General Chemistry 1 *(CHEM 1141)*

Shawnee State University – Fall 2018

October 25, 2018

Exam # 2A

Name _____

Please write your full name, and the exam version (2A) that you have on the scantron sheet !
(Bubble in the best answer choice for each question on the green & white scantron sheet in pencil !)

Please ☑ check the box next to your correct section number.

Section #:

❒ 1. (Monday Lab, 10:00 AM – 12:53 PM)

❒ 2. (Wednesday Lab, 10:00 AM – 12:53 PM)

❒ 3. (Monday Lab, 2:00 PM – 4:53 PM)

❒ 4. (Wednesday Lab, 2:00 PM – 4:53 PM)

❒ 6. (Tuesday Lab, 12:30 PM – 3:23 PM)

Multiple Choice:	_____	**/ 50**
Q21:	_____	**/ 10**
Q22:	_____	**/ 10**
Q23:	_____	**/ 10**
Q24:	_____	**/ 10**
Q25:	_____	**/ 10**
BONUS:	_____	**/ 5**
TOTAL:	_____	**/ 100**

Each problem in this section (multiple choice) is worth 2.5 points !

Q1. The molecular formula of trinitrobenzene is $C_6H_3N_3O_6$. What is its empirical formula?

A) $C_6H_3N_3O_6$

B) C_4HNO_4

C) C_2HNO_2

D) CHNO

Q2. An example of an element that exists as a diatomic molecule would be:

A) iron

B) sulfur

C) iodine

D) helium

Q3. Calculate the molar mass of $Ca_3(PO_4)_2$.

A) 87.05 g/mol

B) 215.21 g/mol

C) 310.18 g/mol

D) 279.21 g/mol

Q4. Determine the stoichiometric coefficient for oxygen when the following equation is balanced using the lowest, whole-number coefficients.

$$\_\_\_\_CH_4O\ (l) + \_\_\_\_O_2(g) \rightarrow \_\_\_\_CO_2(g) + \_\_\_\_H_2O\ (l)$$

A) 9

B) 7

C) 5

D) 3

Q5. The percentage (by mass) of carbon in C_3H_8O is:

A) 8.33 %

B) 60.0 %

C) 38.5 %

D) 52.1 %

Q6. Calculate the number of CO_2 molecules contained in 65.5 g of CO_2 :

A) 8.96×10^{23} CO_2 molecules

B) 1.71×10^{24} CO_2 molecules

C) 4.04×10^{24} CO_2 molecules

D) 1.92×10^{24} CO_2 molecules

Q7. Identify the compound that would be classified as a **strong acid as well as a strong electrolyte:**

A) HF

B) HNO_3

C) CH_3COOH

D) HNO_2

Q8. When dissolved in water, KOH behaves as:

A) an acid that forms K^+ and OH^- ions

B) an acid that forms KO^- and H^+ ions

C) a base that forms K^+ and OH^- ions

D) a base that forms KO^- and H^+ ions

Q9. The correct formula for the ammonium, bicarbonate, and sulfite ion (respectively) is:

A) NH_3^+, CO_3^{2-}, and SO_4^{2-}

B) NH_4^+, CO_3^{2-}, and SO_4^{2-}

C) NH_3^+, HCO_3^-, and SO_3^{2-}

D) NH_4^+, HCO_3^-, and SO_3^{2-}

Q10. Which of the following solution combinations will form a precipitate when mixed?

A) $NaNO_3(aq) + LiCl(aq)$

B) $KC_2H_3O_2(aq) + (NH_4)_2SO_4$

C) $HNO_3(aq) + NaOH(aq)$

D) $Na_2S(aq) + Mg(NO_3)_2(aq)$

Q11. Which of the following solution combinations will form a gas when mixed?

A) $LiHCO_3(aq) + NaNO_3(aq)$

B) $K_2CO_3(aq) + HCl(aq)$

C) $Pb(NO_3)_2(aq) + NaI(aq)$

D) $NaOH(aq) + H_2SO_4(aq)$

Q12. For the reaction that occurs between HBr(aq) and NH4OH(aq) identify the equation shown below that correctly identifies the net-ionic equation.

A) $NH4^+(aq) + Br^-(aq) \longrightarrow NH4Br(s)$

B) $H^+(aq) + OH^-(aq) \longrightarrow H_2O(l)$

C) $NH4^+(aq) + Br^-(aq) + H^+(aq) + OH^-(aq) \longrightarrow NH4Br(s) + H^+(aq) + OH^-(s)$

D) $H^+(aq) + Br^-(aq) \longrightarrow HBr(s)$

Q13. The oxidation state of the sulfur atom in SO_3^{2-} ion is:

A) −2

B) +2

C) +4

D) +6

Q14. The oxidation state of the phosphorus atom in K_3PO_4 is:

A) +5

B) −5

C) +3

D) −3

Q15. The oxidizing agent in the reaction:

$2Al^{3+}(aq) + 2Fe(aq) \longrightarrow 2Al(s) + 2Fe^{3+}(aq)$

is

A) Al^{3+}

B) Fe

C) Al

D) Fe^{3+}

Q16. Determine the concentration (in molarity, M) for a solution that contains 20.8 g of CaCl2 dissolved in 0.500 L of water.

A) 0.167 M

B) 0.375 M

C) 0.667 M

D) 1.50 M

Q17. Calculate the volume (in mL) needed to make 525 mL of a 1.20 M $NaNO_3$ solution from a 6.00 M $NaNO_3$ stock solution.

A) 13.7 mL

B) 87.5 mL

C) 105 mL

D) 2600 mL

Q18. The gas law that states that pressure is inversely proportional to volume is:

A) Avogadro's law

B) Boyle's law

C) Charles's law

D) Torricelli's law

Q19. A sample of gas with a volume of 25.0 mL at a temperature of 25°C is cooled down to −25°C. Assuming no change in pressure, its final volume will be:

A) −25.0 mL

B) 20.8 mL

C) 18.4 mL

D) 27.3 mL

Q20. The pressure of 0.500 mol of He(g) at a temperature of 133°C, and a volume of 4.00 L is predicted to be:

A) 2.45 atm

B) 3.95 atm

C) 4.17 atm

D) 0.953 atm

Each problem in this section (short answer) is worth 10 points !

All work must be show in order to receive credit !

You must use the factor–label (conversion–factor) method for all conversions !

Be sure to include units where applicable !

All numeric answers must be rounded to the correct number of significant figures !

Q21. One of the ingredients in Bufferin tables is composed of 28.83 % Mg, 14.25 % C, and 56.93% O (percentages are by mass). Show how to determine (by calculation) the empirical formula for this compound and then provide the correct name of this compound.

Q22. Provide the correct name or formula for each of the following compounds.

A) O_3F_2 _____

B) $Fe(NO_3)_3 \cdot 9\ H_2O$_____

C) sodium bicarbonate_____

D) chromium (III) sulfate _____

E) $(NH_4)_2CO_3$_____

Q23. The reaction between $C_3H_6(g)$ and $O_2(g)$ forms $CO_2(g)$ and $H_2O(g)$.

A) Write out a balanced chemical equation for this reaction, using the lowest set of whole number coefficients.

B) Predict the mass of $H_2O(g)$ formed from the complete reaction of 14.0 g $C_3H_6(g)$ and 18.0 g $O_2(g)$

C) If the actual mass of $H_2O(g)$ formed was 5.40 g, then calculate the theoretical yield of this reaction.

Q24. In a titration, it is found that 43.0 mL of 0.100 M NaOH(aq) is required to fully neutralize 20.00 mL of a sample of H_3PO_4(aq) (phosphoric acid) of unknown concentration. What must the molar concentration of this sample of phosphoric acid be?

Q25. Write correctly the balanced molecular, complete ionic, and net ionic equation for the reaction:

molecular: $\_\_Pb(NO_3)_2(aq) + \_\_K_3PO_4(aq) \rightarrow$

complete ionic:

net ionic:

5 Point Bonus Question

15.0 mL of 1.25 M sodium sulfate(aq) is mixed with 25.0 mL of 3.20 M calcium nitrate(aq). Predict the mass of the precipitate that is expected to form.

Useful Information: PV = nRT R= 0.0821 $\frac{L\,atm}{mol\,K}$

$P_1V_1 = P_2V_2$ $P_1/T_1 = P_2/T_2$ $V_1/T_1 = V_2/T_2$

$N_A = 6.022 \times 10^{23}$ $V_1/n_1 = V_2/n_2$

TABLE 4.1 Solubility Rules for Ionic Compounds in Water

Compounds Containing the Following Ions Are Generally Soluble	Exceptions
Cl^-, Br^-, and I^-	When these ions pair with Ag^+, Hg_2^{2+}, or Pb^{2+}, the resulting compounds are insoluble.
SO_4^{2-}	When SO_4^{2-} pairs with Sr^{2+}, Ba^{2+}, Pb^{2+}, Ag^+, or Ca^{2+}, the resulting compound is insoluble.
Compounds Containing the Following Ions Are Generally Insoluble	**Exceptions**
OH^- and S^{2-}	When these ions pair with Li^+, Na^+, K^+, or NH_4^+, the resulting compounds are soluble.
	When S^{2-} pairs with Ca^{2+}, Sr^{2+}, or Ba^{2+}, the resulting compound is soluble.
	When OH^- pairs with Ca^{2+}, Sr^{2+}, or Ba^{2+}, the resulting compound is slightly soluble.
CO_3^{2-} and PO_4^{3-}	When these ions pair with Li^+, Na^+, K^+, or NH_4^+, the resulting compounds are soluble.

Periodic Table of the Elements

IA	IIA											IIIA	IVA	VA	VIA	VIIA	VIIIA
1																	*18*
1 H 1.008	*2*											*13*	*14*	*15*	*16*	*17*	2 He 4.003
3 Li 6.941	4 Be 9.012											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 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.60	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba* 137.3	71 Lu 175.0	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	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 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm [145]	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.50	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0
**	89 Ac [227]	90 Th 232.0	91 Pa 231.0	92 U 238.0	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]