CHEM 10, Fall 2009 Name KEY

Exam #4 (Chp 8, 11) *100 points total*

25/29

NERUse Scantron to answer questions 1 – 11 (3 pt each). Select only one answer.

Chp 8

1) In a stoichiometry problem, before determining conversion factors, it is necessary to make sure the equation is properly balanced. A) TRUE B) FALSE

2) The limiting reactant is the product that is completely consumed in a chemical reaction.
A) TRUE B) FALSE

3) The percent yield can never be greater than 100%.
A) TRUE B) FALSE

4) How many moles of chlorine gas are needed to make 0.6 moles of sodium chloride?
Given the reaction: $2Na + Cl_2 \rightarrow 2NaCl$
A) 0.6 B) 0.3 C) 1.2 D) 3.6

5) Which of the following statements is FALSE?
A) The limiting reactant is completely consumed in a chemical reaction.
B) The theoretical yield is the amount of product that can be made based on the amount of limiting reagent.
C) The actual yield is the amount of product actually produced by a chemical reaction.
D) The percent yield = $\frac{\text{Actual Yield}}{\text{Theoretical Yield}}$ x 100%
E) All of the above are true statements.

Chp 11

6) As you increase temperature, you increase the average energy of the gas particles.
A) TRUE B) FALSE

7) Gases and liquids are compressible, but solids are not.
A) TRUE B) FALSE

8) As we climb a mountain to a higher altitude, we experience a pressure decrease.
A) TRUE B) FALSE

9) What is the equivalent pressure of 0.905 atm in units of mm Hg?
A) 688 B) 840 C) 0.905 D) 13.3

10) A balloon filled with 0.500 L of air at sea level is submerged in the water to a depth that produces a pressure of 3.25 atm. What is the volume of the balloon at this depth?
A) 1.63 L B) 0.154 L C) 6.50 L D) 0.615 L

11) What is the initial temperature of a gas if the volume changed from 1.00 L to 1.10 L and the final temperature was determined to be 255.0 °C?
A) 480 °C B) -41 °C C) 232 °C D) 207 °C

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{1}{T_1} = \frac{1.10}{255+273} \Rightarrow T_1 = 480\ K - 273 = 207°C$

33 pt

Chp 8

12). (13 pt) Using the following balanced chemical equation, determine which reactant is limiting if you start with 10.0 grams of Al and 19.0 grams of O_2 . Molar masses are Al=26.98 g, O_2=32.00 g, Al_2O_3=101.96 g

Reaction: $4Al + 3O_2 \rightarrow 2Al_2O_3$

smallest

$10\ g\ Al \times \frac{1\ mol\ Al}{26.98\ g} \times \frac{2\ Al_2O_3}{4\ Al} = 0.185\ mol\ Al_2O_3$

$19.0\ g\ O_2 \times \frac{1\ mol\ O_2}{32.00\ g} \times \frac{2\ Al_2O_3}{3\ O_2} = 0.396\ mol\ O_2$

Limiting reactant is Al

13). (4 pt) Calculate the theoretical yield (grams) of aluminum oxide?

$0.185\ mol\ Al_2O_3 \times \frac{101.96\ g\ Al_2O_3}{1\ mol} = 18.8\ g\ Al_2O_3$

in grams

14). (8 pt) Calculate the amount remaining of the excess reactant. Oxygen

$0.185\ mol\ Al_2O_3 \times \frac{3\ O_2}{2\ Al_2O_3} = 0.278\ mol\ O_2$ consumed

$0.278\ mol\ O_2 \times \frac{32.00\ g}{1\ mol} = 8.88\ g\ O_2$ consumed.

$19.0\ g\ O_2 - 8.88\ g\ O_2 = 10.1\ g\ O_2$ remain

15) (11 pt) In the following reaction was done with 8.5 g NH_3 and only 4.5 g of NO was obtained. Calculate the percent yield for this reaction. Reaction: $4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$

molar masses: NH_3 = 17.03 g, O_2 = 32.00 g, NO = 30.01 g, H_2O = 18.02 g

$8.5\ g\ NH_3 \times \frac{1\ mol}{17.03\ g}\ NH_3 \times \frac{4\ NO}{4\ NH_3} \times \frac{30.01\ g\ NO}{1\ mol} =$

$15.0\ g\ NO$ Theo.

$\%\ yield = \frac{act}{Theo} \times 100 = \frac{4.5\ g\ NO}{15.0\ g\ NO} \times 100 = 30.0\%\ yield$

39 pt

16) (7 pt) It is not safe to put aerosol canisters in a campfire, because the pressure inside the canisters gets very high and they can explode. If I have a 1.0 liter canister that holds 2 moles of gas, and the campfire temperature is 1400° C, what is the pressure inside the canister?

atm

$V_1 = 1.0\ L$

$n = 2\ mol$

$T_1 = 1400°C + 273 = 1673\ K$

$PV = nRT$

$P = \frac{nRT}{V} = \frac{2\ (0.0821)\ (1673)}{1\ L} = 275\ atm$

rounded to

300 atm

17) (10 pt) If I place 3 moles of N_2 and 4 moles of O_2 in a 35 L container at a temperature of 25° C, what will the pressure of the resulting mixture of gases be?

mm Hg

$3 + 4 = 7\ mol$ of gas in 35 L @ $25 + 273 = 298\ K$

$P = nRT/V = 7\ (62.4)\ 298 / 35 = 3719\ mm$

rounded 4000 mm

18) (8 pt) What will be the partial pressures of the N_2 and the O_2?

mm Hg

$\frac{3\ mols\ N_2}{7\ mol\ tot} \times 3719\ mm = 1594\ mm$ → 2000 mm N_2

$\frac{4\ mol\ O_2}{7\ mol\ tot} \times 3719\ mm = 2125\ mm$ → 2000 mm O_2

19) (10 pt) A sample of helium gas initially at 37.0 °C, 785 torr and 2.00 L was heated to 58.0 °C while the volume expanded to 3.24 L. What is the final pressure in atm?

$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ $\frac{785\ torr\ (2.00)}{37.0 + 273} = \frac{P_2\ (3.24\ L)}{58.0 + 273}$

$P_2 = \frac{785 \times 2 \times (58.0 + 273)}{(37.0 + 273)\ (3.24)} = 517\ torr$

$517\ torr \times \frac{1\ atm}{760\ torr} =$ 0.681 atm

35 pt