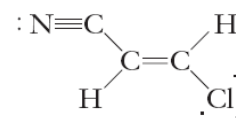
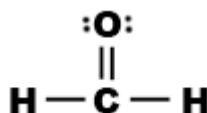
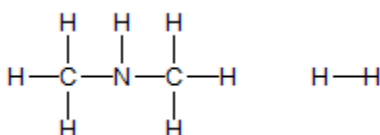
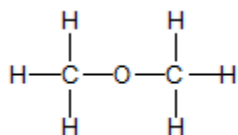


Q5. Rank the following ionic compounds in order of increasing melting point: LiF, NaCl, MgO

_____ < _____ < _____

Q6. For which of the following compounds would hydrogen bonding be expected to play an important role in holding the molecules in the liquid state. Circle all that apply.



Q7. Use the vapor pressure curves to answer the following questions.

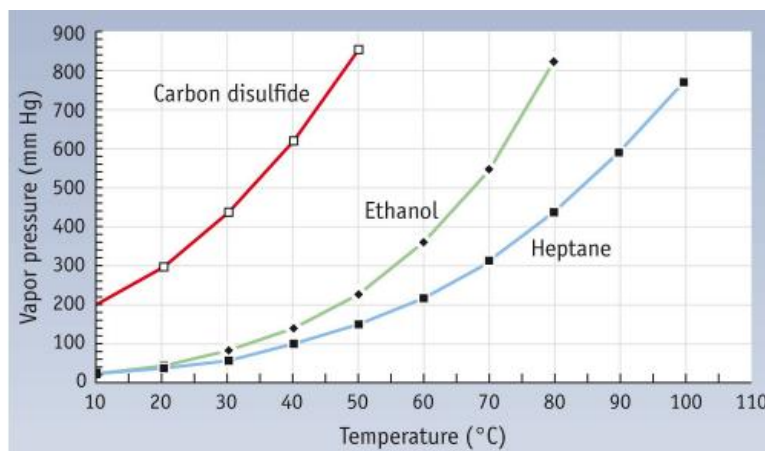
a. What is the vapor pressure of ethanol when the temperature is 70 °C.

b. What is the normal boiling point of carbon disulfide.

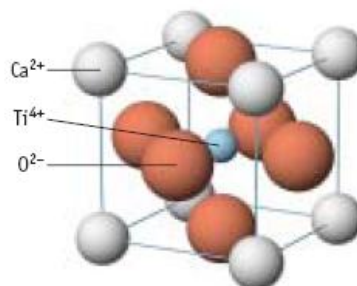
c. Which of the three has the weakest intermolecular forces?

d. Which compounds has the largest enthalpy of vaporization?

e. Draw a new curve on the graph for a compound with weaker intermolecular forces than the compounds depicted.



Q8. Using the unit cell structure shown here, determine the formula of the unit cell of this compound. The Ti ion is in the very center of the unit cell.

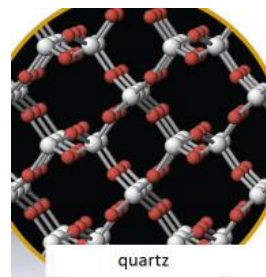


Q9. What type of solid is each of the following: (choices: molecular, ionic, extended/covalent, metallic)

quartz _____

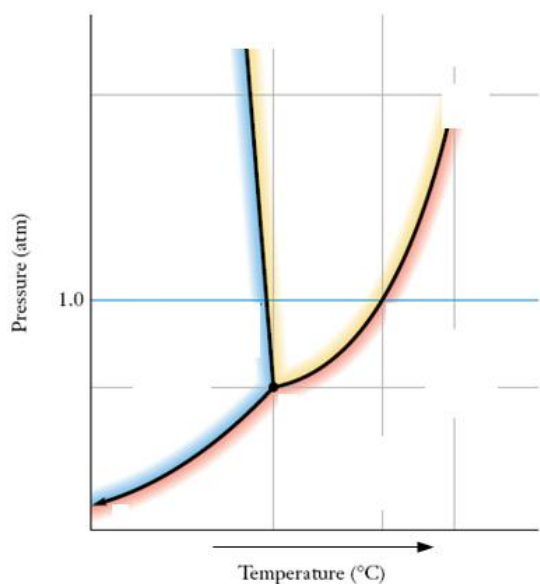
ice _____

potassium nitrate _____



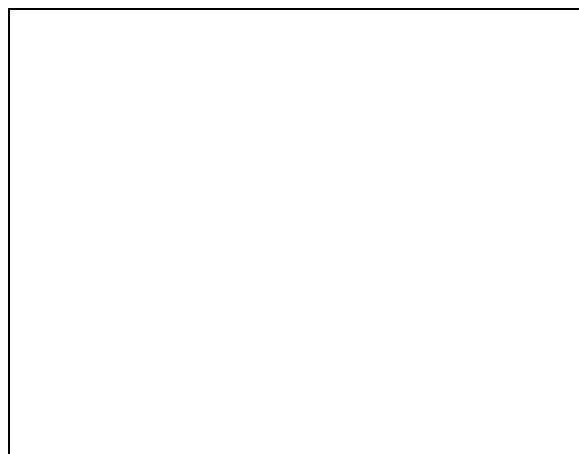
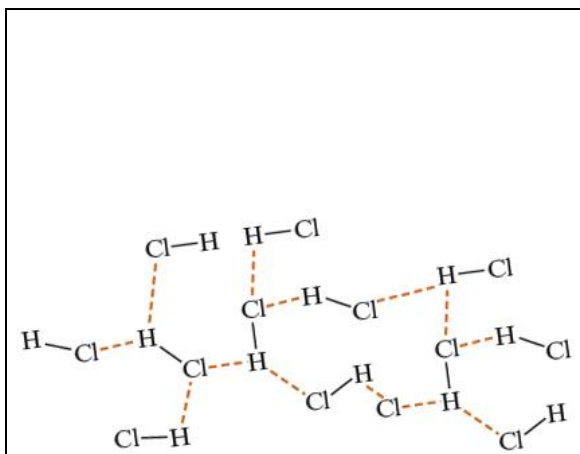
Which of the above will have the weakest IMFs? _____

Q10. Consider the phase diagram below.

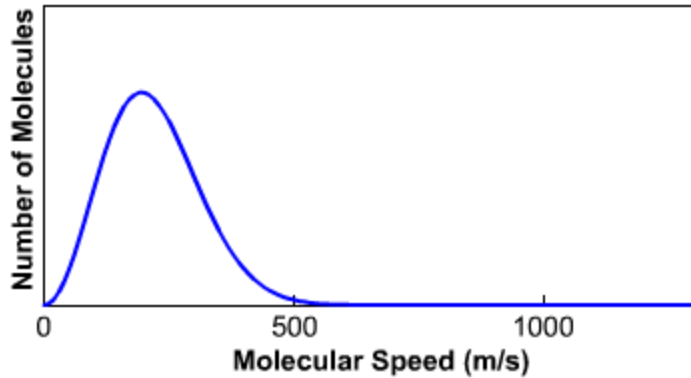


- Label the regions for gas, liquid and solid.
- Draw an arrow for the transition that occurs when the liquid evaporates at constant temperature.
- Write a "T" on top of the triple point.
- Write a "B" showing the normal boiling point.
- Which is more dense:
the solid or the liquid

Q11. The box on the left has a depiction of HCl in the liquid phase. Draw in the right box a depiction of the same atoms/molecule after they vaporize.



Q12. A Boltzmann distribution plot for Xe gas at a temperature of 300 K is shown here.



- Draw another curve showing the distribution of speeds for CO_2 at the same temperature. Label it **A**.
- Draw another curve for Xe at a temperature of 270 K. Label it **B**.
- On average, do the gas particles for Xe at 300 K move faster than a car going 60 mph?

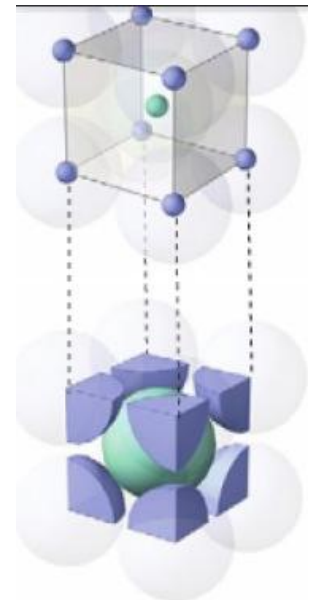
yes or no

Q13. An element takes the solid state form of a body-centered cubic unit cell. You must show all your work.

a) How many atoms are contained within the boundaries of the unit cell?

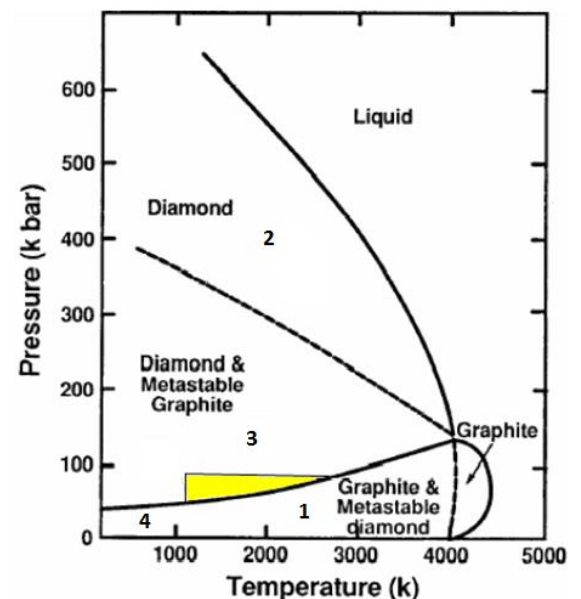
b) Assume the atom has a radius of 1 cm (it's much smaller than that, of course). What volume do the atoms take up?

c) What percentage of space in the unit cell is taken up by the atoms?



Q14. The phase diagram for carbon is shown to the right. You start with graphite at position **1** and then move to positions **2**, **3**, and finally **4**, in order. In what form is the carbon when you are at the final position **4**? Choose one.

- liquid
- gas
- graphite
- diamond
- nanotube
- can't be determined without more information



Q15. You perform an experiment like you did in lab. A flask of 134 mL volume weighs 106.00 g. You add 4.50 g of a volatile liquid. You then cover the flask with foil containing a small hole and heat the flask to 98.0 °C. Atmospheric pressure is 748 mm Hg. When all the liquid has just evaporated, the flask is removed and cooled, allowing the remaining vapor to condense. The flask is reweighed and found to have a mass of 106.86 g. What is the molar mass of the gas?

You must show all your work.

Molar Mass = _____ g/mol

Q16. The vapor pressure of acetic acid at 10 °C is 43.5 mm Hg, and at 50 °C is 156.5 mm Hg. Use this to determine the enthalpy of vaporization of acetic acid.

You must show all your work.

_____ **kJ/mol**

Points per question:

Q1=8, 2=6, 3=6, 4=8, 5 = 4, 6 = 5, 7 = 5, 8 = 6, 9 = 4, 10 = 5, 11 = 5, 12 = 6, 13 = 8, 14 = 5, 15 = 10, 16 = 10

Equations and Constants: Exam 1

$PV = nRT$

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

$R = 0.082057 \text{ L}\cdot\text{atm}/\text{K}\cdot\text{mol} = 8.314 \text{ J}/\text{K}\cdot\text{mol}$

$$v_{\text{rms}} = \sqrt{\frac{3RT}{M}}$$

Volume sphere = $\frac{4}{3}\pi r^3$

$$\ln \frac{P_2}{P_1} = \frac{\Delta H_{\text{vap}}^{\circ}}{R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$$

$2d\sin\theta = n\lambda$

$$\frac{\text{Rate}_1}{\text{Rate}_2} = \sqrt{\frac{M_2}{M_1}}$$

1 atm = 760 mm Hg

1 1.0079 H HYDROGEN	2 4.0026 He HELIUM											18 39.948 Ar ARGON					
3 6.941 Li LITHIUM	4 9.0122 Be BERYLLIUM											13 10.811 B BORON	14 12.011 C CARBON	15 14.007 N NITROGEN	16 15.999 O OXYGEN	17 18.998 F FLUORINE	10 20.180 Ne NEON
11 22.990 Na SODIUM	12 24.305 Mg MAGNESIUM	3 44.956 Sc SCANDIUM	4 47.867 Ti TITANIUM	5 50.942 V VANADIUM	6 51.996 Cr CHROMIUM	7 54.938 Mn MANGANESE	8 55.845 Fe IRON	9 58.933 Co COBALT	10 58.693 Ni NICKEL	11 63.546 Cu COPPER	12 65.39 Zn ZINC	13 69.723 Ga GALLIUM	14 72.64 Ge GERMANIUM	15 74.922 As ARSENIC	16 78.96 Se SELENIUM	17 79.904 Br BROMINE	36 83.80 Kr KRYPTON
19 39.098 K POTASSIUM	20 40.078 Ca CALCIUM	21 44.956 Sc SCANDIUM	22 47.867 Ti TITANIUM	23 50.942 V VANADIUM	24 51.996 Cr CHROMIUM	25 54.938 Mn MANGANESE	26 55.845 Fe IRON	27 58.933 Co COBALT	28 58.693 Ni NICKEL	29 63.546 Cu COPPER	30 65.39 Zn ZINC	31 69.723 Ga GALLIUM	32 72.64 Ge GERMANIUM	33 74.922 As ARSENIC	34 78.96 Se SELENIUM	35 79.904 Br BROMINE	36 83.80 Kr KRYPTON
37 85.468 Rb RUBIDIUM	38 87.62 Sr STRONTIUM	39 88.906 Y YTTRIUM	40 91.224 Zr ZIRCONIUM	41 92.906 Nb NI OBIUM	42 95.94 Mo MOLYBDENUM	43 (98) Tc TECHNETIUM	44 101.07 Ru RUTHENIUM	45 102.91 Rh RHODIUM	46 106.42 Pd PALLADIUM	47 107.87 Ag SILVER	48 112.41 Cd CADMIUM	49 114.82 In INDIUM	50 118.71 Sn TIN	51 121.76 Sb ANTIMONY	52 127.60 Te TELLURIUM	53 126.90 I IODINE	54 131.29 Xe XENON
55 132.91 Cs CAESIUM	56 137.33 Ba BARIUM	57-71 La-Lu Lanthanide	72 178.49 Hf HAFNIUM	73 180.95 Ta TANTALUM	74 183.84 W TUNGSTEN	75 186.21 Re RHENIUM	76 190.23 Os OSMIUM	77 192.22 Ir IRIDIUM	78 195.08 Pt PLATINUM	79 196.97 Au GOLD	80 200.59 Hg MERCURY	81 204.38 Tl THALLIUM	82 207.2 Pb LEAD	83 208.98 Bi BISMUTH	84 (209) Po POLONIUM	85 (210) At ASTATINE	86 (222) Rn RADON
87 (223) Fr FRANCIUM	88 (226) Ra RADIUM	89-103 Ac-Lr Actinide	104 (261) Rf RUTHERFORDIUM	105 (262) Db DUBNIUM	106 (266) Sg SEABORGIUM	107 (264) Bh BOHRIUM	108 (277) Hs HASSIUM	109 (268) Mt MEITNERIUM	110 (281) Uuu UNUNNIUM	111 (272) Uuuu UNUNNIUM	112 (285) Uub UNUNBIUM	114 (289) Uuq UNUNQUADIUM					

LANTHANIDE

57 138.91 La LANTHANUM	58 140.12 Ce CERIUM	59 140.91 Pr PRASEODYMIUM	60 144.24 Nd NEODYMIUM	61 (145) Pm PROMETHIUM	62 150.36 Sm SAMARIUM	63 151.96 Eu EUROPIUM	64 157.25 Gd GADOLINIUM	65 158.93 Tb TERBIUM	66 162.50 Dy DYSPROSIUM	67 164.93 Ho HOLMIUM	68 167.26 Er ERBIUM	69 168.93 Tm THULIUM	70 173.04 Yb YTTERIUM	71 174.97 Lu LUTETIUM
--	-------------------------------------	---	--	-------------------------------------	---------------------------------------	---------------------------------------	---	--------------------------------------	---	--------------------------------------	-------------------------------------	--------------------------------------	---------------------------------------	---------------------------------------

ACTINIDE

89 (227) Ac ACTINIUM	90 232.04 Th THORIUM	91 231.04 Pa PROTACTINIUM	92 238.03 U URANIUM	93 (237) Np NEPTUNIUM	94 (244) Pu PLUTONIUM	95 (243) Am AMERICIUM	96 (247) Cm CURIUM	97 (247) Bk BERKELIUM	98 (251) Cf CALIFORNIUM	99 (252) Es EINSTEINIUM	100 (257) Fm FERMIUM	101 (258) Md MENDELEVIUM	102 (259) No NOBELIUM	103 (262) Lr LAWRENCIUM
-----------------------------------	--------------------------------------	---	-------------------------------------	------------------------------------	------------------------------------	------------------------------------	---------------------------------	------------------------------------	--------------------------------------	--------------------------------------	-----------------------------------	---------------------------------------	------------------------------------	--------------------------------------