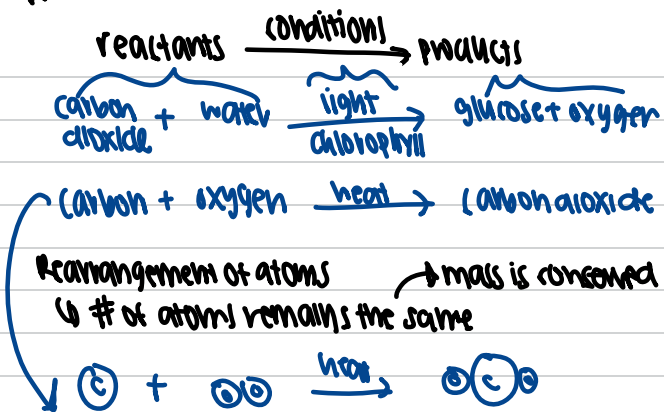


physical change	chemical change
no new substance involved	new substance form
reversible by separation technique	not easily reversible

represented by word eqn.



Chemical reactions

① **Combustion**
 substance **HEAT** with **OXYGEN**
 (heat & light released)
 $\text{carbon} + \text{oxygen} \rightarrow \text{carbon dioxide}$

② **Thermal decomposition**
 substance **breakdown** by heating
 $\text{calcium carbonate} \xrightarrow{\text{heat}}$
 $\text{calcium oxide} + \text{carbon dioxide}$

③ **Oxidation**
 matter **reacts** with **OXYGEN**
 e.g. **Rusting**
 $\text{iron} + \text{oxygen} + \text{water} \xrightarrow{\text{rust}}$
 $\text{hydrated iron(III) oxide}$
Respiration
 $\text{glucose} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water}$

④ **Neutralisation**
acid + alkali to form salt & water

acid
 sour
 turn blue litmus red
 react with alkali, metal, carbonate
 e.g. hydrochloric acid, sulfuric acid, nitric acid
 e.g. (home) vinegar, citric acid

alkali
 bitter / soapy
 turns red litmus blue
 react with acid
 e.g. sodium hydroxide, calcium hydroxide, potassium hydroxide
 e.g. (home) ammonia, bleach

acid reactions.

① **acid + alkali** → salt + water
 (neutralisation)

hydrochloric acid + sodium hydroxide → sodium chloride + water
 sulfuric acid + calcium hydroxide → calcium sulfate + water

② **acid + metal** → salt + hydrogen
 (except copper, silver, gold)

hydrochloric acid + zinc → zinc chloride + hydrogen
 nitric acid + calcium → calcium nitrate + hydrogen

* to test hydrogen, use lighted splint,
 which will extinguish with a 'pop' sound

③ **acid + carbonate** → salt + water + CO₂

hydrochloric acid + magnesium carbonate → magnesium chloride + water + CO₂
 sulfuric acid + iron(II) carbonate → iron(II) sulfate + water + CO₂

* to test CO₂, bubble it through limewater,
 white precipitate will be formed.

Acid and alkali test:

0 most acidic
 2 lemon juice
 4 tomato juice
 7 neutral
 9 water
 12 baking soda
 14 ammonia
 14 most alkaline
 oven cleaner

acid
 red litmus remain red
 blue litmus turns red
 * if only one, may be neutral

alkali
 blue litmus remain blue
 red litmus turns blue

Other indicators

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	red							pink							blue
B		pink			yellow				blue					green	
C			yellow							green					violet

* match based on question

* universal indicator
 to add and then match.

How do chemical change occur

- ① Mixing — acid + ...
- ② Heating — combustion / thermal decom
- ③ Light — photosynthesis
- ④ Oxygen — oxidation
- ⑤ Electric current — electroplating / electrolysis

Applications

↳ cooking, respiration, decay, rusting
 ↳ combustion → air pollutants produced

pollutant	source	effects :-
carbon monoxide	fuels & motor low oxygen	toxic! reduce oxygen in blood :-
sulfur dioxide	sulfur containing fuel or volcanic eruption	• irritate eye, nose, lung • worsen heart condition • worsen asthma / respiratory prob
oxide of nitrogen	• burn fuel @ 4 Temp. in motor & factories • N₂ + O₂ during lightning	• dissolve in water to form ACID RAIN • destroy ocean & building

pH no longer suitable
 for corals & certain fish
 leading to disrupt in ecosystem!