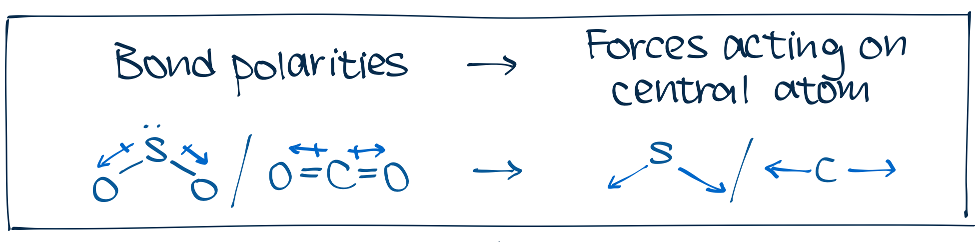
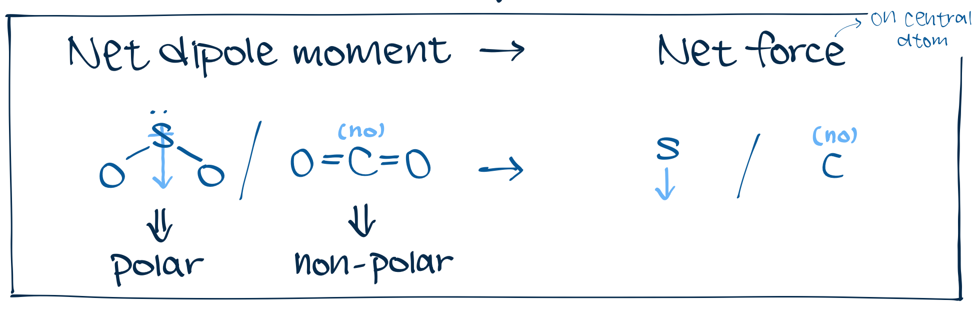
Polar molecules

1 Determining if a molecule is polar

- Polar molecule = permanently relative charged ($\delta-$ O – H $\delta+$ – O $\delta-$)
- Whether a molecule is polar: determined by
  1) polar bonds
  2) shape



⇓



→ Non-polar = 所有 bond polarities 互相抵消
条件 - molecule shape 对称
- 所有 bond 一样 polar (→ force 一样)

- Marking scheme:
  - The molecule is in a ______ shape
  - Molecule is (not) symmetrical, bond polarities (cannot) cancel out each other
  → Resulting in (no) net dipole moment
  → ∴ Molecule is polar/non-polar

- Tricks to determine:
  > central atom 爆手 (× lone pair)
    个个瘢住都一样 (与 central atom bond 的全是同一元素)
    } non-polar (需两个条件皆符合)
  > 若 molecule 带 charge, 就一定是 polar

2 Example questions

CH_4

C 最多 4 只手, 4×H 用尽 4 只手 → √爆手
全部瘢住也是 H
⇒ non-polar

CH_4 is tetrahedral in shape and is symmetrical.
The bond polarities cancel out each other,
resulting in no net dipole moment
∴ Non-polar

NH_3

N 最多 3 只手, 被 3 个 H 用尽后还剩 1 个 l.p. ⇒ polar

NH_3 is trigonal pyramidal in shape.
NH_3 is not symmetrical, bond polarities cannot cancel out each other, resulting in a net dipole moment.
∴ Polar

H_2S

S 最多有 6 只手, 但两个 H 只用了 2 只 → ×爆手 ⇒ polar

H_2S is v-shaped.
H_2S is not symmetrical, bond polarities cannot cancel out each other, resulting in net dipole moment.
∴ polar

CH_3Cl

C 有 4 只手, 3×H + 1×Cl 用尽 → 爆手
与 C bond 的 atoms 有 H 跟 Cl → 不一样
⇒ polar

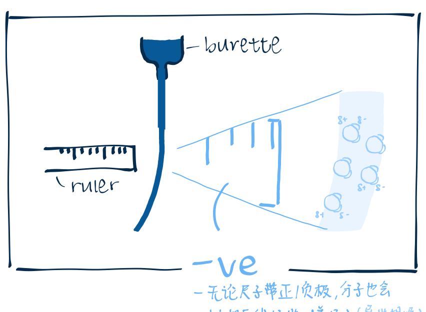
CH_3Cl is tetrahedral in shape.
CH_3Cl is not symmetrical, bond polarities cannot cancel out each other, resulting in net dipole moment.
∴ Polar

NH_4^+

有 charge → 一定 polar

NH_4^+ is tetrahedral.
NH_4^+ is not symmetrical, bond polarities cannot cancel out each other, resulting in net dipole moment.
∴ Polar

3 Test for polar liquids



- 无论尺子带正/负极, 分子也会以相反的极性对着尺子 (异性相吸)
→ 尺子带哪电极无所谓

1. Bring a charged rod (+ve/-ve both ok) towards a running jet of liquid being tested from a burette.
2. If the liquid is polar, it will deflect towards the charged rod. (异性相吸)