

Types of Chemical Reactions

Answer key with worked solutions

A. Classifying

1. Classify.

(a) **synthesis** (b) **decomposition** (c) **double displacement** (precipitation of BaSO_4) (d) **single displacement** (e) **combustion**

B. Predicting products

2. Will it react?

- (a) Mg is above Zn: $\text{Mg} + \text{ZnCl}_2 \longrightarrow \text{MgCl}_2 + \text{Zn}$
(b) Ag is below Cu: **no reaction**
(c) Zn is above H: $\text{Zn} + 2\text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$
(d) Cl is more reactive than Br: $\text{Cl}_2 + 2\text{NaBr} \longrightarrow 2\text{NaCl} + \text{Br}_2$
(e) Br is less reactive than Cl: **no reaction**

3. Complete and balance.

(a) $2\text{Na} + \text{Cl}_2 \longrightarrow 2\text{NaCl}$ (b) $\text{MgCO}_3 \longrightarrow \text{MgO} + \text{CO}_2$ (c)
 $\text{H}_2\text{SO}_4 + 2\text{NaOH} \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$

C. Combustion

4. Combustion.

- (a) $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
(b) $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \longrightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$
(c) **Carbon monoxide** (CO), a poisonous gas (or soot, C).

D. Double displacement

5. Why one reacts.

Silver nitrate + sodium chloride gives **silver chloride, which is insoluble**, so a precipitate forms and the reaction happens: $\text{AgNO}_3 + \text{NaCl} \longrightarrow \text{AgCl(s)} + \text{NaNO}_3$. With potassium nitrate + sodium chloride, the possible products (KCl and NaNO_3) are **both soluble**: no precipitate, water or gas, so no reaction.

E. Calculations

6. Magnesium oxide.

$$\begin{aligned} & 2.43 \text{ g Mg} \times \frac{1 \text{ mol Mg}}{24.31 \text{ g Mg}} \\ & \times \frac{2 \text{ mol MgO}}{2 \text{ mol Mg}} \times \frac{40.31 \text{ g MgO}}{1 \text{ mol MgO}} \\ & = \mathbf{4.03 \text{ g MgO}} \end{aligned}$$

7. Zinc used.

$\text{Zn} + \text{CuSO}_4 \longrightarrow \text{ZnSO}_4 + \text{Cu}$: 1 mol Zn gives 1 mol Cu.

$$\begin{aligned} & 4.86 \text{ g Cu} \times \frac{1 \text{ mol Cu}}{63.55 \text{ g Cu}} \\ & \times \frac{1 \text{ mol Zn}}{1 \text{ mol Cu}} \times \frac{65.38 \text{ g Zn}}{1 \text{ mol Zn}} \\ & = \mathbf{5.00 \text{ g Zn}} \end{aligned}$$

F. Challenge

8. Order of reactivity.

X > Z > Y. A metal can only displace a less reactive metal. X displaces both others, so it is the most reactive; Z displaces Y, so Z is more reactive than Y.