yellow flame (easy)

Priya in Chennai notices her gas stove has a yellow, sooty flame.

1. Explain what the yellow flame suggests.
2. State the colour of a flame when combustion is complete.
3. Suggest what should be done.

Problem 7 Methane atoms (easy)

Look at $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$.

1. Count the atoms of C, H and O on the left.
2. Count the atoms of C, H and O on the right.
3. State whether atoms are conserved.

Problem 8 Burning hydrogen (medium)

A rocket engine in Florida burns hydrogen: $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$.

1. Balance the equation.
2. Name the only product.
3. Explain why hydrogen is called a clean fuel.

Problem 9 Camping stove (medium)

Propane burns on a camping stove in the Rockies: $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$.

1. Balance the equation.
2. Check by counting each element.

Problem 10 Mass of carbon dioxide (medium)

12 g of carbon burns with 32 g of oxygen to make 44 g of carbon dioxide.

1. Show that mass is conserved.
2. Calculate the mass of CO_2 from 3.0 g of carbon.
3. Calculate the mass of oxygen needed.

Problem 11 Water from methane (medium)

From worked data, 16 g of methane burns to give 44 g of CO_2 and 36 g of water, using 64 g of oxygen.

1. Calculate the mass of water formed from 4.0 g of methane.
2. Calculate the mass of oxygen used.
3. Calculate the mass of carbon dioxide formed.

Problem 12 Incomplete combustion (medium)

Incomplete combustion of carbon: $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$.

1. Check that the equation is balanced.
2. Compare the number of O_2 molecules used per carbon atom with complete combustion ($\text{C} + \text{O}_2 \rightarrow \text{CO}_2$).
3. State why the stove needs a good air supply.

Problem 13 Charcoal indoors (medium)

Charcoal burns on a small stove in a closed room in winter.

1. Identify which actions reduce the risk: (a) open a window; (b) put a CO alarm in the room; (c) block the vent; (d) burn the charcoal outdoors.
2. Explain why a CO alarm is needed.

Problem 14 How CO harms the body (medium)

Carbon monoxide combines with haemoglobin in the blood more strongly than oxygen does.

1. Explain why this is harmful.
2. Suggest why a person who is breathing normally can still be in danger.

Problem 15 Limewater equation (medium)

The limewater test is $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$.

1. Show that it is balanced.
2. Identify the product that makes the liquid cloudy.
3. Explain why a burning splint is a poor test for CO_2 .

Problem 16 Butane lighter (hard)

Butane, C_4H_{10} , burns in a lighter: $\text{C}_4\text{H}_{10} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$.

1. Balance the equation using whole-number coefficients.
2. Count each element on both sides.
3. Calculate the number of molecules of CO_2 made from 5 molecules of butane.

Problem 17 Extinguisher choice (hard)

The table shows which extinguishers suit different fires.

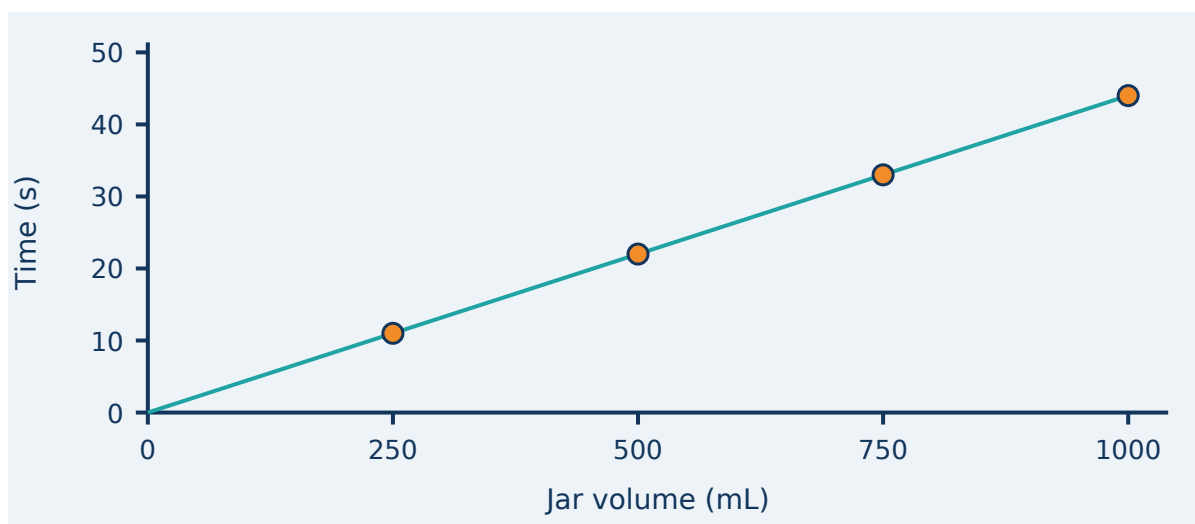
Extinguisher	Best for	Never use on
Water	Wood, paper, cloth	Electrical equipment, cooking oil
CO_2	Electrical equipment, small fires	Metal fires
Foam	Flammable liquids	Electrical equipment

1. Choose the best extinguisher for a laptop charger fire and explain using the fire triangle.
2. Explain why water must not be used on a pan of burning cooking oil.
3. Suggest a safer way to stop the oil fire.

Problem 18 Candle in a jar (hard)

A candle burns in closed jars of different volumes.

1. Read the graph: estimate the time for a 500 mL jar.
2. Calculate the time per mL and predict the time for a 1250 mL jar.
3. Calculate the volume of oxygen in 500 mL of air (21 % oxygen).
4. Explain why the candle goes out.



Time that a candle burns in a closed jar against the volume of the jar (Problem 18).

Problem 19 Steel wool gets heavier (hard)

A 2.50 g piece of steel wool burns in air and ends up with a mass of 3.10 g. Wood, in contrast, loses mass as it burns.

1. Calculate the mass gained.
2. Calculate the percentage increase.
3. Explain both observations using atoms.

Problem 20 Comparing fuels (hard)

Data for four fuels:

Fuel	Energy released (kJ per g)
Methane	55
Carbon (charcoal)	33
Ethanol	30
Hydrogen	142

1. Calculate the energy released by burning 20 g of each fuel.
2. Calculate the mass of methane needed to release 2200 kJ.
3. Identify which fuel makes no carbon dioxide and explain.