

MOCK EXAM: "Chemical Bonding and Nomenclature" (Batx 1)

Name:

Course:

1. Examine the next molecules:  $\text{SO}_2$ ,  $\text{SO}_3$ ,  $\text{BCl}_3$ ,  $\text{CCl}_4$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{CO}_2$  determining the following characteristics:

- the Lewis structure of the molecules
- the shape of the molecules
- the polarity of the molecules
- the intermolecular forces

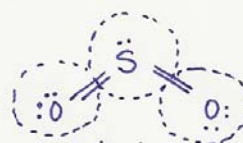
①



Lewis

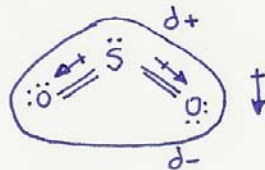


Shape



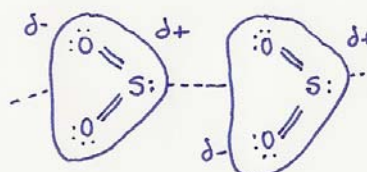
bent /  
V-shaped  
O-S-O  $120^\circ$

→ Polarity

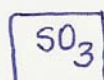


polar

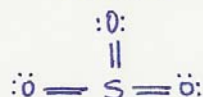
→ Intermolecular forces



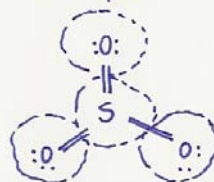
dipole-dipole force



Lewis



Shape



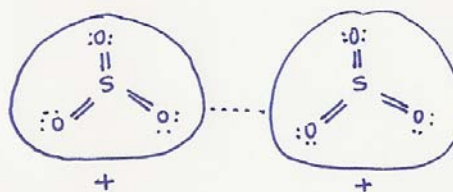
trigonal planar  
O-S-O  $120^\circ$

→ Polarity

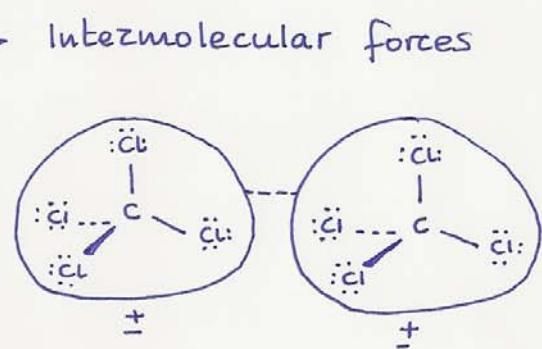
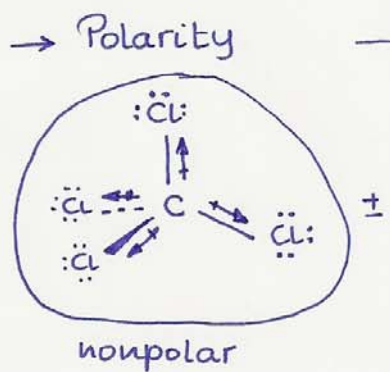
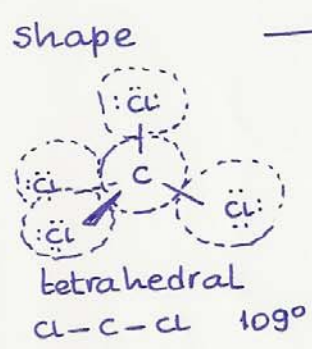
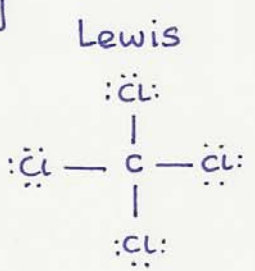
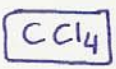
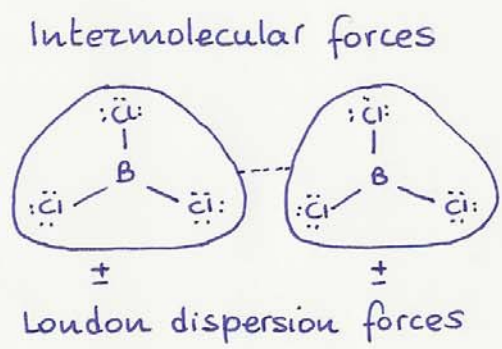
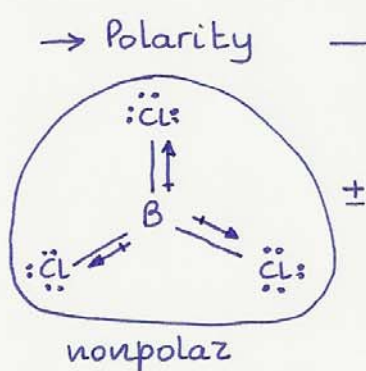
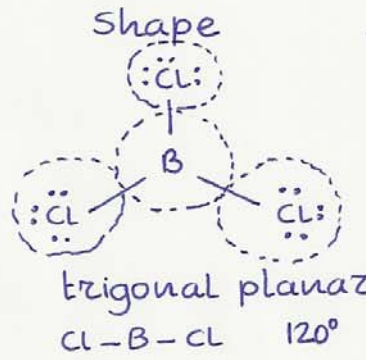
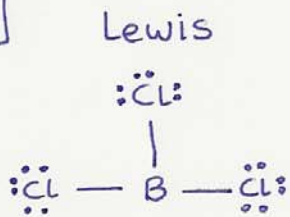
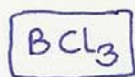


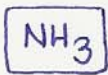
nonpolar

→ Intermolecular forces

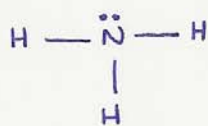


London dispersion forces





Lewis

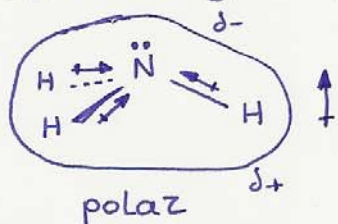


Shape

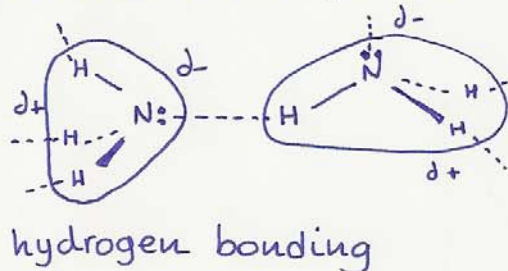


trigonal pyramidal  
 $\text{H} - \text{N} - \text{H} \quad 109^\circ$

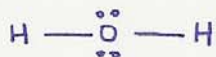
Polarity



Intermolecular forces



Lewis

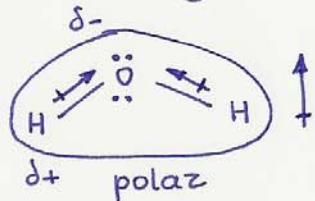


Shape

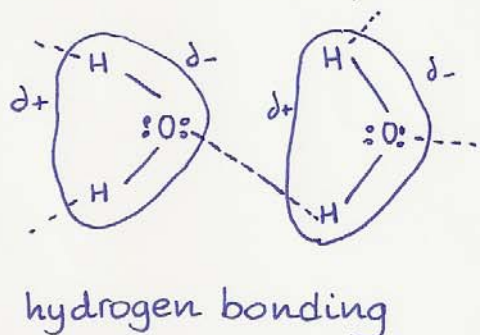


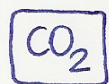
bent / V-shaped  
 $\text{H} - \text{O} - \text{H} \quad 109^\circ$

Polarity



Intermolecular forces

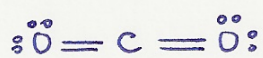




Lewis



Shape



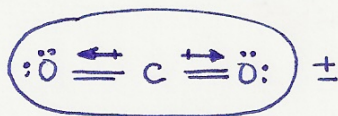
Linear



→ Polarity



Intermolecular forces



nonpolar



London dispersion forces

②

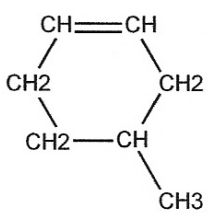

	Type of substance	Melting point	Mechanic properties	Electric behavior	Solubility in water
$\text{NH}_3$	covalent molecular	low	soft	insulator	soluble
$\text{Na}_2\text{SO}_4$	ionic	high	brittle	conductor only dissolved/melt	soluble
$\text{Br}_2$	covalent molecular	low	soft	insulator	insoluble
Fe	metallic	high	malleable	conductor	insoluble
$\text{SiO}_2$	covalent network solid	high	hard	insulator	insoluble

3. Fill the blanks.

(5 points)

Name	Formula	Lewis Structure
perchloric acid	$\text{HClO}_4$	
calcium dihydrogenphosphate	$\text{Ca}(\text{H}_2\text{PO}_4)_2$	
magnesium hydroxide	$\text{Mg}(\text{OH})_2$	
carbon monoxide	$\text{CO}$	
hydrogen sulfide	$\text{H}_2\text{S}$	
nitric acid	$\text{HNO}_3$	
sulfuric acid	$\text{H}_2\text{SO}_4$	
sodium silicate	$\text{Na}_4\text{SiO}_4$	
potassium permanganate	$\text{KMnO}_4$	
potassium nitrite	$\text{KNO}_2$	

ammonia	$\text{NH}_3$	$\begin{array}{c} \text{H} - \ddot{\text{N}} - \text{H} \\   \\ \text{H} \end{array}$
water	$\text{H}_2\text{O}$	$\text{H} - \ddot{\text{O}} - \text{H}$
sodium hydrogencarbonate	$\text{NaHCO}_3$	$\text{Na}^+ \left( \begin{array}{c} \text{O}^- - \text{C} - \text{O} - \text{H} \\    \\ \text{O} \end{array} \right)$
calcium sulfate	$\text{CaSO}_4$	$\text{Ca}^{2+} \left( \begin{array}{c} \text{O}^- - \text{S} = \text{O} \\   \quad \quad   \\ \text{O}^- \quad \quad \text{O} \end{array} \right)$
sodium sulfite	$\text{Na}_2\text{SO}_3$	$2 \times \text{Na}^+ \left( \begin{array}{c} \text{O}^- - \text{S} - \text{O}^- \\    \\ \text{O} \end{array} \right)$
copper (II) sulfide	$\text{CuS}$	$\text{Cu}^{2+} \quad \left( \begin{array}{c} \text{S}^{2-} \\ \cdot\cdot \\ \cdot\cdot \end{array} \right)$
iron (III) hydroxide	$\text{Fe}(\text{OH})_3$	$\text{Fe}^{3+} \quad \left( \begin{array}{c} \text{O}^- - \text{H} \\ \cdot\cdot \\ \cdot\cdot \end{array} \right) \times 3$
magnesium chlorate	$\text{Mg}(\text{ClO}_3)_2$	$\text{Mg}^{2+} \left( \begin{array}{c} \text{O}^- - \text{Cl} = \text{O} \\    \\ \text{O} \end{array} \right) \times 2$
calcium oxide	$\text{CaO}$	$\text{Ca}^{2+} \quad \left( \begin{array}{c} \text{O}^{2-} \\ \cdot\cdot \\ \cdot\cdot \end{array} \right)$
aluminum chloride	$\text{AlCl}_3$	$\text{Al}^{3+} \quad \left( \begin{array}{c} \text{Cl}^- \\ \cdot\cdot \\ \cdot\cdot \end{array} \right) \times 3$

acetic acid	$\text{CH}_3 - \overset{\text{:O:}}{\parallel}{\text{C}} - \ddot{\text{O}} - \text{H}$
2-pentanone	$\text{CH}_3 - \text{CO} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
3,3-dimethyl-1-butanol	$\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3 - \text{C} - \text{CH}_2 - \text{CH}_2\text{OH} \\   \\ \text{CH}_3 \end{array}$
4-methylcyclohexene	
methanal	$\begin{array}{c} \text{H} \\ \diagdown \\ \text{C} = \ddot{\text{O}}: \\ \diagup \\ \text{H} \end{array}$
2-chloropropenoic acid	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_2 = \text{C} - \text{C} \\   \quad \diagdown \\ \text{Cl} \quad \text{OH} \end{array}$
benzene	
propyne	$\text{HC} \equiv \text{C} - \text{CH}_3$
1,3-butadiene	$\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$
1,2-propanediol	$\text{CH}_2\text{OH} - \text{CHOH} - \text{CH}_3$