



DO NOT OPEN

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*CHEM 140 – Dr. McCorkle – Exam #3A **KEY***

While you wait, please complete the following information:

Name: _____

Student ID: _____

Turn off cellphones and stow them away. No headphones, mp3 players, hats, sunglasses, food, drinks, restroom breaks, graphing calculators, programmable calculators, or sharing calculators. Grade corrections for incorrectly marked or incompletely erased answers will not be made.

Periodic Table of the Elements

PERIOD	GROUP																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	IA	IIA	IIIB	IVB	VB	VIB	VIIIB	VIIIB	VIIIB	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 H 1.01	2 He 4.00											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
2	3 Li 6.94	4 Be 9.01											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
3	11 Na 22.99	12 Mg 24.31	3 Sc 44.96	4 Ti 47.88	5 V 50.94	6 Cr 52.00	7 Mn 54.94	8 Fe 55.85	9 Co 58.93	10 Ni 58.69	11 Cu 63.55	12 Zn 65.39	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	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 74.92	34 Se 78.97	35 Br 79.90	36 Kr 83.80
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.95	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 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.29
6	55 Cs 132.91	56 Ba 137.33	57 La* 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	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)
7	87 Fr (223)	88 Ra (226)	89 Ac** (227)	104 Rf (267)	105 Db (268)	106 Sg (271)	107 Bh (270)	108 Hs (277)	109 Mt (276)	110 Ds (281)	111 Rg (280)	112 Cn (285)	113 Nh (284)	114 Fl (289)	115 Mc (288)	116 Lv (293)	117 Ts (294)	118 Og (294)

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
140.12	140.91	144.24	(145)	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.05	174.97
90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr
232.04	231.04	238.03	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(262)

*

**

Multiple Choice – Choose the answer that best completes the question. Use an 815-E Scantron to record your response. [2 points each]

- How many total atoms are in the formula $\text{Al}_2(\text{CO}_3)_3$?
A) 6 B) 8 C) 9 D) 12 **E) 14**
- Which formula shows the proper use of parentheses?
A) $\text{Ca}(\text{F})_2$ B) $\text{Ca}(\text{SO}_4)$ C) $(\text{NH}_4)_3(\text{PO}_4)$ **D) $\text{Ca}(\text{NO}_3)_2$** E) none of these
- Fluorine is considered which of the following?
A) atomic element **B) molecular element**
C) molecular compound D) ionic compound
E) none of the above
- Ammonium iodide is considered which of the following?
A) atomic element B) molecular element
C) molecular compound **D) ionic compound**
E) none of the above
- How many moles of Cu are in 1.48×10^{25} Cu atoms?
A) 0.0408 **B) 24.6** C) 8.91×10^{48} D) 6.022×10^{23} E) none of these
- What is the mass in grams of 5.40 moles of lithium?
A) 6.94 B) 0.778 **C) 37.5** D) 3.25×10^{24} E) none of these
- You have 10.0 g each of Na, C, Pb, Cu and Ne. Which contains the largest number of moles?
A) Na **B) C** C) Pb D) Cu E) Ne
- What is the molar mass in g/mol of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$?
A) 252.10 B) 238.09 C) 260.18 D) 372.18 E) 386.19
- One mole of $(\text{NH}_4)_2\text{HPO}_4$ contains how many moles of hydrogen atoms?
A) 2 B) 7 C) 8 **D) 9** E) none of these
- What is the mass percent of hydrogen in water?
A) 11.2 B) 33.3 C) 66.7 D) 88.8 E) none of these
- Which of the following is already in its empirical formula?
A) $\text{C}_{22}\text{H}_{34}\text{O}_{10}$ B) C_6H_6 C) $\text{C}_6\text{H}_{12}\text{O}_3$ **D) $\text{C}_5\text{H}_{12}\text{O}_2$** E) none of these

12. Determine the empirical formula of a compound containing 83% potassium and 17.0% oxygen.

- A) KO B) KO₂ C) K₂O₃ **D) K₂O** E) none of these

13. What is the mass of 3.91×10^{24} sulfur atoms?

- A) 208 g** B) 5.46×10^{46} g C) 155 g D) 32.07 g E) none of these

Calculations & Short Answers – Write your initials in the upper-right corner of every page that contains work. For full credit show all work and write neatly; give answers with correct significant figures and units. Place a box around your final answer.

14. How grams of oxygen are in 21.8 mg of calcium borate? [5 points]

$$\begin{aligned} 21.8 \text{ mg} \times \frac{10^{-3} \text{ g}}{1 \text{ mg}} \times \frac{1 \text{ mol Ca}_3(\text{BO}_3)_2}{237.86 \text{ g}} \times \frac{6 \text{ mol O}}{1 \text{ mol Ca}_3(\text{BO}_3)_2} \times \frac{16.00 \text{ g}}{1 \text{ mol O}} \\ = 8.80 \times 10^{-3} \text{ g O} \end{aligned}$$

15. How many cyanide ions are in 50.0 g of chromium(III) cyanide? [4 points]

$$\begin{aligned} 50.0 \text{ g Cr}(\text{CN})_3 \times \frac{1 \text{ mol Cr}(\text{CN})_3}{130.06 \text{ g}} \times \frac{3 \text{ mol CN}^-}{1 \text{ mol Cr}(\text{CN})_3} \times \frac{6.022 \times 10^{23} \text{ ions}}{1 \text{ mol CN}^-} \\ = 6.95 \times 10^{23} \text{ CN}^- \text{ ions} \end{aligned}$$

16. Write formulas for the following compounds: [2 points each]

- a. diselenium tetrachloride



- b. thiosulfuric acid



- c. cobalt(III) chlorite



- d. zinc phosphide



- e. tin(IV) dichromate



- f. calcium cyanide



- g. pentaiodine nonaselenide



- h. lead(IV) perbromate



- i. uranium(VI) nitride



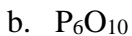
- j. hydroselenic acid



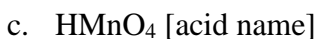
17. Name the following compounds: [2 points each]



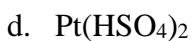
barium selenite



hexaphosphorus decaoxide



permanganic acid



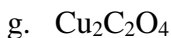
platinum(II) hydrogen sulfate



bismuth(III) borate



radium peroxide



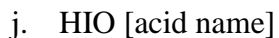
copper(I) oxalate



trichlorine heptafluoride



nickel(III) bromide



hypoiodous acid

18. Lactic acid, $C_3H_6O_3$, is formed in muscle cells during heavy exertion. Determine its percent composition. [4 points]

$$C_3H_6O_3 = 90.09 \text{ g/mol}$$

$$\% C = \frac{3 \times 12.01}{90.09} \times 100 = 39.99 \% C$$

$$\% H = \frac{6 \times 1.01}{90.09} \times 100 = 6.73 \% H$$

$$\% O = \frac{3 \times 16.00}{90.09} \times 100 = 53.28 \% O$$

19. Vitamin C is known chemically by the name ascorbic acid. Determine the molecular formula of ascorbic acid if it is composed of 40.92% carbon, 4.58% hydrogen, and 54.50% oxygen. The molar mass is approximately 176 g/mol. [7 points]

$$40.92 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g}} = 3.407 \text{ mol C}$$

$$4.58 \text{ g H} \times \frac{1 \text{ mol H}}{1.01 \text{ g}} = 4.53 \text{ mol H}$$

$$54.50 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g}} = 3.406 \text{ mol O}$$

$$\frac{C_{3.407}H_{4.53}O_{3.406}}{3.406 \quad 3.406 \quad 3.406} = CH_{1.33}O \times 3 = C_3H_4O_3$$

$$\text{Empirical formula mass} = 88.07 \text{ g/mol}$$

$$n = \frac{\text{Empirical formula mass}}{\text{Molar mass}} = \frac{176 \text{ g/mol}}{88.07 \text{ g/mol}} \approx 2$$

$$(C_3H_4O_3)_n = (C_3H_4O_3)_2 = C_6H_8O_6$$

Extra Credit: What is the name of the guacamole at Trader Joe's? [2 points]

Avocado's Number

**Formulas & Constants
(you may or may not need)**

$$1 \text{ inch} = 2.54 \text{ cm (exact)}$$

$$1 \text{ lb} = 453.6 \text{ g}; 1 \text{ lb} = 16 \text{ oz}$$

$$T_K = T_{\text{C}} + 273.15$$

$$1 \text{ cal} = 4.184 \text{ J}$$

$$\text{Avogadro's \#} = 6.022 \times 10^{23}$$

$$1 \text{ mile} = 5280 \text{ ft} \approx 1.609 \text{ km}$$

$$1 \text{ gal} = 4 \text{ qt} = 8 \text{ pt} \approx 3.785 \text{ L}$$

$$T_{\text{F}} = 1.8 \times T_{\text{C}} + 32$$

$$1 \text{ Cal} = 1000 \text{ cal}$$

$$1 \text{ kg} \approx 2.205 \text{ lb}$$

$$1 \text{ L} = 1000 \text{ cm}^3$$

$$T_{\text{C}} = (T_{\text{F}} - 32)/1.8$$

Scratch Page
(to be handed in)