

**Chem 101A Study Questions, Chapters 3 & 4**

Name: \_\_\_\_\_

Review Tues 10/02/18

Due 10/04/18 (Exam 2 date)

*This is a homework assignment. Please show your work for full credit. If you do work on separate paper, attach the work to these.*

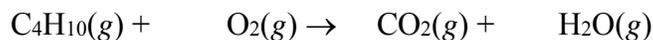
1. Naturally occurring element X exists in three isotopic forms: X-28 (27.977 amu, 92.23% abundance), X-29 (28.976 amu, 4.67% abundance), and X-30 (29.974 amu, 3.10% abundance). Calculate the atomic weight of X.  
A) 48.63 amu  
B) 27.16 amu  
C) 28.97 amu  
D) 86.93 amu  
E) 28.09 amu
2. Rhenium has two (2) stable isotopes. Given that 37.1% of rhenium is rhenium-185, what is the other stable isotope? *hint: assume rhenium-185 weighs about 185 amu*  
A)  $^{181}_{75}\text{Re}$   
B)  $^{190}_{75}\text{Re}$   
C)  $^{187}_{75}\text{Re}$   
D)  $^{189}_{75}\text{Re}$   
E)  $^{183}_{75}\text{Re}$
3. What is the molar mass of propanol (C<sub>3</sub>H<sub>7</sub>OH)?  
A) 36.07 g/mol  
B) 60.09 g/mol  
C) 30.03 g/mol  
D) 149.04 g/mol  
E) 59.09 g/mol
4. What is the mass of a 7.613-mol sample of sodium hydroxide?  
A) 5.254 g  
B) 0.1903 g  
C) 304.5 g  
D) 182.7 g  
E) 40.00 g

5. One molecule of a compound weighs  $2.03 \times 10^{-22}$  g. The molar mass of this compound is:
- A) 818 g/mol
  - B) 114 g/mol
  - C) 122 g/mol
  - D) 2.97 g/mol
  - E) none of these
6. Ammonium carbonate,  $(\text{NH}_4)_2\text{CO}_3$ , contains what percent nitrogen by mass?
- A) 29.2%
  - B) 18.8%
  - C) 14.6%
  - D) 58.3%
  - E) none of these
7. A chloride of rhenium contains 63.6% rhenium. What is the empirical formula of this compound?
- A)  $\text{ReCl}_7$
  - B)  $\text{Re}_2\text{Cl}_3$
  - C)  $\text{ReCl}_3$
  - D)  $\text{ReCl}_5$
  - E)  $\text{ReCl}$
8. A 0.4801-g sample of a compound known to contain only carbon, hydrogen, and oxygen was burned in oxygen to yield 0.8921 g of  $\text{CO}_2$  and 0.1826 g of  $\text{H}_2\text{O}$ . What is the empirical formula of the compound?
- A)  $\text{C}_3\text{H}_3\text{O}_2$
  - B)  $\text{C}_6\text{H}_3\text{O}_2$
  - C)  $\text{C}_3\text{H}_6\text{O}_2$
  - D)  $\text{CHO}$
  - E)  $\text{C}_2\text{H}_2\text{O}$

9. Adenine is among the four nucleobases which are part of the basic building blocks of DNA. As well, it is part of the structure of ATP and ADP which regulates energy transfer in cellular respiration. The molar mass of adenine is 135.1 g/mol. A sample of adenine contains 1.87g carbon, 0.157g hydrogen, and 2.18g nitrogen. What is the molecular formula of adenine?

- A)  $C_3H_6N_3$
- B)  $C_2H_2N_2$
- C)  $C_6H_{12}N_6$
- D)  $C_5H_5N_5$
- E) none of these

10. When the equation below is balanced using whole number coefficients, what is the coefficient for  $O_2$ ?



- A) 13
- B) 8
- C) 9
- D) 10
- E) 4

11. When the equation  $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$  is balanced with the smallest set of integers, the sum of the coefficients is

- A) 33
- B) 11
- C) 24
- D) 4
- E) 19

12. The hormone epinephrine is released in the human body during stress and increases the body's metabolic rate. Epinephrine, like many biochemical compounds, is composed of carbon, hydrogen, oxygen, and nitrogen. The percentage composition of the hormone is 59.0% C, 7.15% H, 26.2% O, and 7.65% N. Determine the empirical formula.

13. The refining of aluminum from bauxite ore (**which contains 50.% Al<sub>2</sub>O<sub>3</sub> by mass**) proceeds by the overall reaction  $2\text{Al}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Al} + 3\text{CO}_2$ . How much bauxite ore is required to give the  $5.0 \times 10^{13}$  g of aluminum produced each year in the United States?
- A)  $5.3 \times 10^{13}$  g
  - B)  $1.9 \times 10^{14}$  g
  - C)  $7.6 \times 10^{14}$  g
  - D)  $1.3 \times 10^{13}$  g
  - E) none of these
14. SO<sub>2</sub> reacts with H<sub>2</sub>S as follows:
- $$2\text{H}_2\text{S} + \text{SO}_2 \rightarrow 3\text{S} + 2\text{H}_2\text{O}$$
- When 7.50 g of H<sub>2</sub>S reacts with 12.75 g of SO<sub>2</sub>, which statement applies?
- A) 1.13 g of H<sub>2</sub>S remain.
  - B) 0.0216 moles of H<sub>2</sub>S remain.
  - C) SO<sub>2</sub> is the limiting reagent.
  - D) 10.6 g of sulfur are formed.
  - E) 6.38 g of sulfur are formed.
15. A 5.95-g sample of AgNO<sub>3</sub> is reacted with excess BaCl<sub>2</sub> according to the equation
- $$2\text{AgNO}_3(aq) + \text{BaCl}_2(aq) \rightarrow 2\text{AgCl}(s) + \text{Ba}(\text{NO}_3)_2(aq)$$
- to give 4.46 g of AgCl. What is the percent yield of AgCl?
- A) 88.8%
  - B) 44.4%
  - C) 63.2%
  - D) 100%
  - E) 75.0%
16. The limiting reactant in a reaction
- A) is the reactant for which there is the fewest number of moles
  - B) is the reactant for which there is the most amount in grams
  - C) is the reactant for which there is the least amount in grams
  - D) is the reactant which has the lowest coefficient in a balanced equation
  - E) none of the above
17. In order to determine the molecular formula from the empirical formula, we must know the \_\_\_\_\_.

18. Which of the following is a strong acid?
- A) HI
  - B) HF
  - C) HClO
  - D) HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>
  - E) KOH
19. 1.00 mL of a  $4.50 \times 10^{-4} M$  solution of oleic acid is diluted with 9.00 mL of petroleum ether, forming solution A. Then 2.00 mL of solution A is diluted with 8.00 mL of petroleum ether, forming solution B. What is the concentration of solution B?
- A)  $9.00 \times 10^{-5} M$
  - B)  $9.00 \times 10^{-6} M$
  - C)  $1.00 \times 10^{-4} M$
  - D)  $1.25 \times 10^{-5} M$
  - E)  $4.50 \times 10^{-6} M$
20. What mass of calcium chloride, CaCl<sub>2</sub>, is needed to prepare 1.900 L of a 1.55 M solution?
- A) 327 g
  - B) 136 g
  - C) 2.95 g
  - D) 90.5 g
  - E) 111 g
21. What volume of 18 M sulfuric acid must be used to prepare 1.70 L of 0.205 M H<sub>2</sub>SO<sub>4</sub>?
- A)  $2.2 \times 10^3$  mL
  - B) 19 mL
  - C) 6.3 mL
  - D) 0.35 mL
  - E) 4.0 mL
22. The following reactions:
- $$\text{Pb}^{2+}(\text{aq}) + 2\text{I}^{-}(\text{aq}) \rightarrow \text{PbI}_2(\text{s})$$
- $$2\text{Ce}^{4+}(\text{aq}) + 2\text{I}^{-}(\text{aq}) \rightarrow \text{I}_2(\text{aq}) + 2\text{Ce}^{3+}(\text{aq})$$
- $$2\text{HBr}(\text{aq}) + \text{Ca}(\text{OH})_2(\text{aq}) \rightarrow \text{CaBr}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$$
- are examples of
- A) precipitation, redox, and acid-base reactions, respectively
  - B) precipitation, acid-base, and redox reactions, respectively
  - C) redox, acid-base, and precipitation reactions, respectively
  - D) acid-base reactions
  - E) unbalanced reactions

23. Which of the following salts are expected to be insoluble in water?

- I. barium nitrate
- II. potassium phosphate
- III. sodium sulfide
- IV. ammonium sulfate

- A) I. and II.
- B) I., II., and III.
- C) I. only
- D) none are soluble
- E) I. and III.

24. Which pair of ions would *not* be expected to form a precipitate when dilute solutions of each are mixed?

- A)  $\text{Mg}^{2+}$ ,  $\text{SO}_4^{2-}$
- B)  $\text{Pb}^{2+}$ ,  $\text{OH}^-$
- C)  $\text{Pb}^{2+}$ ,  $\text{Cl}^-$
- D)  $\text{Al}^{3+}$ ,  $\text{S}^{2-}$
- E)  $\text{Ba}^{2+}$ ,  $\text{PO}_4^{3-}$

25. Write the net ionic equation for the reaction of calcium bromide and sodium phosphate (show your work).

The net ionic equation contains which of the following species exactly?

- A)  $2\text{Ca}_3(\text{PO}_4)_2(s)$
- B)  $3\text{Ca}^{2+}(aq)$
- C)  $6\text{NaBr}(aq)$
- D)  $\text{PO}_4^{3-}(aq)$
- E)  $2\text{Br}^-(aq)$

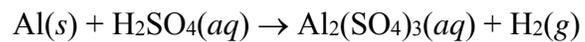
26. Solutions of cobalt(II) chloride and carbonic acid are mixed.

- a) write and balance the molecular equation, underline any precipitate produced.
- b) write and balance the complete ionic equation
- c) write and balance the net ionic equation.
- d) list any spectator ions

27. You have 75.0 mL of a 2.50 M solution of  $\text{Na}_2\text{CrO}_4(\text{aq})$ . You also have 125 mL of a 2.23 M solution of  $\text{AgNO}_3(\text{aq})$ . Calculate the concentration of  $\text{Ag}^+$  after the two solutions are mixed together. *hint: think limiting reactant*
- A) 1.39 M
  - B) 0.00 M
  - C) 0.279 M
  - D) 0.697 M
  - E) 0.088 M
28. You have 85.0 mL of a 2.50 M solution of  $\text{Na}_2\text{CrO}_4(\text{aq})$ . You also have 125 mL of a 2.50 M solution of  $\text{AgNO}_3(\text{aq})$ . Calculate the concentration of  $\text{Na}^+$  after the two solutions are mixed together. *hint: try the net ionic equation*
- A) 0.425 M
  - B) 2.02 M
  - C) 0.00 M
  - D) 1.01 M
  - E) 5.00 M
29. When solutions of oxalic acid and potassium hydroxide react, what is the net ionic equation?
30. With what volume of 5.00 M HF will 5.50 g of calcium hydroxide react completely, according to the following reaction?
- $$2\text{HF} + \text{Ca}(\text{OH})_2 \rightarrow \text{CaF}_2 + 2\text{H}_2\text{O}$$
- A) 742 mL
  - B) 14.8 mL
  - C) 29.7 mL
  - D) 33.7 mL
  - E) 148 mL
31. Provide the oxidation state of each atom in the species below. Show your work!
- a)  $\text{MnO}_2$
  - b)  $\text{CO}$
  - c)  $\text{H}_2\text{O}_2$
  - d)  $\text{CH}_4$
  - e)  $\text{CaH}_2$
  - f)  $\text{Na}_2\text{Cr}_2\text{O}_7$

32. In the reaction  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ ,  $\text{N}_2$  is
- A) the electron donor
  - B) the reducing agent
  - C) reduced
  - D) oxidized
  - E) two of these
33. Which of the following are oxidation-reduction reactions?
- I.  $\text{PCl}_3 + \text{Cl}_2 \rightarrow \text{PCl}_5$
  - II.  $\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{Ag}$
  - III.  $\text{CO}_2 + 2\text{LiOH} \rightarrow \text{Li}_2\text{CO}_3 + \text{H}_2\text{O}$
  - IV.  $\text{FeCl}_2 + 2\text{NaOH} \rightarrow \text{Fe}(\text{OH})_2 + 2\text{NaCl}$
- A) I, II, and III
  - B) I and II
  - C) I, II, III, and IV
  - D) IV
  - E) III
34. *True or False?* Oxidation is the gain of electrons.
- A) True
  - B) False
35. Consider the following unbalanced oxidation-reduction reaction:
- $$\text{Fe}^{2+} + \text{Br}_2 \rightarrow \text{Fe}^{3+} + \text{Br}^-$$
- In the balanced equation, the number of electrons transferred is
- A) 2
  - B) 1
  - C) 4
  - D) 3
  - E) none of these
36. Assign oxidation number to all species in the equation below and explain why it is not redox.
- $$2\text{HBr}(\text{aq}) + \text{Ca}(\text{OH})_2(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{CaBr}_2(\text{aq})$$

37. How many electrons are transferred in the following reaction (balance it first)?



- A) 2
- B) 3
- C) 6
- D) 12
- E) Reaction is not redox

## Answer Key

1.	E
	Chapter/Section: 3.2
2.	C
	Chapter/Section: 3.2
3.	B
	Chapter/Section: 3.4
4.	C
	Chapter/Section: 3.4
5.	C
	Chapter/Section: 3.4
6.	A
	Chapter/Section: 3.6
7.	C
	Chapter/Section: 3.7
8.	A
	Chapter/Section: 3.7
9.	D
	Chapter/Section: 3.7
10.	A
	Chapter/Section: 3.9
11.	A
	Chapter/Section: 3.9
12.	$C_9H_{13}NO_3$
	See Sec. 3.7 of Zumdahl, <i>Chemistry</i> .
	$59.0 \text{ g C} * (1 \text{ mol C}/12.01 \text{ g}) = 4.91 \text{ mol C} \quad (\square 0.546) = 9 \text{ mol C}$
	$7.15 \text{ g H} * (1 \text{ mol H}/1.008 \text{ g}) = 7.09 \text{ mol H} \quad (\square 0.546) = 13 \text{ mol H}$
	$26.2 \text{ g O} * (1 \text{ mol O}/16.00 \text{ g}) = 1.64 \text{ mol O} \quad (\square 0.546) = 3 \text{ mol O}$
	$7.65 \text{ g N} * (1 \text{ mol N}/14.01 \text{ g}) = 0.546 \text{ mol N} \quad (\square 0.546) = 1 \text{ mol N}$
	Chapter/Section: 3.7
13.	B
	Chapter/Section: 3.10
14.	D
	Chapter/Section: 3.11
15.	A
	Chapter/Section: 3.11
16.	E
	Chapter/Section: 3.11
17.	molar mass
	Chapter/Section: 3.7
18.	A
	Chapter/Section: 4.2
19.	B
	Chapter/Section: 4.3

20.	A
	Chapter/Section: 4.3
21.	B
	Chapter/Section: 4.3
22.	A
	Chapter/Section: 4.4
23.	D
	Chapter/Section: 4.5
24.	A
	Chapter/Section: 4.5
25.	B
	Chapter/Section: 4.6
26.	a) molecular equation
	$\text{CoCl}_2(aq) + \text{H}_2\text{CO}_3(aq) \rightarrow \text{CoCO}_3(s) + 2\text{HCl}(aq)$
	b) complete ionic equation
	$\text{Co}^{2+}(aq) + 2\text{Cl}^{-}(aq) + \text{H}_2\text{CO}_3(aq) \rightarrow \text{CoCO}_3(s) + 2\text{H}^{+}(aq) + 2\text{Cl}^{-}(aq)$
	c) net ionic equation
	$\text{Co}^{2+}(aq) + \text{H}_2\text{CO}_3(aq) \rightarrow \text{CoCO}_3(s) + 2\text{H}^{+}(aq)$
	d) spectator ion: $\text{Cl}^{-}$
	Chapter/Section: 4.6
27.	B
	Chapter/Section: 4.7
28.	B
	Chapter/Section: 4.7
29.	$\text{H}_2\text{C}_2\text{O}_4(aq) + 2\text{OH}^{-}(aq) \rightarrow 2\text{H}_2\text{O}(l) + \text{C}_2\text{O}_4^{2-}(aq)$
	Note: since oxalic acid is a weak acid, it is a weak electrolyte, and thus is not 100% dissociated in aqueous media.
	Chapter/Section: 4.8
30.	C
	Chapter/Section: 4.8
31.	a) Mn=+4 O=-2
	b) C=+2 O=-2
	c) H=+1 O=-1
	d) C=-4 H=+1
	e) Ca=+2 H=-1
	f) Na=+1 Cr=+6 O=-2
	Chapter/Section: 4.8
32.	C
	Chapter/Section: 4.9

33.	B
	Chapter/Section: 4.9
34.	B
	Chapter/Section: 4.9
35.	A
	Chapter/Section: 4.10
36.	see Buzz for the answer
	Chapter/Section: 4.10
37.	C
	Chapter/Section: 4.10