S23 CHEM 1032 – *Bloom* Quiz 1 – Week 3 Key Circle Day and Time:

M		T		W		Tr		F	
8	9	10	11	12	1	2	3	4	5

Name: _____

Clearly write your letter answer <u>on the line</u>.

A 1. (Remember) When the temperature of a pure liquid increases, the average kinetic energy of the molecules _____.

A. increases
B. decreases
C. is constant
D. not enough info

Kinetic energy represents the speed of the molecules. Raising the temperature indicates heat energy has been added, so speed will increase.

D 2. (Remember) Which force can only exist in a mixture of compounds?

A. Dispersion Forces
B. Dipole-Dipole Force
C. Hydrogen Bonding
D. Ion-Dipole Force → Require anion (from an ionic compound) + molecule w/ dipole

A, B, C occur in pure compounds

C 3. (Understand) A solution contains 0.450 mole of NaOH and 650 g of water. What is the mass percentage of NaOH?

A. 0.07 %
B. 1.24 %
C. 2.76 %
D. 69.2 %

$\text{mass \%} = \frac{\text{mass solute}}{\text{mass solution}} \times 100 = \frac{17.998\text{ g}}{650\text{ g} + 17.998\text{ g}} \times 100 = 2.76\%$

$0.450\text{ mole NaOH} \left| \frac{39.997\text{ g}}{1\text{ mole NaOH}} \right. = 17.998\text{ g NaOH}$

C 4. (Understand) Which statement best describes the enthalpy of vaporization (ΔH_{vap})?

A. It is always exothermic because energy is released during vaporization.
B. It is always exothermic because energy is taken in during vaporization.
C. It is always endothermic because energy is taken in during vaporization.
D. It is always endothermic because energy is released during vaporization.

Vaporization
liq → gas
E in (endo)

A 5. (Apply) Using intermolecular forces, which of the following elements would be expected to have the highest melting point?

A. Br_2
B. Cl_2
C. F_2
D. N_2

All are diatomic, so no polar bonds
means solely dependent on dispersion
As mass ↑ dispersion force ↑

IMF ↑ melting point ↑

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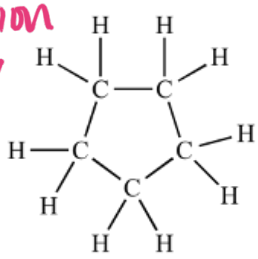
B 6. (Apply) A scientist observes that an unknown molecule has a normal boiling point of 69 °C and a boiling point of 45 °C when they lower the pressure to 0.464 atm. Calculate the enthalpy of vaporization of the molecule.

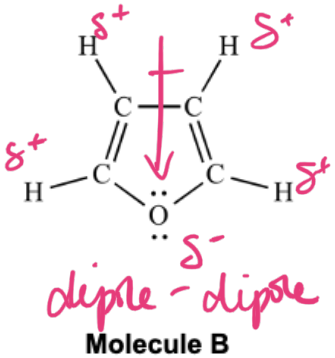
A. 76.7 kJ/mol
B. 28.9 kJ/mol
C. 6.31 kJ/mol
D. 1.45 kJ/mol

$$\ln\left(\frac{0.464\ \text{atm}}{1\ \text{atm}}\right) = \frac{\Delta H_{vap}}{8.314\ \text{J/mol·K}}\left(\frac{1}{(69+273)} - \frac{1}{(45+273)}\right)$$

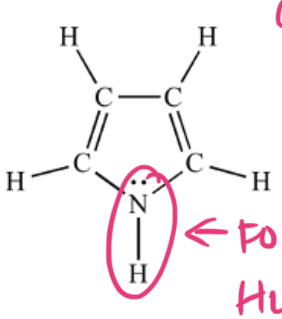
C 7. (Analyze) Molecule A has the lowest boiling point of the three listed below. Which molecule would you expect to have the highest boiling point and why?



Molecule A



Molecule B

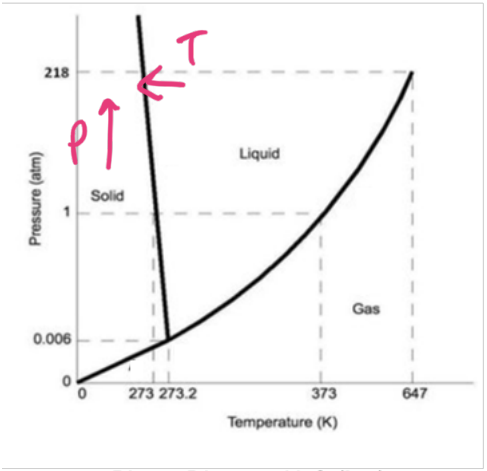


Molecule C

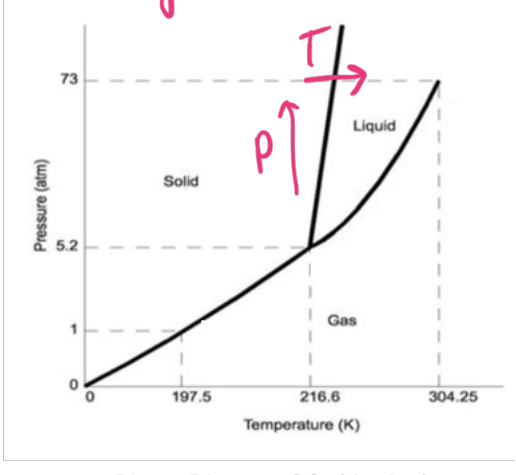
A. Molecule B because of the two carbon-oxygen bonds.
B. Molecule B because of the oxygen atom and its two lone pairs.
C. Molecule C because of the nitrogen-hydrogen bond.
D. Molecule C because of the nitrogen atom and its one lone pair.

B 8. (Analyze) The physical properties of ice make it particularly useful for skating. Using the phase diagram below, why can we skate on **ice** (H_2O) but not **dry ice** (solid CO_2)?

A. The melting point of **ice** increases as pressure increases.
B. The melting point of **ice** decreases as pressure increases.
C. The melting point of **dry ice** decreases as pressure increases.
D. **Ice** sublimes while **dry ice** does not.



Phase Diagram H_2O (**ice**)



Phase Diagram CO_2 (**dry ice**)

S23 CHEM 1032 – *Bloom* Quiz 1 – Week 3 Circle Day and Time:

B 9. (Evaluate) Equal amounts of water and an unknown pure liquid are left in separate cups on a countertop. After 24 hours the following observations are made. Select the property you know to be true.

takes less E to vaporize water

X. The level of the liquid water is lower than the level of unknown liquid.
Y. The unknown liquid pours slower than the liquid water. ← they are both thick, strong IMF
Z. Neither liquid has a smell. ← neither smells, strong IMF

This may be true but we don't know for sure

A. The molar mass of the unknown liquid is higher than the molar mass of water.
B. The intermolecular forces of the unknown liquid are stronger than the intermolecular forces of the water. Unknown is being held together more than water.
~~C.~~ The unknown liquid contains ion-dipole force, while the water contains hydrogen bonding.
~~D.~~ The unknown liquid has a lower boiling point than the water.

we do not know the molecules so impossible to tell.

Based on Observation X, water evaporated more than unknown, so its BP is lower

_____10. (Create) Read the paragraph below and identify the best explanation for the observation.

"*The polar ice caps on Mars extend and recede with the seasons. They are mostly solid carbon dioxide and form by direct conversion of the gas into a solid. They disappear by sublimation. Although some solid water (ice) is also present in the polar caps, it does not change phase, and always stays as a solid.*"

dispersion ★ H-bonding

~~A.~~ The IMF of carbon dioxide are stronger than the IMF of water on Mars.
~~B.~~ Carbon dioxide has a larger enthalpy of fusion than water on Mars. ← CO_2 moving to gas easier so ΔH_{vap} smaller
C. The freezing point of water is higher than the freezing point of carbon dioxide on Mars.
~~D.~~ The vapor pressure of carbon dioxide is lower than the vapor pressure of water on Mars.

← CO_2 moving to gas easier so higher P_{vap}

The water is staying solid, while CO_2 is becoming gas, so it requires more E to transform H_2O, so freezing is higher.

Side note: water & CO_2 are the same molecules on earth as they are on mars... we know CO_2 is a gas way sooner than H_2O is...

Useful information:

1 atm = 760 mmHg 1 mmHg = 1 torr 0 ºC = 273 K

R = 8.314 J/(mol K) = 0.08206 (L atm)/(mol K)

$$\ln\left(\frac{P_2}{P_1}\right) = \frac{\Delta H_{vap}}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

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Circle Day and Time:

Periodic Table of the Elements

1 IA 1A	2 IIA 2A	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8	9 VIII 8	10	11 IB 1B	12 IIB 2B	13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A
1 **H** Hydrogen 1.008																	2 **He** Helium 4.003
3 **Li** Lithium 6.941	4 **Be** Beryllium 9.012											5 **B** Boron 10.811	6 **C** Carbon 12.011	7 **N** Nitrogen 14.007	8 **O** Oxygen 15.999	9 **F** Fluorine 18.998	10 **Ne** Neon 20.180
11 **Na** Sodium 22.990	12 **Mg** Magnesium 24.305											13 **Al** Aluminum 26.982	14 **Si** Silicon 28.086	15 **P** Phosphorus 30.974	16 **S** Sulfur 32.066	17 **Cl** Chlorine 35.453	18 **Ar** Argon 39.948
19 **K** Potassium 39.098	20 **Ca** Calcium 40.078	21 **Sc** Scandium 44.956	22 **Ti** Titanium 47.867	23 **V** Vanadium 50.942	24 **Cr** Chromium 51.996	25 **Mn** Manganese 54.938	26 **Fe** Iron 55.845	27 **Co** Cobalt 58.933	28 **Ni** Nickel 58.693	29 **Cu** Copper 63.546	30 **Zn** Zinc 65.38	31 **Ga** Gallium 69.723	32 **Ge** Germanium 72.631	33 **As** Arsenic 74.922	34 **Se** Selenium 78.971	35 **Br** Bromine 79.904	36 **Kr** Krypton 83.798
37 **Rb** Rubidium 85.468	38 **Sr** Strontium 87.62	39 **Y** Yttrium 88.906	40 **Zr** Zirconium 91.224	41 **Nb** Niobium 92.906	42 **Mo** Molybdenum 95.95	43 **Tc** Technetium 98.907	44 **Ru** Ruthenium 101.07	45 **Rh** Rhodium 102.906	46 **Pd** Palladium 106.42	47 **Ag** Silver 107.868	48 **Cd** Cadmium 112.414	49 **In** Indium 114.818	50 **Sn** Tin 118.711	51 **Sb** Antimony 121.760	52 **Te** Tellurium 127.6	53 **I** Iodine 126.904	54 **Xe** Xenon 131.294
55 **Cs** Cesium 132.905	56 **Ba** Barium 137.328	57-71	72 **Hf** Hafnium 178.49	73 **Ta** Tantalum 180.948	74 **W** Tungsten 183.84	75 **Re** Rhenium 186.207	76 **Os** Osmium 190.23	77 **Ir** Iridium 192.217	78 **Pt** Platinum 195.085	79 **Au** Gold 196.967	80 **Hg** Mercury 200.592	81 **Tl** Thallium 204.383	82 **Pb** Lead 207.2	83 **Bi** Bismuth 208.980	84 **Po** Polonium [208.982]	85 **At** Astatine 209.987	86 **Rn** Radon 222.018
87 **Fr** Francium 223.020	88 **Ra** Radium 226.025	89-103	104 **Rf** Rutherfordium [261]	105 **Db** Dubnium [262]	106 **Sg** Seaborgium [266]	107 **Bh** Bohrium [264]	108 **Hs** Hassium [269]	109 **Mt** Meitnerium [278]	110 **Ds** Darmstadtium [281]	111 **Rg** Roentgenium [280]	112 **Cn** Copernicium [285]	113 **Nh** Nihonium [286]	114 **Fl** Flerovium [289]	115 **Mc** Moscovium [289]	116 **Lv** Livermorium [293]	117 **Ts** Tennessine [294]	118 **Og** Oganesson [294]

Lanthanide Series	57 **La** Lanthanum 138.905	58 **Ce** Cerium 140.116	59 **Pr** Praseodymium 140.908	60 **Nd** Neodymium 144.243	61 **Pm** Promethium 144.913	62 **Sm** Samarium 150.36	63 **Eu** Europium 151.964	64 **Gd** Gadolinium 157.25	65 **Tb** Terbium 158.925	66 **Dy** Dysprosium 162.500	67 **Ho** Holmium 164.930	68 **Er** Erbium 167.259	69 **Tm** Thulium 168.934	70 **Yb** Ytterbium 173.055	71 **Lu** Lutetium 174.967
Actinide Series	89 **Ac** Actinium 227.028	90 **Th** Thorium 232.038	91 **Pa** Protactinium 231.036	92 **U** Uranium 238.029	93 **Np** Neptunium 237.048	94 **Pu** Plutonium 244.064	95 **Am** Americium 243.061	96 **Cm** Curium 247.070	97 **Bk** Berkelium 247.070	98 **Cf** Californium 251.080	99 **Es** Einsteinium [254]	100 **Fm** Fermium 257.095	101 **Md** Mendelevium 258.1	102 **No** Nobelium 259.101	103 **Lr** Lawrencium [262]