

**Chemistry 1140 Final Exam**

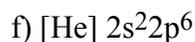
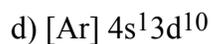
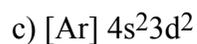
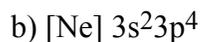
Name \_\_\_\_\_

$R = 0.08206 \text{ L}\cdot\text{atm}/\text{K}\cdot\text{mol}$

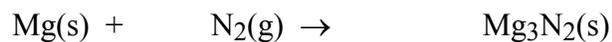
$N = 6.022 \times 10^{23} / \text{mol}$

**All work must be shown to get full credit. Five points will be deducted if a pen is used.**

1. (12 points) Identify the element with each of the following electronic configurations.

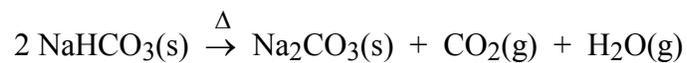


2. (12 points) Balance each reaction. Use the smallest integer coefficients possible.



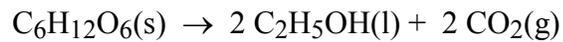
3. (10 points) How many ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) molecules are there in a droplet with a volume of  $52.0 \mu\text{L}$ ? Ethanol has a density of  $0.790 \text{ g/mL}$ .

4. (12 points) Consider the following reaction that you conducted in laboratory.



Calculate the percent yield if  $1.905 \text{ g}$  of sodium bicarbonate produces  $1.156 \text{ g}$  of sodium carbonate.

5. (20 points) Consider the fermentation of glucose:



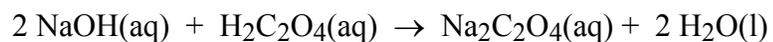
(a) How many kilograms of ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) can be made from  $1.00 \times 10^3$  kg (one metric ton) of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ )?

(b) What volume of carbon dioxide can be produced from  $1.00 \times 10^3$  kg of glucose at a pressure of 742 torr and a temperature of  $18^\circ\text{C}$ ? See the chemical equation above.

6. (10 points) Using the periodic table of elements, complete the following table of neutral isotopes.

isotope	atomic number	mass number	protons	neutrons
$^{11}\text{B}$				
	34	79		
		52	24	

7. (10 points) Consider the reaction between oxalic acid and sodium hydroxide:



If 38.45 mL of a 0.1025 M sodium hydroxide solution is used to titrate 25.00 mL of an oxalic acid solution, what is the molarity of the oxalic acid solution?

8. (10 points) Consider the molecular substances hydrogen fluoride and hydrogen chloride. One has a boiling point of 188.3 K and one has a boiling point of 293.7 K. Which has the higher boiling point? Briefly explain your choice.

9. (10 points) 0.15 g of NaOH is dissolved in 100.0 mL of water.

a) What is  $[\text{OH}^-]$ ?

b) What is pH?

10. (12 points) Name four ways to *increase* the rate of a reaction.

11. (8 points) Bromine is comprised of 60.52%  $^{79}\text{Br}$  (isotopic mass is 78.9243 amu) and 39.48%  $^{81}\text{Br}$  (isotopic mass is 80.9214 amu). Using these values, what is the *atomic* mass of bromine?

12. (8 points) Given that the specific heat of water is  $4.183 \text{ J/g}\cdot^{\circ}\text{C}$ , how many kilojoules of energy is required to heat 1.20 kg of water from  $20.0$  to  $100.0^{\circ}\text{C}$ ?

13. (12 points) Write the chemical formula for each acid.

a) sulfuric acid

b) sulfurous acid

c) lactic acid

d) acetic acid

e) nitric acid

f) nitrous acid

14. (12 pts) Write the name for each substance.



15. (16 points) Write the Lewis dot structures for the following molecules or polyatomic ions. Include nonbonding electron pairs.

a) ammonia

b) carbon disulfide

c) cyanide ion

d) oxygen difluoride

16. (10 points) Convert the density 5.2 ng/mL to units of  $\mu\text{g}/\text{m}^3$ .

17. (6 points) Write the abbreviation of each unit with its proper prefix.

$10^9$  hertz

$10^{-2}$  meter

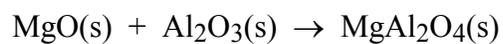
$10^{-9}$  second

$10^{-6}$  gram

$10^{-3}$  mole

$10^3$  joule

18. (10 points) Consider the following reaction:



How many grams of magnesium oxide are required to make 3.000 g of product?

Extra Credit (no more than 10 points) What is the pH of a 0.10 M ascorbic acid solution, given that  $K_a$  for ascorbic acid (Vitamin C) is  $8.0 \times 10^{-5}$ ?