

THINK TANK 2

1. Rb : $5s^1$
2. Cs : $6s^1$
3. Ba : $6s^2$
4. Br : $4s^2 4p^5$
5. I : $5s^2 5p^5$
6. Xe : $5s^2 5p^6$

THINK TANK 3

- 1.1 1
- 1.2 2
- 1.3 3
- 1.4 4
2. Neon and argon
- 3.1 Bromine
- 3.2 Germanium
- 3.3 Gallium
- 3.4 Calcium
- 3.5 Potassium
- 3.6 Selenium
- 3.7 Krypton

4. The Number of Group 1 and 2 is the same as the number of electrons in the outermost energy levels.

A Group Number of 13 to 18 is related to the number of outermost electrons in the energy levels by:

$$\text{Group Number} - 10 = \text{Number of electrons in outermost energy level}$$

e.g. $13 - 10 = 3$ (for elements such as aluminium).

ACTIVITY 1: Reactions of Group 1 Metals (Lithium, Sodium and Potassium)

These reactions should be demonstrated to the class. Alkali metals (Group 1 metals) are highly reactive.

- Do not touch the metal with bare hands; use tongs to handle the metal and for safety wear protective rubber gloves.
- Ensure that all equipment is dry (free of water). Alkali metals react spontaneously with water. The knife, tongs and ceramic file must be dried thoroughly before handling the metal.
- Oxygen can be prepared by adding manganese dioxide (MnO_2) to a concentrated solution of hydrogen peroxide (H_2O_2) and collecting the gas by the downward displacement of water.
- Use a large bowl or basin when reacting the alkali metal in water. Do not use a small container such as a beaker as the reaction occurs vigorously giving off large amounts of energy.

**Questions**

1. They are very reactive in air and in water. The paraffin protects them from direct contact with air or water.

2.

| Metal | Physical Properties | Chemical Properties |
|-----------|--|--|
| Lithium | Fairly soft metal Dark grey in colour Shiny when cut. | Loses its shine soon after cutting (it is a chemical property as it is reacting with air). |
| Sodium | Light grey in colour Softer than lithium Shiny when cut. | Loses its shine quicker than lithium (it is a chemical property as it is reacting with air). |
| Potassium | Grey metal Softer than sodium Shiny when cut. | Loses its shine quicker than sodium (it is a chemical property as it is reacting with air). |

3. Group 1 metals react with air and water. If there is any water on your hands the metal will react; the reaction will burn your skin.
4. The metal reacts with air. It is safer to put the large piece back into the bottle so that it does not react spontaneously with the air.
5. Potassium. It tarnishes more quickly when cut and exposed to air.
6. Potassium.
7. Potassium. Its outermost electrons are further away from the nucleus.
8. Sodium oxide.
9. Potassium oxide.
10. Lithium oxide is soluble in water.
11. Litmus changes colour in an acid or a base. It tells us whether a solution is acidic or basic (alkaline).
12. A solution of lithium oxide is alkaline (basic).
13. We heat the sample to start the reaction so that the metal ignites in oxygen.
14. The Group 1 metals have a low melting point.
- 15.

| Group 1 Metal | Symbol | Colour of flame | Appearance of product | Solubility of product | Colour of litmus | Type of product |
|---------------|--------|-----------------|-----------------------|-----------------------|------------------|-----------------|
| Lithium | Li | Red | White powder | Soluble | Blue | Basic |
| Sodium | Na | Orange | White powder | Soluble | Blue | Basic |
| Potassium | K | Purple | White powder | Soluble | Blue | Basic |
| Rubidium | Rb | n/a | White powder | Soluble | Blue | Basic |

16. Group 1 metals burn in oxygen forming their oxides which dissolve in water to form basic (alkaline) solutions.
17. A soluble base is called an alkali. The Group 1 metals form soluble basic oxides, therefore they are known as the alkali metals.
18. Alkali metals are less dense than water.
19. Hydrogen. All alkali metals release hydrogen from water (alkali metal + water \rightarrow hydrogen + metal hydroxide).
20. Potassium. It reacts most vigorously with water.
21. Francium.
22. Product is alkaline (basic).
23. Alkali metals react with water releasing hydrogen gas. They float on the water surface, giving off the gas. The product of the reaction is basic (turns red litmus blue).

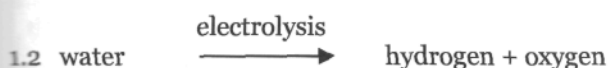
- 24.1 Sodium + water \rightarrow sodium hydroxide + hydrogen
- 24.2 Potassium + water \rightarrow potassium hydroxide + hydrogen
- 24.3 Rubidium + water \rightarrow rubidium hydroxide + hydrogen
- 24.4 Caesium + water \rightarrow caesium hydroxide + hydrogen
- 25.1 LiOH
- 25.2 NaOH
- 25.3 KOH
- 25.4 RbOH
- 25.5 CsOH
26. The more reactive metals are placed lower down in the Group. The electronic configuration of the outermost electrons of Group 1 metals is the same therefore they react in similar ways. Because they are all in the same Group and called the alkali metals, we can predict that they form alkaline oxides, and react with water to release hydrogen and form an alkali.

THINK TANK 4

| Metal | Physical Properties | Chemical Properties |
|------------|---|--|
| Metals | Shiny; solid; malleable; ductile; some are magnetic; high melting point; high boiling point; good conductors of heat and electricity | Acids corrode metals giving off hydrogen (except precious metals such as gold, silver and platinum). Metals do not react with alkalis. |
| Metalloids | Solids; not malleable or ductile; greater resistance to electric current than metals | Metalloids react with metals in a similar way to non-metals; Metalloids react with non-metals in a similar way to metals. |
| Non-metals | Dull; good insulators (except carbon as graphite); low melting points; low boiling points; many non-metals are gases at room temperature. | Non-metals do not react with acids. |

THINK TANK 5

1.1 Hydrogen with atomic mass 1.



1.3 Electrical energy is transferred to chemical energy.

2.1 Se $Z = 34$

2.2 Metalloid

2.3 A photocell transfers light energy to electrical energy

3.1 Malleable

3.2 Ductile

3.3 Steel is a mixture. The amounts of iron and other elements can be altered to make various types of steel.

4. A good insulator does not conduct heat or electricity.

5. Copper conducts heat and electric current.

6. Metal is a good conductor of heat, it transfers the heat from the stove to the ingredients allowing food to cook quickly. Wooden or plastic handles are good insulators. Heat is not transferred to the handle, so we can pick up the pot without burning the food.