

Exercise:

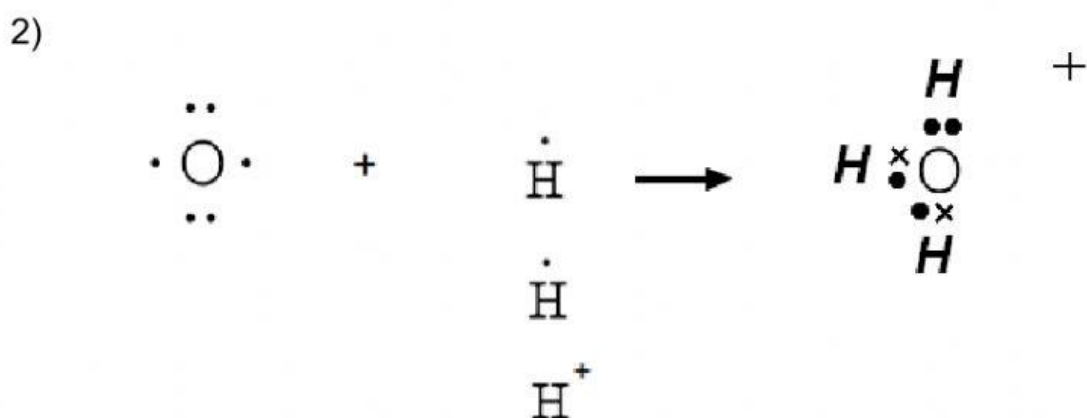
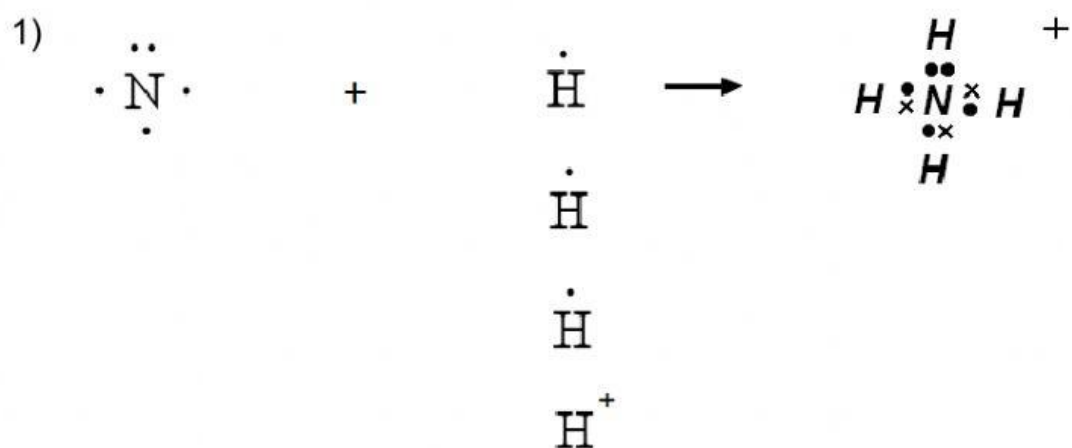
Consider the first 3 examples given and complete the table below:

Molecule	Number of lone pairs on terminal atom	Shape
H <sub>2</sub> O	2	Bent/angular
CO <sub>2</sub>	0	Linear/straight
NH <sub>3</sub>	1	
BF <sub>3</sub>		
CH <sub>4</sub>		
CCl <sub>4</sub>		
CH <sub>3</sub> F		
PCl <sub>5</sub>		
SF <sub>6</sub>		
SO <sub>2</sub>		

New rule for gr 11:

- Atoms with an empty valence shell can share a lone pair of electrons from another atom to form a coordinate or dative covalent bond, eg in NH<sub>4</sub><sup>+</sup> the lone pair of nitrogen is shared with H<sup>+</sup> and in H<sub>3</sub>O<sup>+</sup> the lone pair of oxygen is shared with H<sup>+</sup>.

Examples of dative covalent bonds:



## Intermolecular forces

Drag the correct descriptions below to the matching IMF in the table:

Occurs between molecules in which Hydrogen is bonded to N, O or F

Occurs between 2 polar molecules

Occurs between 2 non-polar molecules

Occurs between a polar and non-polar molecule

Occurs between an ion and a polar molecule

Occurs between an ion and a non-polar molecule

Van der Waals forces Dipole-dipole Dipole-induced dipole London	Where do they occur
Other 3 IMF Ion-dipole ion- induced dipole Hydrogen bonding	

13. Give the name of the strongest IMF(intermolecular force) of the 6 listed above

14. Give the name of the weakest IMF of the 6 listed above

15. Research the following definitions and write them into your chemistry book

Boiling point	
Melting point	
Vapour pressure	
Solubility	

16. State the relationship between boiling or melting point and strength of IMF

The stronger the IMF the higher the boiling and melting point

The stronger the IMF the lower the boiling and melting point

17. What is the relationship between molecular mass of a substance and the strength of the intermolecular forces between particles?

The larger the molecule the stronger the IMF between particles

The larger the molecule the weaker the IMF between particles

18. What is the relationship between molecular mass and the boiling point of the substance?

The larger the molecule the stronger the higher the boiling point.

The larger the molecule the weaker the lower the boiling point

19. What is the relationship between viscosity and the strength of the intermolecular forces between particles?

As the IMF increases the viscosity increases

As the IMF increases the viscosity decreases

20. What is the relationship between vapour pressure and the strength of the intermolecular forces between particles?

As the IMF increases the vapour pressure increases

As the IMF increases the vapour pressure decreases

## Bond Strength

### 21. Define the following: write the definitions into your book

Bond length	
Bond energy	
Bond order	

22.1 What happens to the atomic radius of atoms as you move from left to right across a period in the periodic table? (State increases or decreases)

22.2 What happens to the atomic radius at atoms as you move down a group in the periodic table? (State increases or decreases)

23. What is the relationship between bond length and strength of the bond between atoms?

As bond length increases the bond strength decreases

As bond length increases the bond strength increases

24. State the relationship between bond energy and bond length

As bond length increases the bond energy decreases

As bond length increases the bond energy increases

25. State the relationship between bond order and bond strength

As bond order increases the bond strength decreases

As bond order increases the bond strength increases

## Solubility

When it comes to substances dissolving in each other 'like dissolves like' in other words molecules will dissolve in substances if they have similar strengths of intermolecular forces

### Examples

Water (IMF – hydrogen bonds) will dissolve in ethanol (hydrogen bonds)

CCl<sub>4</sub> (london forces) will **not** dissolve in water (hydrogen bonds)

Iodine (London forces) dissolves in CCl<sub>4</sub> (London forces)