/114 = %

Name:_____

SCH 4U Unit Test
Forces and Molecular Properties

1. Fill in each table as done on the assignment. Including the oxidation state of the central atom:

NO_3^{1-}	total # of e^- pairs	
	σ bonding pairs	
	lone pairs	
	π bonding pairs	
	base shape	
	actual shape	
oxidation state of N	approx. bond angles	

/8

SF_4	total # of e^- pairs	
	σ bonding pairs	
	lone pairs	
	π bonding pairs	
	base shape	
	actual shape	
oxidation state of S	approx. bond angles	

/8

SO_3^{2-}	total # of e^- pairs	
	σ bonding pairs	
	lone pairs	
	π bonding pairs	
	base shape	
	actual shape	
oxidation state of S	approx. bond angles	

/9

/25

2. Classify each of the following formula according to type of forces by placing each formula in the correct place in the table:

BF_3 (boron trifluoride)

C_3H_7COOH (butanoic acid)

$CH_3CHOHCH_3$ (isopropyl alcohol)

CH_3COCH_3 (acetone – a ketone)

$Cu_{0.85}Zn_{0.10}Sn_{0.05}$ (brass)

$HSiCl_3$ (trichlorosilane)

Na_2CO_3 (sodium carbonate)

SiC (silicon carbide m.p. = 2730 °C)

$SnCl_4$ (tin tetrachloride b.p. = 114 °C)

XeF_4 (zenon tetrafluoride)

$C_{12}H_{25}OH$ (1-dodecanol)

$C_{12}H_{26}$ (dodecane)

C_2H_2 (acetylene)

C_n (diamond)

$CO_2(s)$ (carbon dioxide)

H_2O (hydrogen oxide)

N_2 (nitrogen gas)

Na_2O (sodium oxide)

SiO_2 (quartz)

W (pure tungsten)

Ionic Crystals (including crystals containing polyatomic ions)	Covalently Bonded Compounds				Metallic Crystals
	Covalent Network Crystals	Discrete Covalent Molecules			
		van der Waal (intermolecular force)	dipole inter-action (intermolecular force)	hydrogen bond (intermolecular force)	

/20

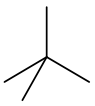
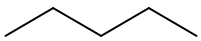
3. For each pair of compounds, circle the one with the higher melting and/or boiling point. In the space provided give the rational for your choice. Including precise reference to the attractive forces that must be overcome to melt or boil each compound as well as any other forces that may be present and why this leads to the choice you have made. Be specific as to whether the forces that must be overcome are intramolecular or intermolecular. Include any additional relevant information that has helped your choice. Use point form.

a) Mg vs Al

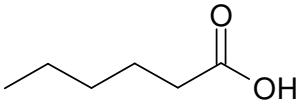
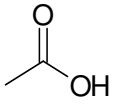
/3

b) SiO_2 vs CO_2

/3

c)  vs  consider b.p. only

/3

d)  vs 

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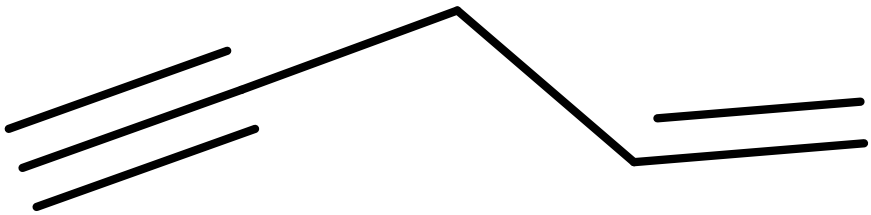
4. Match with the **BEST** possible term:

_____	a solid that can have variable composition, a solid solution	a)	alloy
_____	a solid that has molecules as the lattice points	b)	anisotropic
_____	always present between molecules within liquids or solids composed of discrete covalent molecules	c)	covalent bonding
_____	describes a physical property that has a directional characteristic	d)	covalent network crystal
_____	creates macromolecules that may be soluble in water	e)	dipole interactions
_____	forms the core (cental bond) of double and triple bonds	f)	electronegativity
_____	most diverse and specific type of bonding, well studied and complex	g)	hybridized atomic orbitals
_____	non-conductive in any state, insoluble in all solvents	h)	hydrogen bond
_____	occupies the lattice points in ammonium nitrate (NH_4NO_3)	i)	ionic bonding
_____	present when bond polarizations and geometry make possible regions of partial positive and partial negative charge	j)	metallic bonding
_____	produces strong yet flexible bonds	k)	molecular solid
_____	property that is used when determining bond type or bond polarization possibilities	l)	pi
_____	requires hard charge polarization and lone pair interaction with N, O or F	m)	polyatomic ions
_____	sp, sp^2, sp^3 are examples of	n)	sigma
_____	type of bond that has little effect on shape	o)	van der Waal force

/15

5. For the organic structure shown, label the hybridization for each carbon atom (i.e. sp^3, sp^2, sp). Label each bond according to bond type (i.e. σ, π). Add the bond angles that exist within the carbon framework (do not consider any hydrogen atoms). Finally state the shape (i.e. octahedral) that each carbon atom uses for its bonding. Note that in all cases, base electron shape and actual shape are the same, therefore one shape name per atom will do.

Shape					
Hybridization					
					
Bond Type					

/9

6. Why are the planes in graphite flat? Include all specifics about the forces present in the planes. What forces exist between the planes. Why is conductivity observed within a plane, but not between planes? Be precise.

/6

/15

7. For the NH_4NO_3, the solid state is completely non-conductive. However when dissolved in water, the resulting solution becomes conductive.

a) Draw a 2-dimensional diagram that represents the lattice structure for ammonium nitrate in solid form. Label two different forces present in your diagram.

/4

b) For the forces you have named in a), which force must come first? Explain. **/2**

c) What occupies the lattice point in the solid – be precise (you may answer using symbols)

/2

d) Draw a sketch that clearly shows all aspects of the solvent solute interaction.

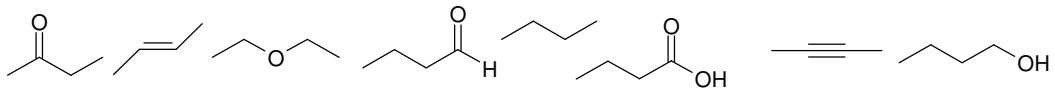
/4

e) Why is this solid non-conductive? **/1**

f) Why is the aqueous state conductive? What are the charge carriers? **/2**

/15

8. For each of the following substances, organize in order of **INCREASING** melting and boiling point (lowest melting point to the left). State the intermolecular forces at play for each substance. It is possible that some of these compounds have roughly the same M.P. and B.P.



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9. Why is lead(II) chloride ($PbCl_2$) slightly soluble in water, while lead(II) nitrate ($Pb(NO_3)_2$) is highly soluble in water? Explain with reference to appropriate terminology.

/3

/11