K	C	A	T
22		41	37

/100

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

IF_5	total # of e^- pairs	
	σ bonding pairs	
	lone pairs	
	π bonding pairs	
	base shape	
	actual shape	
oxidation state of I	approx. bond angles	

/8

ClO_3^{1-}	total # of e^- pairs	
	σ bonding pairs	
	lone pairs	
	π bonding pairs	
	base shape	
	actual shape	
oxidation state of Cl	approx. bond angles	

/9

K	C	A	T
		25	

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

- $SiCl_4$ (silicon(IV) chloride)
- HCOOH (methanoic acid)
- C_2H_5OH (ethyl alcohol)
- C_n (diamond)
- CO_2 (carbon dioxide)
- $Mg_{0.50}Al_{0.25}Ti_{0.25}$
- H_2O (water)
- $H_5C_2OC_2H_5$ (diethyl ether)
- H_2CCl_2 (methylene dichoride)
- NH_3 (ammonia)
- K_2O (potassium oxide)
- $(NH_4)_2SO_4$ (ammonium sulphate)
- Li_3N(lithium nitride)
- NH_4NO_3 (ammonium nitrate)
- PH_3 (phosphorus trihydride)
- XeF_4 (xenon tetrafluoride)
- SiO_2 (quartz)
- Au (gold)
- C_3H_8 (propane)
- $C_{14}H_{10}$ (anthracene)

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)	

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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) C_5H_{12} vs C_3H_8

/4

b) SiO_2 vs SiF_4

/4

c) H_2CCl_2 vs CF_4

/4

d) K vs Ca

/4

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4. Match each description with the term it best describes.

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

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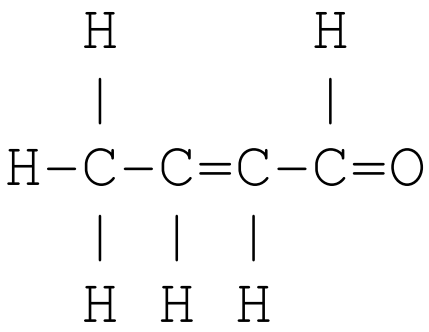
5. For the given structure identify all bonds as either sigma (σ) or pi (π).



/2

6. Describe in detail the structure of graphite and use this information to explain the anisotropic property that is unique to this compound. A diagram may be helpful.

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K	C	A	T
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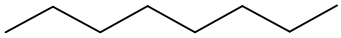
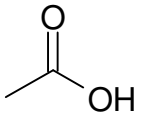
7. Given the following structures and information:

	M.P.	B.P.
	−57 °C	126 °C
	−17 °C	118 °C

a) what class of compounds (ionic, covalent network, discrete covalent molecules, or metallic) do these substance belong to?

/1

b) what are <u>ALL</u> of the intermolecular forces present in the first compound (octane) in order of decreasing strength

/1

c) what are <u>ALL</u> of the intermolecular forces present in the second compound (acetic acid) in order of decreasing strength

/2

d) offer a good explanation as to why the boiling point of octane is higher than acetic acid

/2

e) offer a good explanation as to why the trend in melting point is reversed for these two compounds

/2

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			8

8. Why is the compound NH_4NO_3 non-conductive in the solid state but conductive in both the liquid state and in aqueous solution? What is special about the classification of this compound given its atomic make-up? Include a diagram!

/4

9. For the following solute, solvent pairs indicate if the solute in soluble in the given solvent or not. If soluble, what are the smallest units present – be precise. If not soluble, leave this column blank or write N.A.

SOLUTE	SOLVENT	YES/NO	SMALLEST UNITS OF SOLUTE
KBr	water		
Au (gold)	Hg (mercury)		
$C_{50}H_{102}$ (wax)	water		
$(NH_4)_2SO_4$	water		
$C_{50}H_{102}$ (wax)	C_5H_{12} (pentane)		

/5

K	C	A	T
			9