

ST4
Review

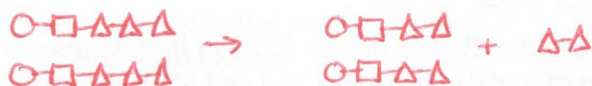
Particle Model, Balancing Equations, Neutralization and Combustion

Particle model, Balancing Equations and Conservation of Mass

1. Represent the following using the particle model.

	Symbol		Symbol
CO ₂		2 Na ₂ SO ₄	
6 Na		2 Mg(OH) ₂	
2 O ₃		CH ₃ COOH	

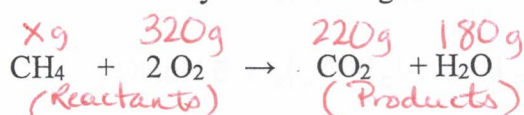
2. Represent each equation using the particle model.



3. The combustion of heptane, C₇H₁₆, produces carbon dioxide, CO₂, and water vapour, H₂O, as indicated in the following unbalanced equation. Balance this equation.



4. A certain amount of methane (CH₄) reacts completely with 320 g of oxygen gas (O₂) to produce 220 g of carbon dioxide (CO₂) and 180 g of water (H₂O). This combustion reaction is described by the following balanced equation:



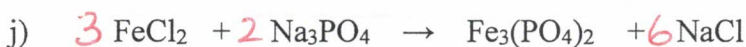
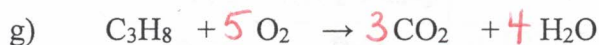
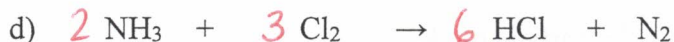
$$\begin{array}{r} 220 \\ + 180 \\ \hline 400 \end{array}$$

What is the total mass of the reactants involved in this combustion reaction?

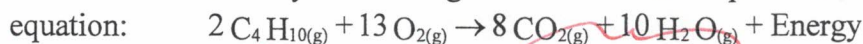
→ 400g

mass reactants = mass products

5. Balance the equations below:



6. The reaction caused by the burning of butane in air is represented by the following equation:



During a laboratory experiment, you react 29 g of butane (C_4H_{10}) in the presence of oxygen (O_2). You observe that 88 g of carbon dioxide (CO_2) and 45 g of water vapour (H_2O) form.

What mass of oxygen did you use in this experiment?

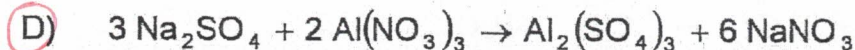
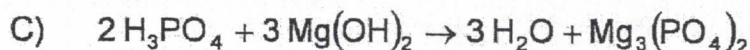
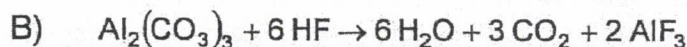
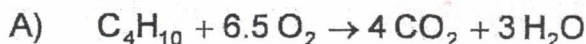
A) 59 g

B) 104 g

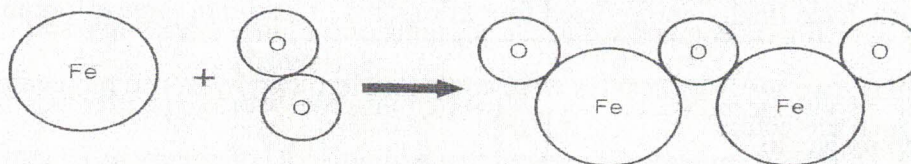
C) 133 g

D) 162 g

7. A chemical equation is a written representation of a chemical reaction. A series of chemical equations are represented below. Which of the following equations is correctly balanced?

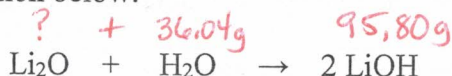


8. The following figure represents the reactants and the product of the oxidation reaction of iron.



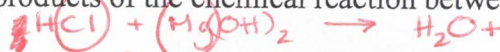
What is the balanced and simplified equation for this reaction?

- A) $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$ C) $4 \text{Fe} + 3 \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3$
 B) $\text{Fe}_4 + 3 \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3$ D) $2 \text{Fe}_2 + 3 \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3$
9. Lithium oxide (Li_2O) reacts with water (H_2O) to form lithium hydroxide (LiOH) according to the equation below:



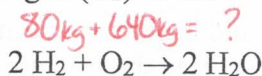
What mass of lithium oxide (Li_2O) reacts with 36.04 g of water (H_2O) to produce 95.80 g of lithium hydroxide (LiOH)?

- A) 11.86 g B) 59.76 g C) 131.84 g D) 155.56 g
10. Hydrochloric acid, HCl , in one of the acids found in the stomach. Heartburn is a symptom that occurs when the stomach produces too much HCl . Heartburn can be relieved by taking an antacid. Felix is suffering from heartburn and takes an antacid made up of magnesium hydroxide. What are the products of the chemical reaction between the stomach acid and the antacid?



- A) Magnesium hydroxide and hydrogen chloride C) Magnesium chloride and water
 B) Magnesium hydroxide and hydrogen chlorate D) Hydrogen chloride and water

11. Some rocket engines use hydrogen (H_2) as fuel. The reaction which is produced is shown in the equation below.:



What mass of water will be produced during the launch of the rocket if 80 kg of hydrogen (H_2) burn along with 640 kg of oxygen (O_2)?

- A) 680 kg B) 720 kg C) 1 440 kg D) 1 600 kg

12. The reaction involving magnesium (Mg) and hydrochloric acid (HCl) produces magnesium chloride (MgCl_2) and hydrogen gas (H_2). The balanced equation for this reaction is as follows:



In the laboratory, 6.00 g of magnesium (Mg) reacts with a certain amount of hydrochloric acid (HCl) to form 23.75 g of magnesium chloride (MgCl_2) and 0.50 g of hydrogen gas (H_2).

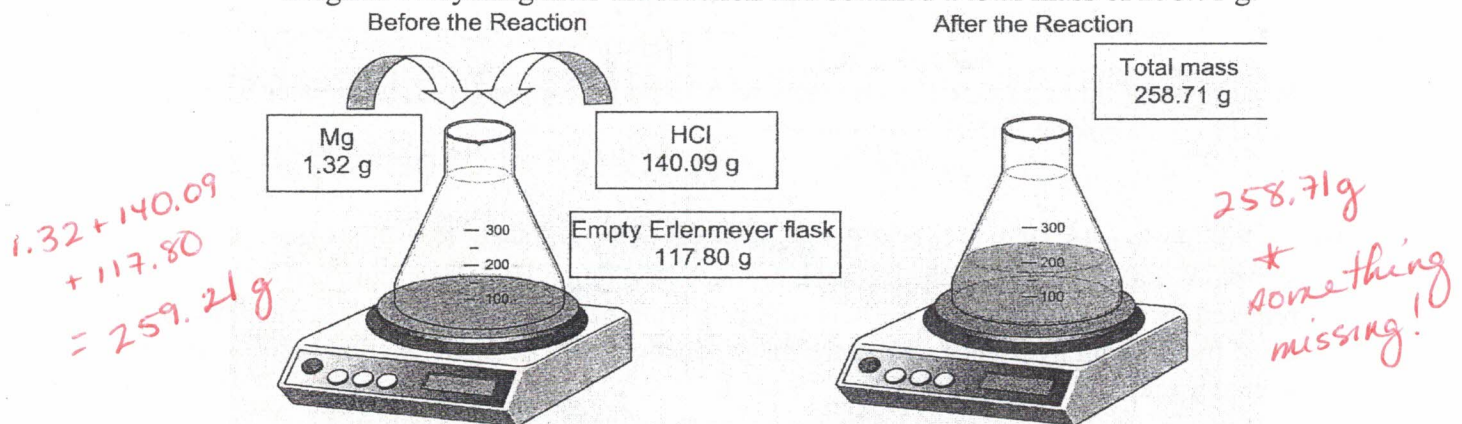
What mass of hydrochloric acid (HCl) is needed for this reaction to occur?

- A) 9.13 g B) 18.25 g C) 24.25 g D) 48.50 g

$$(23.75 + 0.50) - 6.00$$

13. Which of the following newspaper items contradicts the law of conservation of matter?
- A) Three tonnes of a miracle fuel combines with eight tonnes of oxygen to form one tonne of greenhouse gas and ten tonnes of water vapour." $3 + 8 = 1 + 10$ ✓
- B)** "Scientists have finally compressed four kilograms of lead into three kilograms of gold." $Pb \rightarrow Au$ ✗
- C) "Yesterday, two water molecules were converted into two hydrogen molecules and one oxygen molecule." $2H_2O \rightarrow 2H_2 + O_2$ ✓
- D) "Local high school students discovered that adding 25 kJ of energy to 10 g of ice produces 10 g of water vapour." $10g H_2O \rightarrow 10g H_2O$ ✓

14. You conducted the following experiment in the laboratory. In an Erlenmeyer flask which has a mass of 117.80 g, you combined a small amount, 1.32 g of magnesium (Mg) with 140.09 g of a weak solution of hydrochloric acid (HCl). A reaction occurred. You weighed everything after the reaction and obtained a total mass of 258.71 g.

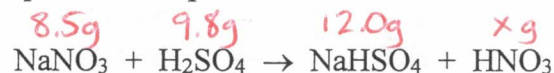


Four students have different procedures of what they could have done differently to ensure that the mass remained the same during the reaction.

Which student's procedure would have ensured the mass remain the same?

- A) Paul thought he could have stirred the mixture while the reaction was taking place.
- B) Carol thought she could have used more concentrated acidic solution.
- C)** Sandra thought she could have sealed the Erlenmeyer flask after adding the reactants.
- D) Bob thought he could have increased the amount of magnesium used.

15. The balanced equation for a particular chemical reaction is





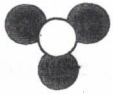
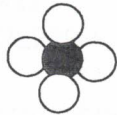
In the laboratory, you react 8.5 g of $NaNO_3$ with 9.8 g of H_2SO_4 and obtain 12.0 g of $NaHSO_4$ and a certain quantity of HNO_3 . What is the quantity of HNO_3 produced?

$(8.5 + 9.8) - 12.0 =$ 6.3g.

16. The molecular models below are constructed using the following symbols:

● : Aluminum

○ : Chlorine

Models	
1. 	3. 
2. 	4. 



Which of the models above correctly represents the structure of a molecule of aluminum chloride (AlCl₃)?

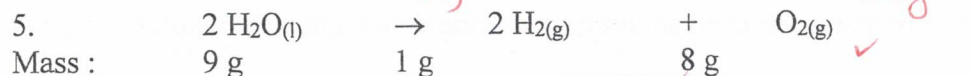
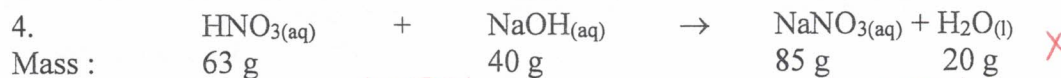
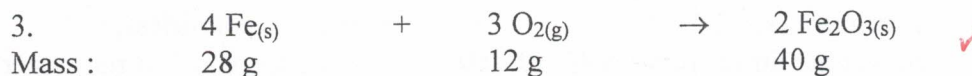
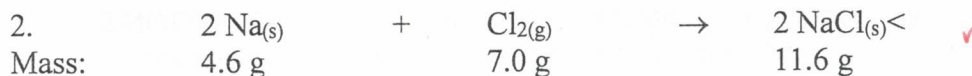
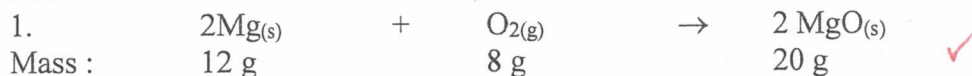
A) Model 1

B) Model 2

C) Model 3

D) Model 4

17. Which of the following sets of results can be used to verify the Law of Conservation of Mass?



A) 1, 3, 4 and 5

B) 2, 3, 4 and 5

C) 1, 2, 3 and 4

D) 1, 2, 3 and 5

Neutralization

1. What type of reaction is shown below? How do you know?



neutralization
 acid + base \Rightarrow salt + water

2. The following equation represents the reaction that occurs when a solution of hydrogen bromide is combined with a solution of lithium hydroxide :
- ~~H~~Br + Li~~O~~H → Product 1 + Product 2
- The products are not identified in the above equation. Identify these products.



3. In neutralizing sulfuric acid, H_2SO_4 , with caustic soda, NaOH , sodium sulfate, Na_2SO_4 , and water are produced. Which equation represents this chemical reaction?

- A) $\text{H}_2\text{SO}_4 + 2 \text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{H}_2\text{O}$
 B) $\text{Na}_2\text{SO}_4 + 2 \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4 + 2 \text{NaOH}$
 C) $\text{H}_2\text{SO}_4 + \text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{H}_2\text{O}$
 D) $\text{Na}_2\text{SO}_4 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4 + 2 \text{NaOH}$



4. You find a bottle containing an unidentified liquid. By using universal indicator paper, you determine that the pH of this liquid is 11. Therefore you have to neutralize it before disposing of it. Which of the following methods can be used to neutralize the liquid?
- A) Add a solution of NaOH .
 B) Add distilled water.
 C) Add a solution whose pH is 5.
 D) Add a solution whose pH is 8.
5. Sophie analyzes the reaction between two solutions she used in an experiment. The following is a description of her work.

1. Properties Observed

SOLUTION 1

- . is a good conductor of electricity,
- . is colourless,
- . turns blue litmus paper red, → acid
- . turns cobalt chloride paper pink.

SOLUTION 2

- . is a good conductor of electricity,
- . is colourless,
- . turns red litmus paper blue, → base
- . turns cobalt chloride paper pink.

2. Preparation of Solution 3

She prepares the third solution by mixing equal amounts of solutions 1 and 2.

3. Properties of Solution 3

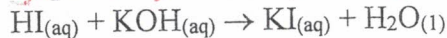
- . is a good conductor of electricity,
- . is colourless,
- . does not change the colour of litmus paper,
- . turns cobalt chloride paper pink.

} salt water

Which equations below **precisely** represents the reaction between solutions 1 and 2?

- A) $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 B) $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 C) $\text{NaOH} + \text{HCl} \rightarrow \text{NaOH} + \text{HCl}$
 D) $\text{NaCl} + \text{H}_2\text{O} \rightarrow \text{HCl} + \text{NaOH}$

6. What type of reaction is represented below:



- A) Synthesis B) Oxidation C) Precipitation **D) Neutralization**

7. Because of an accident involving a truck, 150 000 litres of acid spilled into a river. After removing the vehicle from the water, the emergency response team dumped a substance to neutralize the acid. Which of the following equations correctly represents the chemical reaction involved in this situation?

- A) $\text{C}_2\text{H}_4 + 3 \text{O}_2 \rightarrow 2 \text{CO}_2 + 2 \text{H}_2\text{O}$
B) $\text{Ca}(\text{OH})_2 + 2 \text{HF} \rightarrow \text{CaF}_2 + 2 \text{H}_2\text{O}$
C) $\text{NaOH} + \text{KCl} \rightarrow \text{NaCl} + \text{KOH}$
D) $\text{HBr} + \text{KI} \rightarrow \text{HI} + \text{KBr}$

Combustion

1. What type of chemical reaction is seen below? How do you know?



combustion
"fuel" + oxygen \Rightarrow carbon dioxide + water

2. Combustion is a chemical reaction that occurs under certain conditions. A friend shows you the three conclusions she arrived at after doing her research on forest fires: Justify each of the conclusions by using the fire triangle.

a) If the wind increases, the forest fire will also increase.

\uparrow oxidizing agent

b) Forest fires are more common in summer, when it is hot and dry, than in autumn, when it is cold and wet.

\uparrow ignition temperature

c) Forest fires are more likely to occur in mature forests than in young forests.

\uparrow fuel

3. For each combustion reaction, state whether it is an example of spontaneous, rapid or slow combustion.

a) A fire starts because of a gasoline soaked rug **spontaneous**

b) A scratched bike has rust on it **slow**

c) A family is roasting marshmallows on a camp fire **rapid**

d) Stacks of hay start to burn on a hot summer day. **spontaneous**

e) A half-eaten apple starts to turn brown after you have left it on a table for 40 minutes. **slow**

f) A candle's wick burning **rapid**

g) a propane barbeque lights up when the gas is ignited **rapid**

4. Which part of the fire triangle are firefighters tackling in each of the following situations? Explain your answers.

a) Firefighters at an airport pour foam onto a pool of flammable liquid spilled by an airplane in distress.

oxidizing agent → foam prevents O₂ from reaching liquid

b) Firefighters spray water onto the roofs and sides of two houses next to a blaze.

ignition temperature → water cools down roof ignition temp. not reached.

c) A bulldozer moves trees out of the way of a forest fire.

fuel → trees removed ∴ no fuel to burn

5. On a hot and dry afternoon, some hay in a barn caught fire, but there were no external causes involved. Water was used to put out the fire. Spraying the fire with water affected one of the fire triangle components in particular. Which statement indicates both the type of combustion that caused the fire triangle component that the water affected?

- cool down. → spontaneous*
- A) Slow combustion and the water affected the fuel.
 - B) Slow combustion and the water affected the oxidizer.
 - C) Spontaneous combustion and the water affected the ignition temperature.
 - D) Spontaneous combustion and the water affected the fuel.

6. When oil catches fire in a sauce pan, why should ~~be it be~~ covered with its lid?

- A) the lid limits the amount of oxidizing agent.
- B) the lid increases the activation energy
- C) the lid lowers the ignition temperature
- D) the lid reduces the amount of fuel

7. The following two actions bring about or speed up combustion.

Action 1 – Use a magnifying glass to focus the sun's rays on a surface. ↑

Action 2 - Revive a campfire by blowing on the glowing pieces of wood. ↑

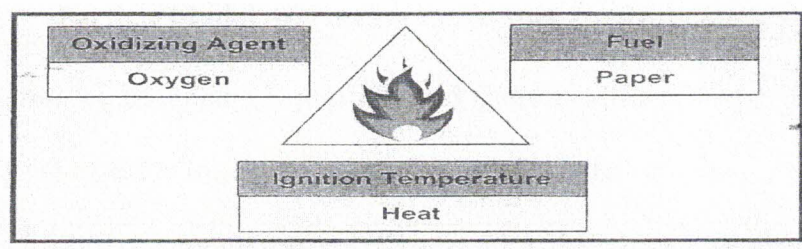
Which of the following choices (A, B, C or D) correctly matches the fire triangle component with each action?

	Action 1	Action 2
A	Fuel	Fuel
B	Fuel	Oxidizing agent
C	Ignition temperature	Fuel
<input checked="" type="radio"/> D	Ignition temperature	Oxidizing agent

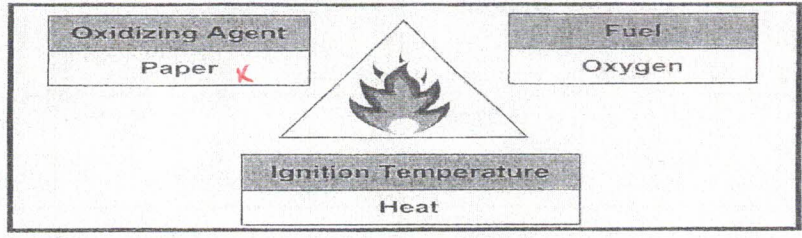
concentrates sun's rays

8. Arthur brings a burning match close to a piece of paper to light a campfire. Which of the following triangles correctly represents the situation?

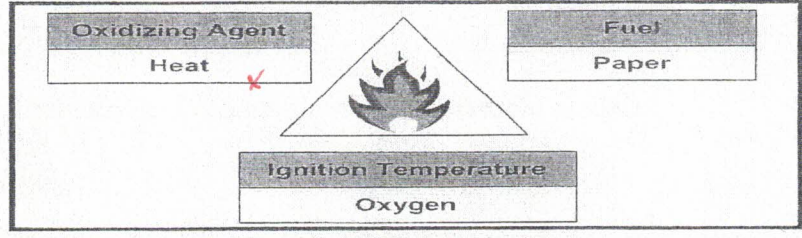
A)



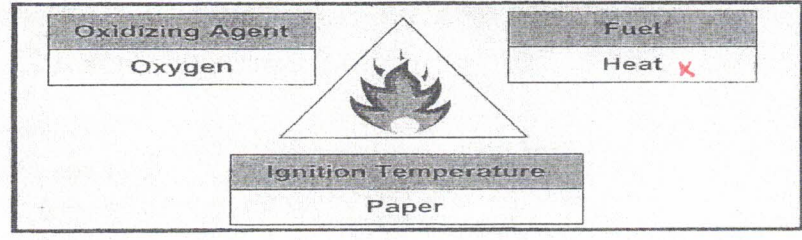
B)



C)



D)



9. Which is not part of the fire triangle?

- A) Oxygen
- B) Carbon dioxide
- C) Wood
- D) Fuel