

Chemistry 210

Exam 1

Be sure to put your name on each page. This page can be removed from your exam so that you will have a Periodic Table handy throughout the exam, it does not need to be turned in. Show all your work for problems which require any sort of calculation, no credit will be given for answers without work shown. If you have shown a significant amount of work or multiple drawings for a problem, draw a box around what you consider your final answer.

$$\text{Avogadro's Number} = 6.022 \times 10^{23} \text{ units/mol}$$

$$32.00^\circ\text{F} = 0.000^\circ\text{C} = 273.15\text{K}$$

$$\text{Density of Water} = 1.000 \text{ g/mL}$$

$$R = 0.08206 \text{ L}\cdot\text{atm/mol}\cdot\text{K}$$

$$PV = nRT$$

$$\Delta T_{\text{fp/bp}} = k_{\text{fp/bp}} \cdot m \cdot i$$

$$\text{For water, } k_{\text{fp}} = -1.86^\circ\text{C}/m; k_{\text{bp}} = 0.512^\circ\text{C}/m$$

$$P_1 = X_1 P_1^\circ$$

$$\Pi = (\Delta M)RTi$$

$$C_1 V_1 = C_2 V_2$$

1 H 1.0079																2 He 4.0026			
3 Li 6.941	4 Be 9.0122													5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
11 Na 22.990	12 Mg 24.305													13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.88	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80		
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29		
55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)		
87 Fr (223)	88 Ra 226.03	89 Ac 227.03	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)	114 (285)		116 (289)					

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.94	70 Yb 173.04	71 Lu 174.97
90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (258)	101 Md (258)	102 No (259)	103 Lr (260)

Multiple Choice: Circle the letter of the most correct response. (6pts. per question)

- Rank the 3 states of matter from lowest kinetic energy to highest kinetic energy.
 - Gas, liquid, solid
 - Solid, liquid, gas
 - Gas, solid, liquid
 - Liquid, gas, solid
 - Solid, gas, liquid
- When dissolving a solid in a liquid:
 - Formation of solvent-solute interactions is endothermic
 - The boiling point of the solution will be lower than that of the pure solvent
 - Energy is released (exothermic) by breaking solvent-solvent and solute-solute interactions
 - The enthalpy of solution is always positive
 - The freezing point of the solution will be lower than that of the pure solvent
- Which of the following is **not** a correct gas law relationship?
 - $PV = nRT$
 - $V_1/V_2 = P_1/P_2$
 - $V_1P_1 = V_2P_2$
 - $V_1T_1 = V_2T_2$
 - $P_1/T_1 = P_2/T_2$
- The volume of a gas:
 - Increases as the pressure increases
 - Decreases as the kinetic energy increases
 - Is always a constant
 - Increases as the temperature increases
 - Remains constant as the amount of gas is increased
- Carbon dioxide (CO₂) has a lower boiling point than sulfur dioxide (SO₂) because:
 - The bonds in SO₂ are polar but the bonds in CO₂ are not
 - CO₂ has stronger London dispersion forces than SO₂
 - SO₂ is a polar molecule but CO₂ is not
 - SO₂ forms stronger hydrogen bonds than CO₂
 - CO₂ sublimates
- If each of the following solids is added to 500.0mL of water, which will change the vapor pressure the most?
 - 1.2mols sugar
 - 0.4mols calcium phosphate
 - 0.6mols sodium chloride
 - 0.5mols calcium nitrate
 - 0.7mols ammonium phosphate

7. You have prepared a solution by dissolving 18.153g of potassium phosphate in enough water to make 500.0mL of solution. What is the *molarity* of this solution? (14pts)

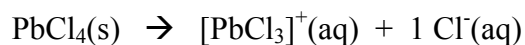
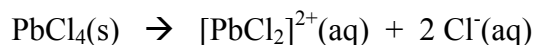
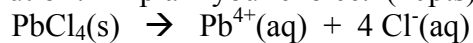
8. You have prepared a solution by dissolving 8.192g of ammonium bromide in 100.0g of water. What is the *molality* of this solution? (14pts)

9. You have prepared a solution by diluting 75.00mL of a 1.892M aqueous solution of sugar ($C_6H_{12}O_6$) to a total volume of 250.0mL. What is the *molarity* of this solution? (14pts)

10. What is the boiling point of a solution made by dissolving 18.188g of lithium nitrate in 200.0g of water? (18pts)

11. A 2.00L vessel contains 4.719g of helium gas at 21.38°C. What is the pressure of the gas? (14pts)

12. Some compounds we call “ionic” do not completely dissociate in water. The extent to which they dissociate can be explored using freezing point depression. When 0.335mols of lead(IV) chloride is dissolved in 500.0g of water, the freezing point of the resulting solution is -6.24°C . Which of the following equations is most consistent with the observed freezing point depression in this solution? Explain your choice. (20pts)



13. How much energy is required to heat 95.82kg of ice from -12.36°C to 68.85°C ? $\{C_s(\text{ice}) = 2.09 \text{ J/g}\cdot\text{K}; C_s(\text{water}) = 4.184 \text{ J/g}\cdot\text{K}; C_s(\text{steam}) = 2.01 \text{ J/g}\cdot\text{K}; \Delta H_{\text{fusion}}(\text{water}) = 6.02 \text{ kJ/mol}; \Delta H_{\text{vaporization}}(\text{water}) = 40.7 \text{ kJ/mol} \}$ (20pts)