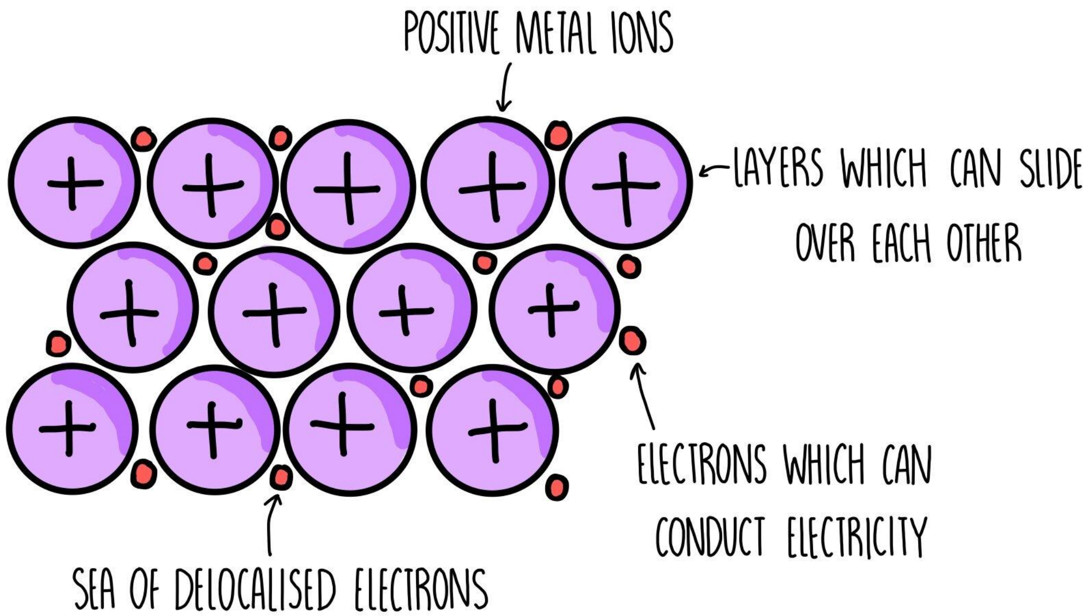
Chemical bonding 🧪

→ Metals

- Giant metallic lattice structure
- Form metallic bonds
- Have giant metallic structures that consist of positive metal ions surrounded by "sea of electrons" that is delocalised from the metal atoms



- Valence electron of each atom are free to move about the overlapping valence shell
- When the valence electron went to the neighbouring shell, a positive metal ion is formed
- Free electrons act as "electronic glue", as it holds positive metal ions together
- The metal is a lattice of positive ions in a "sea of electrons"

- The strong electrostatic forces of attraction between "sea of electrons" and "immobile" positive metal ions that form the structure of the giant metallic lattice is the metallic bonds
- "Sea of electrons" consists of free electrons, mobile electrons and delocalised electrons)

- Properties:
  - Generally exists as a solid at rtp
    - A large amount of energy has to be absorbed to overcome to strong metallic bond
  - Have high melting and boiling points
  - Good heat conductor
    - Sea of electrons are free to move to transfer heat
  - Conduct electricity in any state (aka good electrical conductor)
    - Sea of electrons are free to move to carry electricity
  - Malleable (can bend/be hammered) and ductile (can be drawn out into thin wire without breaking)
    - When force is applied, the neatly arranged layers of metal atoms can envelop each other easily

→ Giant covalent ~~bonds~~ Substance

- Formed between thousands and million of atoms extended 3-dimensionally

Many many many...

- ONLY covalent bonds (duh, that's why they're called giant covalent ~~bonds~~) substance
- ~~Giant~~ strong covalent bonds → Giant covalent substances
- Example 1 of giant covalent substance: Diamond 💎
  - Has a tetrahedral structure
  - Each carbon atom covalently bonded to 4 other carbon atoms
- Example 2 of giant covalent substance: Graphite ✏️
  - Formed by many layer of graphene (a grant molecule)
  - Has a hexagonal structure
  - Each carbon atom covalently bonded to 3 other carbon atoms
    - This leaves 1 free electron per carbon atom not bonded
- Table of comparison between Diamond and Graphite

	Diamond 💎	Graphite ✏️
Structure	- Tetrahedral structure - Giant molecule - Each carbon atom covalently bonded to 4 other carbon atoms	- Hexagonal structure - Layers of carbon atoms are held by weak force of attractions - Each carbon atom covalently bonded to 3 other carbon atoms, leaving 1 free electron per carbon atom not ~~bonded~~ used for bonding

Both are giant molecule

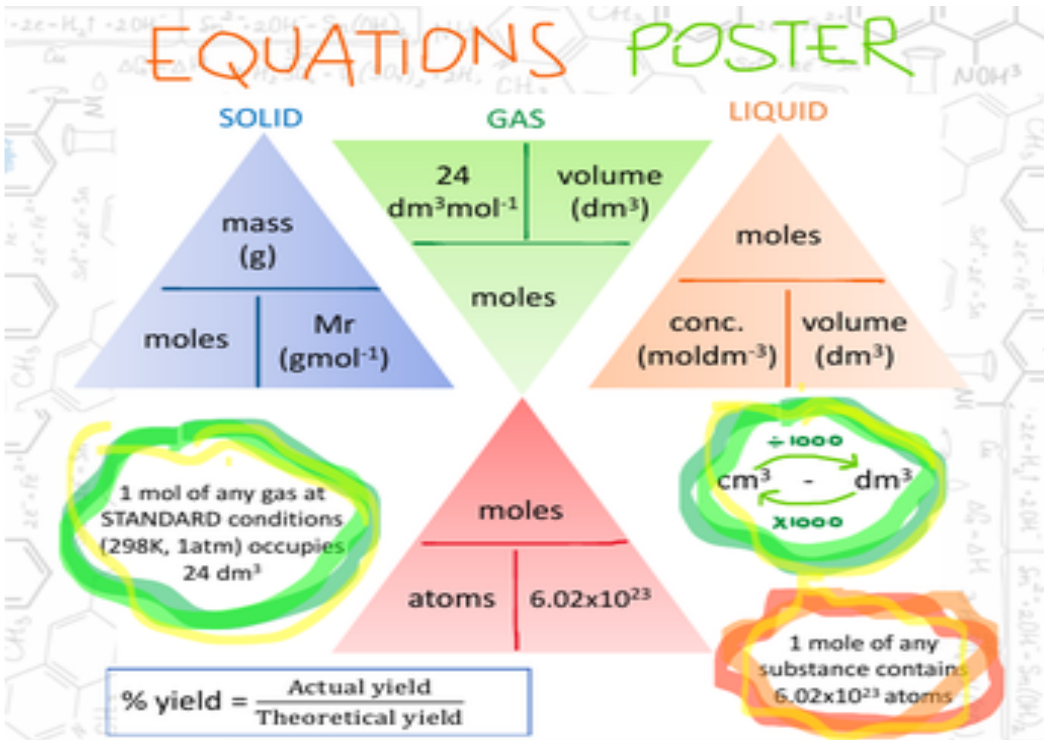
Property	1. High melting point 2. High boiling point 3. Low volatility	Same applies here
Reason	Large amount of energy to be absorbed to break the strong covalent bonds between the carbon atoms	Same applies here
Property	4. Non-electrical conductor	4. Electrical conductor
Reason	No free moving ion or electron to carry electric current	One free electron per carbon atom (impt.) to carry around electric current
Property	5. Hard	5. Soft and slippery
Reason	Large force needed to break the strong covalent bonds between the carbon atoms	Low force needed to break the weak intermolecular forces of attraction to allow to layers to slide over each other easily
Uses	Used in cutting tools or drill bits due to its hardness (or used in engagement rings 😍 #hopelessromantic)	→ Used as a solid lubricant or in pencil lead due to its softness and slippery property

Chemical equations 🌷

➔ One mole of particles / Avogrado's number = 6 x 10^23 = 1 mol

➔ One mol of any gas occupies a volume of 24 dm^3 at rtp and pressure

➔ Formula triangles:



➔ Reacting masses:

- 1. Write a balanced chemical equation
- 2. Compare mole ratio (based on values in the balanced equation; eg. 2 mol of Lithium + 1 mol of Chlorine, write ratio as 2:1)
- 3. Convert into number of moles (for known substance)
- 4. Find number of moles (for unknown substance)

- 5. Convert number of moles into required unit given by the question (eg. mass, volume)

➔ Volume of reacting gases:

- Direct proportional relationship between number of mole of gases and volume of gases
    - 1. Write a balanced chemical equation
    - 2. Compare mole ratio from balanced equation
    - 3. Find volume of unknown substance
    - 4. Find number of moles using volume of unknown substance
    - 5. Convert number of moles into required unit given by question

➔ Concentration of solutions:

- Concentration is the amount of solute dissolved in a given volume of solution
    - 1. Write a balanced chemical equation
    - 2. Compare mole ratio from balanced equation
    - 3. From the question, calculate number of mole (for known substance)
    - 4. From there, calculate number of moles for unknown substance using the mole ratio
    - 5. Convert number of moles for unknown substance into required unit given by the question
- $mol/dm^3 \times Mr = g/dm^3$
- g/dm^3 divided by $Mr = mol/dm^3$

➔ Percentage yield

- No experiment can get 100% yield due to mass loss, contaminations or incomplete reaction along the way in the experiment
- (Actual yield divided by theoretical yield) x 100%
  - 1. Write balanced chemical equation
  - 2. Compare mole ratio
  - 3. Find number of moles for unknown substance
  - 4. Convert number of moles into mass
  - 5. Use percentage yield formula to find answer

➔ Percentage purity

- (Mass of pure substance ÷ mass of impure substance) x 100%
- Do NOT use impure sample data to calculate number of moles
  - 1. Write balanced chemical equation
  - 2. Compare mole ratio
  - 3. Find number of moles for unknown substance
  - 4. Convert number of moles into mass
  - 5. Use percentage purity formula to find answer

➔ Limiting reactant

- The limiting reactant is the substance that is completely used up in a reaction

- When the limiting reactant is used up, the reaction stops
- ONLY the limiting reactant should be used for calculation (eg. finding number of moles)
- Whenever there is more than one reactant information, *which allow to find mole* find out what is the limiting reactant by calculating the number of moles (using formulas from the formula triangles)
    - 1. Write balanced chemical equations
    - 2. Check if more than 1 reactant information is given. If yes, find the number of moles for both reactants and compare mole ratio using data from the equation and one of the reactants.
    - 3. From the equation, compare mole ratio between the limiting reactant and the unknown substance
    - 4. Calculate the number of mole of unknown substance
    - 5. Convert number of moles into required unit

→ Remember, when in doubt, just find the number of moles!

SLAY THE DAY (or exam lol)! :)

A1 in your hand