

**Practice Final Exam**  
(25 pts)  
For review on Dec 7, 2016

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10	
<b>TOTAL</b>	

1. (a) (10 pts) Normal air contains about 0.28 g of oxygen per liter. An average human inhales about 0.50 L of air per breath and takes about 20 breaths per minute. How many grams of oxygen does a human inhale per hour?

(b) (10 pts) Find the density of the metal used if a 42.55 g sample added to a graduated cylinder of water raises the level of water by 4.77 mL? (Make sure that your answer has the correct # of significant figures)

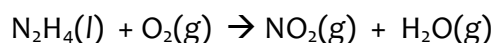
2. (a) Complete the following table:

Element	Atomic Symbol	Z	A	# protons	# neutrons	# electrons
	F <sup>-</sup>					
		83	209			83
Cobalt-60						
				80	119	80
	Sr <sup>2+</sup>				50	

(b) Complete the table below with the missing formula or name:

Ionic or Covalent?	Formula	Name
	P <sub>4</sub> O <sub>8</sub>	
		Strontium bromide
		Carbon tetraiodide
	Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>	
	(NH <sub>4</sub> ) <sub>2</sub> CO <sub>3</sub>	

3. (a) Hydrazine, N<sub>2</sub>H<sub>4</sub>, a substance used as rocket fuel, reacts with oxygen as follows:



How many grams of oxygen are needed to react with 165 g of hydrazine?

(b) The “French paradox” is a phenomenon noted where, despite a high fat diet, there is a relatively low mortality rate from coronary heart disease in France. Researchers have implicated *resveratrol*, a compound found in grapes as having a cardioprotective effect. Chemical analysis of red Bordeaux grapes showed the analytical results as follows:

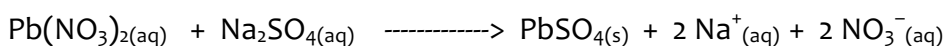
$$\%C = 73.68\%$$

$$\%H = 5.26\%$$

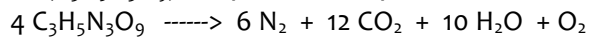
$$\%O = 21.06\%$$

Based on the elemental data, suggest an empirical formula for resveratrol.

4. (a) (10 pts) 15 mL of a 0.07M solution of Pb(NO<sub>3</sub>)<sub>2</sub> is mixed with 9 mL of a 0.15 M solution of Na<sub>2</sub>SO<sub>4</sub>. What is the mass of PbSO<sub>4</sub> that would be expected to precipitate?



**(b) (10 pts)** Nitroglycerin ( $C_3H_5N_3O_9$ ) is a powerful explosive that decomposes as follows:



If 200 g of nitroglycerin react and 6.55 g of oxygen are produced, what is the yield?

5. **(a)** Write electron configurations for the following atomic species:

(i)  $Se^{2-}$

(ii) Sc

(iii) Al

(iv)  $Ca^{2+}$

(v)  $Mn^{2+}$

**(b)** Arrange the atomic species listed in order of increasing size:

(i) Na Al Cl

(ii) Pb Si Sn

(iii) N  $N^{3-}$  C

(c) Arrange the atoms listed in order of decreasing electron affinity:

(i) K Br Ga

(ii) As Sn S

**6.(a)** Sketch Lewis dot structures for the following covalent molecules:

(i)  $BBr_3$

(ii)  $CHCl_3$

(iii)  $CH_2O$

(iv)  $NCl$

(v)  $(CH_2CH_3)_2$

(b) For each of the molecules drawn in part (a), identify the geometry at the underlined atom.

7. (a) Microwaves emit electromagnetic radiation with a wavelength of 12.9 cm. What is the energy associated with microwaves?

(b) How much heat energy is released when 150 g of iron metal reacts with elemental chlorine gas:



8. (a) Hyperbaric oxygen therapy is the use of oxygen gas at level higher than normal atmospheric pressure, which is effective in treating carbon monoxide poisoning. If the chamber has a volume of 200 L, how many grams of oxygen are needed to pressurize the chamber to 3 atm at a temperature of 27°C?

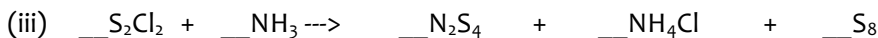
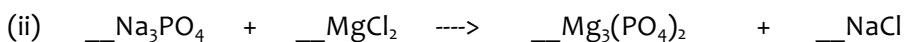
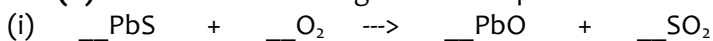
(b) A sample of ammonia gas at 40°C exerts a pressure of 5.3 atm – what is the pressure if the temperature is raised to 100°C?

9. (a) Find the pH of the following solutions:

(i) freshly squeezed lemon juice:  $[\text{H}_3\text{O}^+] = 3.47 \times 10^{-4} \text{ M}$

(b) bleach solution:  $[\text{H}_3\text{O}^+] = 9.96 \times 10^{-12} \text{ M}$

10. (a) Balance the following chemical equations:



(b) For each of the equations in part (a), identify the type of reaction.

### Conversion Factors

1.0 kilogram	2.2 pounds	1000 grams
1.0 kilometers	0.6214 miles	1000 meters
1 meter	39.37 inches	1000 millimeters
1 liter	1.057 quarts	0.264 gallons
1 cm <sup>3</sup>	1 milliliter	0.0338 fluid ounces
$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9$	$^{\circ}\text{F} = (^{\circ}\text{C} \times 1.8) + 32^{\circ}$	$\text{K} = ^{\circ}\text{C} + 273$

### Equations

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

$$c = \lambda \times \nu = 2.9979 \times 10^8 \text{ m/s}$$

$$E = h \nu \quad h = 6.626 \times 10^{-34} \text{ J s}$$

$$\text{Boyle's Law: } P_1V_1 = P_2V_2$$

$$\text{Charles' Law: } \frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\text{Gay-Lussac's Law: } \frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$\text{Combined gas Law: } \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\text{Ideal Gas Law: } pV = nRT$$

$$R = 0.082 \frac{\text{L atm}}{\text{mole K}} = 63.26 \frac{\text{L torr}}{\text{mole K}}$$

$$\text{Dalton's Law of Partial Pressures: } p_T = \sum(p_1 + p_2 + p_3 + \dots)$$

$$[\text{H}_3\text{O}^+][\text{OH}^-] = K_w = 1 \times 10^{-14}$$

$$\text{pH} = -\log_{10}[\text{H}_3\text{O}^+]$$

$$10^{-\text{pH}} = [\text{H}_3\text{O}^+]$$