

## Chemistry1100 Practice Exam 4

**Choose the best answer for questions 1-20. You must show your work for all questions to receive credit. Be sure to include units and correct numbers of significant figures. Calculators cannot be shared.**

pico p $10^{-12}$	nano n $10^{-9}$
micro $\mu$ $10^{-6}$	milli m $10^{-3}$
centi c $10^{-2}$	kilo k $10^3$
mega M $10^6$	giga G $10^9$
NA = $6.022 \times 10^{23}/\text{mol}$	d = m/V

**2 points each for questions 1-20.**

1. How many milliliters of water will overflow from a full container of water if a 66.7 gram sample of vanadium (density = 6.11 g/mL) is carefully placed in the container so there is no splashing, just overflowing?

- a. 11.9 mL
- b. 9.92 mL
- c. 60.6 mL
- d. 10.9 mL
- e. 0.0916 mL

2. The number, 0.0030600, is properly expressed in scientific notation as

- a.  $3.0600 \times 10^{-2}$
- b.  $0.30600 \times 10^{-2}$
- c.  $0.306 \times 10^{-2}$
- d.  $3.06 \times 10^{-3}$
- e.  $3.0600 \times 10^{-3}$

3. A number resulting from a measurement was properly expressed in scientific notation as  $3.170 \times 10^{-2}$  meters. The number could also be correctly written as

- a. 0.0317 m
- b. 0.03170 m
- c. 0.032 m
- d. 317 m
- e. 317.0 m

4. The diameter of an atom was determined and a value of  $2.35 \times 10^{-8}$  cm was obtained. How many nanometers is this?

- a.  $2.35 \times 10^1$  nm
- b.  $2.35 \times 10^{-19}$  nm
- c.  $2.35 \times 10^{-15}$  nm
- d.  $2.35 \times 10^{-1}$  nm
- e.  $2.35 \times 10^{-10}$  nm

5. The atomic mass of chromium is 51.996 g. How many moles of Cr are there in a 5.44 g sample of chromium?

- a. 0.0875 moles
- b. 0.0907 moles
- c. 0.105 moles
- d. 0.220 moles
- e. 2.33 moles

6. What is the mass of a phosphorus sample which contains 0.585 moles of phosphorus atoms?

- a. 17.3 g
- b. 18.1 g
- c. 22.3 g
- d. 26.5 g
- e. 34.2 g

7. The molar mass of  $\text{Ni}(\text{H}_2\text{O})_6\text{Cl}_2$  is

- a. 157.69 g
- b. 193.00 g
- c. 227.61 g
- d. 237.69 g
- e. 296.83 g

8. How many moles of carbon atoms are combined with 11.2 moles of hydrogen atoms in a sample of the compound,  $\text{C}_3\text{H}_8$ ?

- a. 3.00
- b. 5.60
- c. 4.20
- d.  $6.02 \times 10^{23}$
- e. 29.9

9. What is the percent, by mass, of chromium in  $\text{K}_2\text{CrO}_4$ , to the proper number of significant digits?

- a. 26.776 %
- b. 31.763 %
- c. 40.268 %
- d. 42.241 %
- e. 51.996 %

10. Magnetite is a binary compound containing only iron and oxygen. The percent, by weight, of iron is 72.360 %. What is the empirical formula of magnetite?

- a. FeO
- b.  $\text{FeO}_2$
- c.  $\text{Fe}_3\text{O}_4$
- d.  $\text{Fe}_2\text{O}_3$
- e.  $\text{Fe}_2\text{O}_5$

11. A compound has an empirical formula  $\text{CH}_2$ . An independent analysis gave a value of 70 for its molar mass. What is the correct molecular formula?

- a.  $\text{C}_2\text{H}_4$
- b.  $\text{C}_3\text{H}_6$
- c.  $\text{C}_4\text{O}_8$
- d.  $\text{C}_5\text{H}_{10}$
- e.  $\text{C}_5\text{H}_{11}$

12. Given the balanced chemical equation,  $\text{C}_4\text{H}_4 + 5 \text{O}_2 \rightarrow 4 \text{CO}_2 + 2 \text{H}_2\text{O}$ . If 0.3618 moles of  $\text{C}_4\text{H}_4$  are allowed to react with 1.818 moles of  $\text{O}_2$ , and this is the only reaction which occurs, what is the maximum quantity of carbon dioxide that could be produced?

- a. 1.447 moles
- b. 1.454 moles
- c. 1.456 moles
- d. 2.180 moles
- e. 0.3978 moles

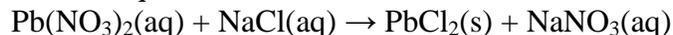
13. Given the balanced chemical equation,  $\text{C}_4\text{H}_4 + 5 \text{O}_2 \rightarrow 4 \text{CO}_2 + 2 \text{H}_2\text{O}$ . If 0.3618 moles of  $\text{C}_4\text{H}_4$  are allowed to react with 1.818 moles of  $\text{O}_2$ , and this is the only reaction which occurs, what is the maximum quantity of water that could be produced?

- a. 11.02 g
- b. 13.04 g
- c. 13.20 g
- d. 19.64 g
- e. 65.50 g

14. An acid-base neutralization is the reaction of

- a.  $\text{H}_2(\text{g})$  with  $\text{O}_2(\text{g})$  to form  $\text{H}_2\text{O}(\text{l})$
- b.  $\text{H}_2(\text{aq})$  with  $\text{OH}^-(\text{aq})$  to form  $\text{H}_2\text{O}(\text{l})$
- c.  $\text{H}^+(\text{aq})$  with  $\text{O}_2(\text{g})$  to form  $\text{H}_2\text{O}(\text{l})$
- d.  $\text{H}^+(\text{aq})$  with  $\text{OH}^-(\text{aq})$  to form  $\text{H}_2\text{O}(\text{l})$
- e.  $\text{Na}^+(\text{aq})$  with  $\text{OH}^-(\text{aq})$  to form  $\text{NaOH}(\text{aq})$

15. The equation for the reaction,



can be written as an ionic equation. In this ionic equation, the spectator ions are

- a.  $\text{Na}^+$  and  $\text{Pb}^{2+}$
- b.  $\text{Na}^+$  and  $\text{Cl}^-$
- c.  $\text{Pb}^{2+}$  and  $\text{Cl}^-$
- d.  $\text{Pb}^{2+}$  and  $\text{NO}_3^-$
- e.  $\text{Na}^+$  and  $\text{NO}_3^-$

16. Which one of the following compounds produces 4 ions per formula unit by dissociation when dissolved in water?

- a.  $\text{K}_2\text{C}_2\text{O}_4$
- b.  $\text{Al}(\text{NO}_3)_3$
- c.  $\text{Hg}_2(\text{NO}_3)_2$
- d.  $\text{NaBrO}_3$
- e.  $\text{Na}_2\text{S}_2\text{O}_3$

17. 66.7 mL of 18.0 molar sulfuric acid solution was dissolved in enough water to make 500 mL of solution. The molarity of the diluted mixture is

- a. 36.0 molar
- b. 0.135 molar
- c. 2.40 molar
- d. 9.00 molar
- e. 0.00741 molar

18. Potassium nitrate,  $\text{KNO}_3$ , has a formula weight of 101.10. What is the molar concentration of a solution prepared by dissolving 7.58 grams of potassium nitrate in enough water to prepare 250 mL of the solution?

- a. 0.0937 molar
- b. 0.300 molar
- c. 1.895 molar
- d. 3.065 molar
- e. 3.34 molar

19. What is the oxidation number of each sulfur atom in the  $\text{S}_2\text{O}_8^{2-}$  ion?

- a. -2
- b. +1
- c. +3
- d. +5
- e. +7

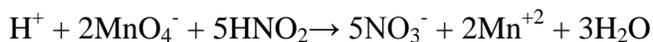
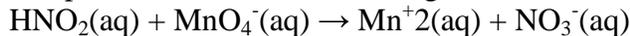
20. In a chemical reaction, zinc metal reacts with nitric acid solution to produce zinc nitrate(in solution), ammonium nitrate (in solution), and water. The species being oxidized in this reaction is

- a.  $\text{HNO}_3(\text{aq})$
- b.  $\text{NH}_4^+(\text{aq})$
- c.  $\text{Zn}^{2+}(\text{aq})$
- d.  $\text{Zn}(\text{s})$
- e.  $\text{Zn}(\text{NO}_3)_2(\text{aq})$

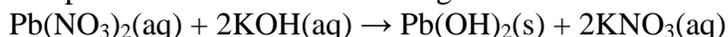
END PART 1. BEGIN PART 2 ON THE NEXT PAGE.

Part 2: Answer all questions and show your work.

1. 6 points. Balance the following reaction in acidic solution.



2. 6 points. Consider the following reaction:



Suppose that 2.500 g of each reactant is added together. Calculate the number of grams of the  $\text{KNO}_3$  that will be produced. Then identify the Limiting Reagent and the Excess Reagent.

**0.0151 mol  $\text{KNO}_3$  from  $\text{Pb}(\text{NO}_3)_2$**  so the lead nitrate is the limiting reagent  
0.0446 mol  $\text{KNO}_3$  from  $\text{KOH}$  so the  $\text{KOH}$  is the excess reagent

**mass of  $\text{KNO}_3 = 1.527 \text{ g}$  from **0.0151 mol****

3. 6 points. A titration between  $\text{KOH}$  and a solution of  $\text{HC}_2\text{H}_3\text{O}_2$  takes place. The concentration of  $\text{KOH}$  is 0.1005 M and 23.05 mL is required to fully neutralize the acetic acid. If 25.00 mL of acetic acid solution is used calculate the mass percent of the acetic acid solution. The density of the acetic acid solution is 1.02 g/mL.

$$\text{mass} = \frac{\text{mass solute} \times 100}{\text{mass solution}}$$

4. 6 points. Consider the following reaction. Write the balanced (a) molecular, (b) complete ionic, (c) net ionic equations. Be sure to include states of matter.

