Exam 3A
Chem 1121
Fall 2018

Name: KEY

Show all work to receive credit.

Multiple Choice. [4 pts. each.] Select the *best* answer on the scantron sheet.

Q1. What mass would 1 mol of silver weigh?
A) 107.9 g
B) 121.8 g
C) 197.0 g
D) 200.6 g

Q2. What mass would 1 mol of NH_4NO_3 weigh?
A) 10.03 g
B) 34.02 g
C) 68.05 g
D) 80.06 g

Q3. How many moles of H_2O are there in 12.5 g of H_2O?
A) 18.0 mol
B) 12.5 mol
C) 0.694 mol
D) 0.125 mol

Q4. Given the balanced chemical equation:

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

How many moles of NH_3 will theoretically be formed from 1.50 mol N_2?
A) 6.00 mol
B) 3.00 mol
C) 1.50 mol
D) 0.750 mol

Q5. Which of the following ionic compounds would be insoluble in water?
A) Na_2SO_4
B) KCl
C) $LiNO_3$
D) $PbCl_2$

Q6. A solution where the maximum amount of solute is dissolved in a given amount of solvent is best said to be:
A) concentrated
B) super-saturated
C) saturated
D) hypotonic

Q7. The molar concentration of a solution formed by dissolving 0.25 mol NaCl in water such that the total volume is 500. mL is:
A) 0.00050 M
B) 0.0025 M
C) 0.25 M
D) 0.50 M

Q8. The number of moles of $CaCl_2$ contained in 3.2 L of a 0.30 M $CaCl_2$(aq) solution is:
A) 0.96 mol
B) 0.74 mol
C) 0.56 mol
D) 0.30 mol

Q9. What volume of 0.30 M $CaCl_2$(aq) is needed to contain 0.096 mol $CaCl_2$?
A) 320 mL
B) 450 mL
C) 750 mL
D) 960 mL

Q10. The molarity of a solution formed by dissolving 14.0 g NaCl in water, such that the total volume is 2.0 L is:
A) 0.060 M
B) 0.090 M
C) 0.12 M
D) 0.24 M

Q11. A solution made by dissolving 5.0 g of NaCl in 25.0 g of water would have a %(w/w) concentration of:
A) 5.0% (w/w)
B) 17% (w/w)
C) 20.% (w/w)
D) 30.% (w/w)

Q12. Which of the following solutions will have the **lowest** freezing point:
A) 1.00 M $FeCl_3$(aq)
B) 1.00 M $Cu(NO_3)_2$(aq)
C) 1.00 M glucose (aq)
D) They would all have the same freezing point

Q13. A red blood cell placed in a hypotonic solution would tend to:
A) contract or shrivel up (crenation)
B) stay unchanged
C) lower the boiling point of the solution
D) expand and possibly explode (hemolysis)

Q14. Which of the following is not a physical quantity associated with gases
A) volume
B) osmotic pressure
C) temperature
D) number of moles

Q15. The device used to measure atmospheric pressure is called
A) hygrometer
B) barometer
C) manometer
D) sphygmomanometer

Short Response. Show your work (where appropriate) to receive full credit!

Q16. [10 pts] Given the balanced chemical equation for the oxidation of glucose ($C_6H_{12}O_6$):

$$C_6H_{12}O_6(s) + 6O_2(g) \longrightarrow 6CO_2(g) + 6H_2O(l)$$

***Hint**: be sure to show all work, and you must use the conversion-factor method to receive full credit.*

a) How many moles of CO_2 can be formed from 0.15 mol $C_6H_{12}O_6$?

$$0.15\,mol\ C_6H_{12}O_6 \times \frac{6\,mol\ CO_2}{1\,mol\ C_6H_{12}O_6} = 0.90\,mol\ CO_2 \quad \} 2$$

(2)

b) How many grams of CO_2 can be formed from 25.0 g of $C_6H_{12}O_6$?

CO_2

$1 \times C = 12.01$
$2 \times O = 2 \times 16.00$
44.01

$C_6H_{12}O_6$

$6 \times C = 6 \times 12.01$
$12 \times H = 12 \times 1.01$
$6 \times O = 6 \times 16.00$
180.18

$$25.0\,g\ C_6H_{12}O_6 \times \underbrace{\frac{1\,mol\ C_6H_{12}O_6}{180.18\,g\ C_6H_{12}O_6}}_{2} \times \underbrace{\frac{6\,mol\ CO_2}{1\,mol\ C_6H_{12}O_6}}_{1} \times \underbrace{\frac{44.01\,g\ CO_2}{1\,mol\ CO_2}}_{2} = \underbrace{36.6\,g\ CO_2}_{1}$$

(6)

c) If 8.50 g of CO_2 is actually formed in the previous step, calculate the percent yield for this reaction.

$$\%\ yield = \frac{actual}{theoretical} \times 100 = \frac{8.50\,g}{36.6\,g} \times 100 = 23.2\% \quad \} 2$$

(2)

Q17. [10 pts] Complete and balance the following chemical equations below. Be sure to balance the equations, show all state symbols, and charges as necessary:

Molecular equation: $\_\_Ba(NO_3)_2(aq) + \_\_Na_2SO_4(aq) \longrightarrow$ $BaSO_4(s) + 2NaNO_3(aq)$ (4)

Complete ionic equation:

$Ba^{2+}(aq) + 2NO_3^-(aq) + 2Na^+(aq) + SO_4^{2-}(aq) \longrightarrow BaSO_4(s) + 2Na^+(aq) + 2NO_3^-(aq)$ (4)

Net-ionic equation:

$Ba^{2+}(aq) + SO_4^{2-}(aq) \longrightarrow BaSO_4(s)$ (2)

Q18. [10 pts.] A sample of air has a volume of 34.0 L at a pressure of 455 mmHg. If the air pressure is increased to 955 mmHg, calculate what the new volume will be? Assume that the number of moles and temperature of the gas do not change.

$P_1V_1 = P_2V_2$

$\Rightarrow V_2 = \frac{P_1V_1}{P_2} = \frac{455\,\text{mmHg} \times 34.0\,\text{L}}{955\,\text{mmHg}} = 16.2\,\text{L}$

Q19. [10 pts.] Using the conversion-factor method, calculate the following:

a) The number of moles of NaCl in 0.300 L of a 0.100 M NaCl(aq) solution.

$$0.300\,L \times \frac{0.100\,mol\ NaCl}{1\,L} = 0.0300\,mol\ NaCl$$

+3

b) The volume of 0.100 M NaCl(aq) solution needed to contain 0.350 mol NaCl.

$$0.350\,mol\ NaCl \times \frac{1\,L}{0.100\,mol\ NaCl} = 3.50\,L$$

+4

c) The mass in grams of NaCl in 325 mL of a 3.50 %(w/v) solution of NaCl(aq).

$$325\,mL\ solution \times \frac{3.50\,g\ NaCl}{100\,mL\ solution} = 11.4\,g\ NaCl$$

+3

BONUS Question:
Who invented the first instrument to measure air pressure?

Torricelli

Useful Information

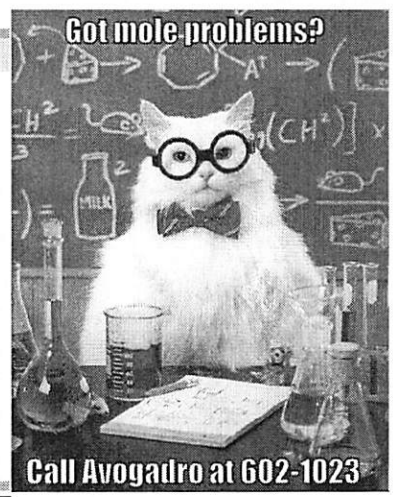
Periodic Table of the Elements

IA	IIA											IIIA	IVA	VA	VIA	VIIA	VIIIA
1																	18
1 H 1.01	2											13	14	15	16	17	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3	4	5	6	7	8	9	10	11	12	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	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	71 Lu 174.97	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 207.20	83 Bi 208.98	84 Po [210]	85 At [210]	86 Rn [222]
87 Fr [223]	88 Ra** [226]	103 Lr [262]	104 Rf [261]	105 Db [262]	106 Sg [266]	107 Bh [264]	108 Hs [265]	109 Mt [268]	110 [269]	111 [272]	112 [277]	113	114 [285]	115	116 [289]	117	118 [293]

*	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm [145]	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04
**	89 Ac [227]	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np [237]	94 Pu [244]	95 Am [243]	96 Cm [247]	97 Bk [247]	98 Cf [251]	99 Es [252]	100 Fm [257]	101 Md [258]	102 No [259]

TABLE 5.1 General Solubility Guidelines for Ionic Compounds in Water

Soluble	Exceptions
Ammonium compounds (NH_4^+)	None
Lithium compounds (Li^+)	None
Sodium compounds (Na^+)	None
Potassium compounds (K^+)	None
Nitrates (NO_3^-)	None
Perchlorates (ClO_4^-)	None
Acetates ($CH_3CO_2^-$)	None
Chlorides (Cl^-)	Ag^+, Hg_2^{2+}, and Pb^{2+} compounds
Bromides (Br^-)	Ag^+, Hg_2^{2+}, and Pb^{2+} compounds
Iodides (I^-)	Ag^+, Hg_2^{2+}, and Pb^{2+} compounds
Sulfates (SO_4^{2-})	Ba^{2+}, Hg_2^{2+}, and Pb^{2+} compounds



$T(\text{K}) = t(^\circ\text{C}) + 273$

1 atm = 760 mmHg = 760 torr = 101,325 Pa

$P_1V_1 = P_2V_2 \qquad \frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad \frac{P_1}{T_1} = \frac{P_2}{T_2} \qquad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$