

| Substance                                     | Molar mass (g.mol <sup>-1</sup> ) | Phase  | Melting point (°C) | Boiling points (°C) |
|-----------------------------------------------|-----------------------------------|--------|--------------------|---------------------|
| Helium                                        | 4                                 | gas    | -272               | -269                |
| Oxygen                                        | 32                                | gas    | -218               | -183                |
| Petrol (C <sub>8</sub> H <sub>18</sub> )      | 114                               | liquid | -57                | 126                 |
| Candle wax (C <sub>23</sub> H <sub>48</sub> ) | 324                               | solid  | 63                 | 380                 |

10.1 Give the name of the substances above that has the strongest IMF? (1)

10.2 What are the key words you would use to explain the above (5)

The chosen substance :

Is polar

Is non-polar

Has the largest molar mass

Has the smallest molar mass

Strongest IMF

Weakest IMF

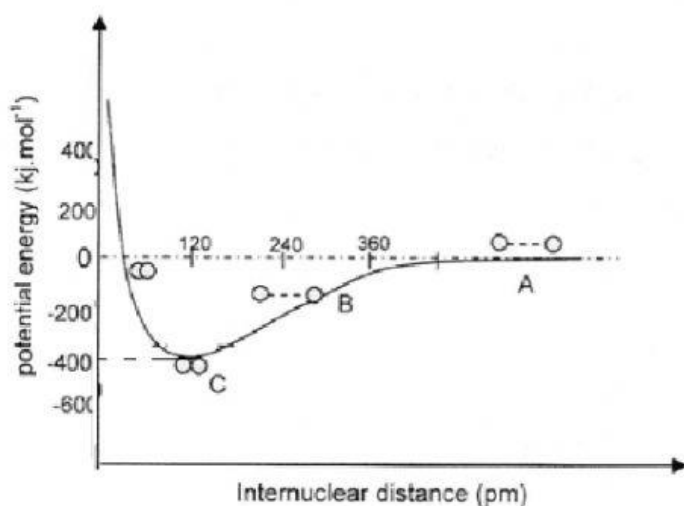
Van der Waals, London

Van der Waals, dipole-dipole

More energy required to weaken IMF and change its phase

Less energy required to weaken IMF and change its phase

11. The graph shows the change in energy that takes place when a hydrogen (H) atom approaches a chlorine (Cl) atom.



11.1 How much energy is released when the H-Cl bond forms? (1)

11.2 What is the bond length, in pm, of the H-Cl bond? (1)

12.1 Which molecule, between H-Cl and Cl-Cl will have the highest bond energy? (1)

12.2 Choose the appropriate key words to explain this. (4)

The chosen molecule has:

The smallest bond length

The biggest bond length

Bigger EN difference

Smaller EN difference

More polar molecule

Less polar molecule

Thus requires more energy to break the bond

Thus requires less energy to break the bond

13. HCl ; HBr and HF are three compounds with the same geometric shape, but different boiling points

13.1 What is the geometric shape of the compounds? (1)

13.2 By referring to the nature and strengths of the forces between the particles and the energy needed explain the difference in the boiling points between:

a) HF and HCl (4)

HF contains hydrogen bonds

HF contains Van der Waals, dipole-dipole forces

HCl contains hydrogen bonds

HCl contains Van der Waals, dipole-dipole forces

Hydrogen bonds are stronger than Van der Waals, dipole-dipole forces

Hydrogen bonds are weaker than Van der Waals, dipole-dipole forces

More energy needed to overcome the IMF forces between HF

Less energy needed to overcome the IMF forces between HF

b) HCl and HBr

(5)

HCl contains Van der Waals, dipole-dipole IMF

HCl contains Hydrogen bonds

HBr have Hydrogen bonds

HBr have Van der Waals, dipole-dipole IMF

Hydrogen bonds are stronger than Van der Waals, dipole-dipole forces

Hydrogen bonds are weaker than Van der Waals, dipole-dipole forces

The 2 molecules have the same strenght of IMF

HBr has a greater molar mass than HCl

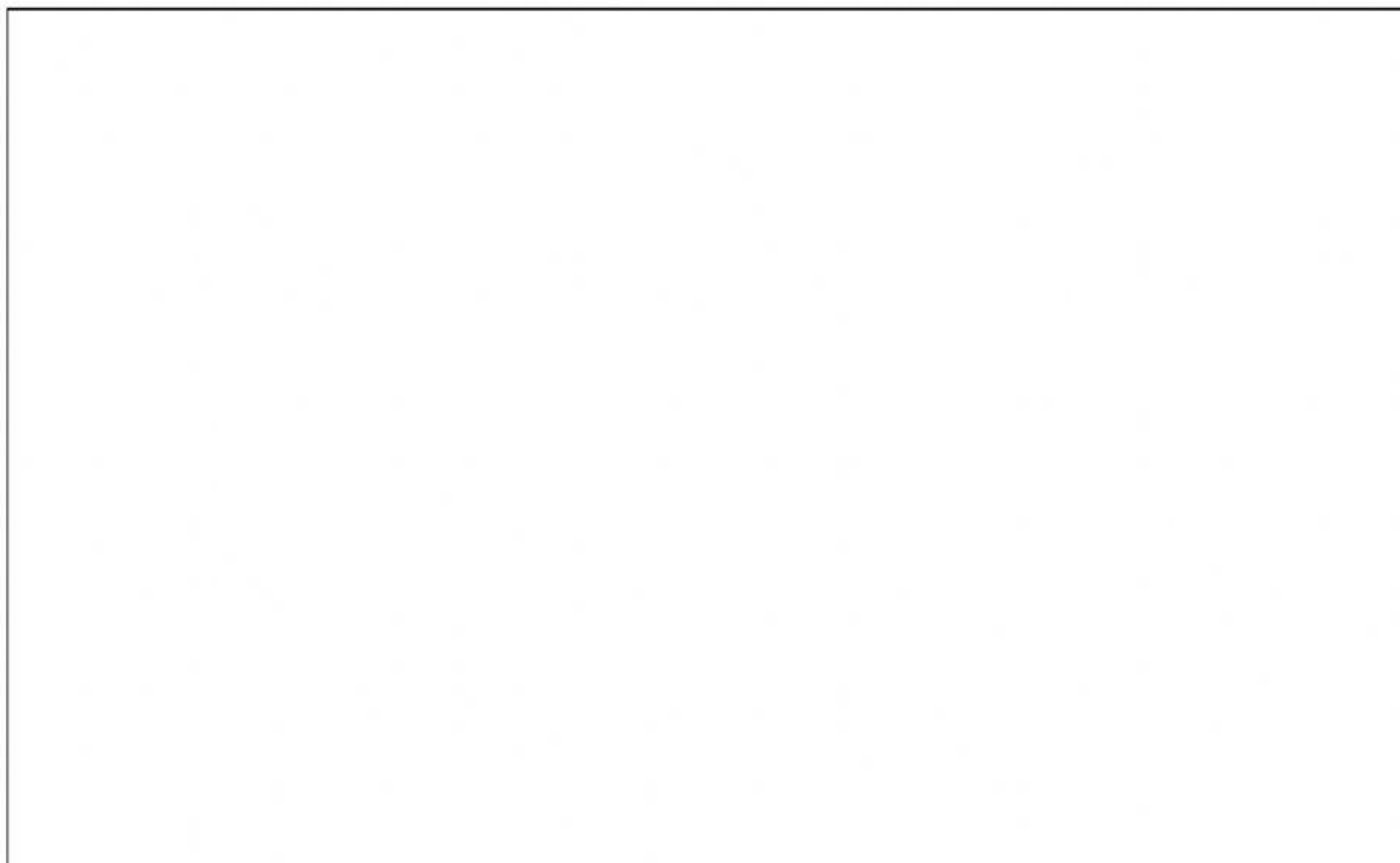
HBr has a smaller molar mass than HCl

More energy needed to overcome the IMF forces between HBr

Less energy needed to overcome the IMF forces between HBr

13.3 Arrange these molecules in order of increasing boiling points

Watch the first 4 mins of the following video and then consider the following example



**14. Use this one as an example**

Consider the molecules

$\text{PF}_3$  and  $\text{BF}_3$

State the bond and molecular polarity of each molecule

14.1  $\text{PF}_3$ :

bond polarity - polar

shape: trigonal pyramidal

molecular polarity – polar

14.2  $\text{BF}_3$ :

bond polarity - polar

shape: trigonal planar

molecular polarity – non-polar

14.3 Choose key phrases to explain the molecular polarity of each

$\text{PF}_3$

The shape is trigonal pyramidal

The shape is asymmetrical

Asymmetrical distribution of charge

Polar molecules are asymmetrical in shape and have asymmetrical distribution of charge.

$\text{BF}_3$

The shape is trigonal planar

The shape is symmetrical

Symmetrical distribution of charge

Non-polar molecules are symmetrical in shape and have symmetrical distribution of charge.

14.4 What is the key difference between the 2 molecules

$\text{NH}_3$  has a lone pair whereas  $\text{BF}_3$  does not

15. Consider the compounds  $\text{CH}_4$  and  $\text{CH}_3\text{F}$

15.1  $\text{CH}_4$ :

bond polarity:

shape:

molecular polarity:

15.2  $\text{CH}_3\text{F}$ :

C-H bond polarity:

C-F bond polarity:

shape:

molecular polarity:

15.3 Choose key phrases to explain the molecular polarity of each

(3)

$\text{CH}_4$

The shape is trigonal planar

The shape is trigonal pyramidal

The shape is tetrahedral

The shape is asymmetrical

The shape is symmetrical

Symmetrical distribution of charge

Non-symmetrical distribution of charge

$\text{CH}_3\text{F}$

(3)

The shape is trigonal planar

The shape is trigonal pyramidal

The shape is tetrahedral

The shape is asymmetrical

The shape is symmetrical

Symmetrical distribution of charge

Non-symmetrical distribution of charge

16. Consider the table below and answer the questions that follow

| Substance                    | Boiling point( °C) |
|------------------------------|--------------------|
| He (4g.mol <sup>-1</sup> )   | -272               |
| F (36 g.mol <sup>-1</sup> )  | -188               |
| Ar (40g.mol <sup>-1</sup> )  | -186               |
| I (254 g.mol <sup>-1</sup> ) | 184                |

16.1 Which of the substances above has the weakest IMF? (1)

16.2 What are the key words you would use to explain the above. (5)

The chosen substance:

Polar molecule  
Non-polar molecule  
The largest molar mass  
The smallest molar mass  
Strongest IMF  
Weakest IMF  
Contains Van der Waals, London forces  
Contains Van der Waals, Dipole-dipole forces  
Contains H-bonding  
More energy required to weaken IMF and change its phase  
Less energy required to weaken IMF and change its phase

17. State whether the following will dissolve in the solvent or not

|                           | Dissolve (yes or no) |
|---------------------------|----------------------|
| Iodine in water           | 17.1                 |
| Sugar in water            | 17.2                 |
| Sugar in CCl <sub>4</sub> | 17.3                 |
| CH <sub>4</sub> in water  | 17.4                 |
| HCl in CCl <sub>4</sub>   | 17.5                 |

**Homework from chemistry booklet:**

**Pg 311 Q2**

**Pg 312/313 Q2 and Q3**

**Pg 316/317 Q2**

**Pg 318 Q2**

**Pg 319/320 Q3 and Q4**

**Pg 321 Q3**

**Pg 324 Q3 and Q4**

**Pg 328/329 Q3**