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:

PO_3^{3-}	total # of e^- pairs	
	σ bonding pairs	
	lone pairs	
	π bonding pairs	
	base shape	
	actual shape	
oxidation state of P	approx. bond angles	

CO_3^{2-}	total # of e^- pairs	
	σ bonding pairs	
	lone pairs	
	π bonding pairs	
	base shape	
	actual shape	
oxidation state of C	approx. bond angles	

IF_3	total # of e^- pairs	
	σ bonding pairs	
	lone pairs	
	π bonding pairs	
	base shape	
	actual shape	
oxidation state of I	approx. bond angles	

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

CH_3COOH (acetic acid)

CH_3COCH_3 (acetone)

$Al_2(SO_4)_3$ (aluminum sulphate)

$(NH_4)_3PO_4$ (ammonium phosphate)

C_6H_6 (benzene)

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

CBr_4 (carbon tetrabromide)

C_n (diamond)

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

C_2H_5OH (ethyl alcohol)

CH_2O (formaldehyde)

HF (hydrogen fluoride)

ICl (iodine monochloride)

Mn (manganese)

OF_2 (oxygen difluoride)

PCl_5 (phosphorus pentachloride)

KCl (potassium chloride)

SiO_2 (quartz)

Rb_3N (rubibium nitride)

H_2O (water)

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)	

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.

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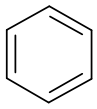
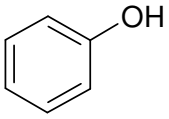
a)  vs 

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b) Y vs Rb

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c) HF vs HCl

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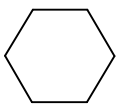
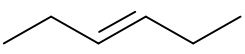
d)  vs  (boiling point only)

4. Both water and diamond contain covalent bonds. The covalent bond in water has an approximate bond strength of 464 kJ/mol while the single carbon carbon bonds in diamond are approximately 347 kJ/mol. Does this mean that diamond will have a lower melting point in comparison to water. Explain FULLY with reference to attractive forces, diagrams etc. By the way, this is an open ended question.

5. Draw a diagram of graphite that shows several planes within graphite and include the details of bonding within each plane. With reference to your diagram indicate:

a) the location of sigma bonds
b) the location of pi bonds
c) the area where van der Waals forces are found
d) the reason for the anisotropic conductivity

6. What are the smallest possible units of solute in each of the following solutions. What forces must be overcome in the solute in order to facilitate dissolving. N.A. may be an appropriate response.

	Smallest Units	Solute Force Overcome
wax ($C_{50}H_{102}$) dissolved in hexane (C_6H_{14})		
wax ($C_{50}H_{102}$) dissolved in water (H_2O)		
NaCl dissolved in hexane (C_6H_{14})		
NaCl dissolved in water (H_2O)		
$(NH_4)_2CO_3$ dissolved in water (H_2O)		
Au dissolved in mercury (Hg)		

7. Provide an example (chemical formula) for each of the following solids:

- covalent network solid: _____
- ionic solid: _____
- metallic solid: _____
- molecular solid: _____
- ionic solid composed of non-metals only: _____

8. Explain the reason for the observed conductivity or lack there of in the following substance (note the states). Be sure to include the exact nature of the charge carriers where appropriate:

iron (s)
NaCl (aq)
NaCl (s)
SiO_2 (s)
$C_{25}H_{52}$ (l)
CH_3COOH (aq)

9. How can covalent bonds lead to ionic compounds. What are some of the difficulties in the full classification for such a substance. Answer this question with reference to an example of your choice!