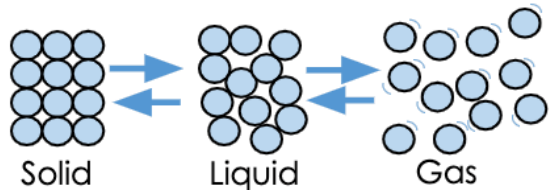
Chemical and Physical Changes

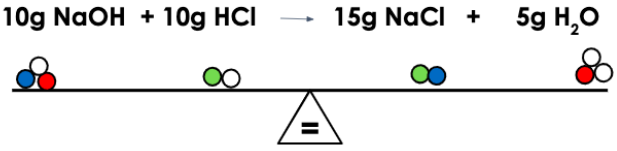
1. A **chemical change** produces a new substance whereas in a **physical change** no new substance is produced.
2. A chemical change is **irreversible** whereas a physical change is **reversible**.
3. Melting, evaporating, condensing, freezing and sublimation are examples of **physical changes** because they only change the <u>state</u> (solid, liquid or gas) of the substance.
4. These processes only change the energy that each particle has (how much it moves) and <u>not</u> its arrangement or properties (e.g. its boiling or melting point).



5. A chemical change can be identified if there is a change in colour or temperature, or if the reaction produces light.
6. In a chemical change, a new substance (or product) is always made.

Chemical Reactions

7. A chemical change can also be called a chemical reaction.
8. The number and type of atoms do not change in a chemical change and are only rearranged.
9. The total overall mass is **conserved** in a chemical change (the mass of the reactant is equal to the mass of the products).
10. Every reactant atom will become a product atom.
11. Extra atoms cannot be made, and atoms cannot disappear.



Reactions of Metals with Oxygen

12. Metals react with oxygen to produce metal oxides.
13. The general equation is: Metal + oxygen → Metal oxide
14. Example 1: Copper + oxygen → copper oxide
15. Example 2: Lithium + oxygen → lithium oxide
16. These reactions are oxidation reactions because the metals gain oxygen
17. **Reduction** is the loss of oxygen
18. **Oxidation** is the gain of oxygen
19. **Exothermic** reactions transfer energy **to** the surroundings
20. **Endothermic** reactions take in energy **from** the surroundings

Reactions of Metals with Acid

21. Acids react with some metals to produce salts and hydrogen
22. Metal + acid → salt + hydrogen
23. This can be remembered by MASH: **M**etal + **A**cid → **S**alt + **H**ydrogen
24. Example 1: Copper + Hydrochloric acid → copper chloride + hydrogen
25. Example 2: Sodium + Nitric Acid → sodium nitrate + hydrogen

Reactions of Acids with Alkalis, Bases and Metal Carbonates

26. Acids are **neutralised** by alkalis (e.g. soluble metal hydroxides) and bases (e.g. insoluble metal hydroxides and metal oxides) to produce salts and water,
27. Acid + alkali → salt + water
28. Acid + base → salt + water
29. Acids are neutralised by metal carbonates to produce salts, water and carbon dioxide.
30. Acid + metal carbonate → salt + water + carbon dioxide
31. The particular salt produced in any reaction between an acid and a base or alkali depends on the acid and metal in the base, alkali or carbonate
32. Hydrochloric acid produces chloride salts, nitric acid produces nitrate salts, and sulfuric acid produces sulfate salts

Acid	**Salt produced**
Hydrochloric Acid	Chloride
Sulfuric Acid	Sulfate
Nitric Acid	Nitrate

33. Example 1:
Hydrochloric Acid + sodium hydroxide → sodium **chloride** + water
34. Example 2:
Sulfuric Acid + sodium chloride → sodium **sulfate** + water
35. Example 3:
Nitric Acid + sodium hydroxide → sodium **nitrate** + water
36. Example 4:
Hydrochloric Acid + sodium carbonate → sodium **chloride** + water + carbon dioxide
37. Example 5:
Nitric Acid + sodium carbonate → sodium **nitrate** + water + carbon dioxide
38. Example 6:
Sulfuric Acid + sodium carbonate → sodium **sulfate** + water + carbon dioxide

Tests for Gases

39. The **test for hydrogen** uses a burning splint held at the open end of a test tube of the gas. Hydrogen burns rapidly with a squeaky pop sound.
40. The **test for carbon dioxide** uses a solution of calcium hydroxide (limewater).
41. When carbon dioxide is shaken with or bubbled through limewater the limewater turns milky (cloudy)