Second - Midterm Exam

Name:	Student ID No:

Choose the correct choice and write your answer in the table below

1) How many phosphate ions are present in 3.01×10^{23} formula units of $Cu_3(PO_4)_2$?

(A) 2 ions (B) 3 ions (C) 6.02×10^{23} ions (D) 1.2×10^{24} ions

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2) A gas sample contains 16.0 g of CH_4 and 16.0 g of O_2. What is the total number of moles of the gas in the sample?

CH_4 $\frac{16g}{16} = 1\ mol$ O_2 $\frac{16g}{32} = 0.5\ mol$

(A) 0.500 mol (B) 15.0 mol (C) 1.50 mol (D) 1.00 mol

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3) How many moles of chloride ions are present in a 66.7g sample of $AlCl_3$? $66.7\ g\ AlCl_3 \times \frac{1\ mol\ AlCl_3}{133.33\ g} \times \frac{3\ mol\ Cl}{1\ mol\ AlCl_3} =$

(A) 1.0 mol (B) 1.33 mol (C) 2.0 mol (D) 1.5 mol

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4) How many oxygen atoms are there in 22.0 g of CO_2?

$22\ g\ CO_2 \times \frac{1\ mol\ CO_2}{44\ g\ CO_2} \times \frac{2\ mol\ O}{1\ mol\ CO_2} \times \frac{6.022 \times 10^{23}\ atom\ O}{1\ mol\ O} =$

(A) 1.42×10^{24} atoms
(B) 6.02×10^{23} atoms
(C) 1.20×10^{24} atoms
(D) 5.09×10^{23} atoms

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5) The empirical formula for an oxide of nitrogen that is 30.4% by mass nitrogen is

N	O
$\frac{30.4g}{14}$	$\frac{69.6g}{16}$
2.17	4.35 mol
$\frac{2.17}{2.17}$	$\frac{4.35}{2.17}$
1	2

(A) NO (B) NO_2 (C) N_2O (D) NO_4

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6) A compound has an empirical formula of C_2H_4O. An independent analysis gave a value of 132 g for its molar mass. What is the molecular formula of the compound?

(A) $C_4H_4O_5$ (B) $C_{10}H_{12}$ (C) C_7O_3 (D) $C_6H_{12}O_3$

empirical molar mass $= 44 \Rightarrow \frac{132}{44} = 3$

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7) Consider the following reaction:

$$3A + 2B \rightarrow A_3B_2$$

Which of the following is a correct interpretation of this equation?

I. 3 grams of A react with 2 grams of B to form 1 gram of A_3B_2.
II. 3 atoms of A react with 2 atoms of B to form 1 molecule of A_3B_2.
III. 3 moles of A react with 2 moles of B to form 1 mole of A_3B_2.

(A) I only
(B) II only
(C) III only
(D) II and III

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8) When the following equation is balanced, the coefficients from left to right are _____

$$C_8H_{18} + O_2 \rightarrow CO_2 + H_2O$$

(A) 2, 3, 4, 4
(B) 1, 4, 8, 9
(C) 4, 4, 32, 36
(D) 2, 25, 16, 18

$\rightarrow 8CO_2 + 9H_2O$

$\frac{25}{2}O_2 \rightarrow$

$2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

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9) $$S_8(s) + 24F_2(g) \rightarrow 8SF_6(g)$$

If you need 2.50 moles of SF_6, you will need to use _____

(A) 0.313 moles of S_8 and 7.50 moles of F_2
(B) 0.313 moles of S_8 and 3.00 moles of F_2
(C) 0.125 moles of S_8 and 7.50 moles of F_2
(D) 0.125 moles of S_8 and 3.00 moles of F_2

$2.5\ mol\ SF_6 \times \frac{24\ mol\ F_2}{8\ mol\ SF_6} = 7.5\ mol\ F_2$

$2.5\ mol\ SF_6 \times \frac{1\ mol\ S_8}{8\ mol\ SF_6} = 0.313\ mol\ S_8$

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10) An element "X" combines with oxygen to form XO_2. If 13.4 g of this element combines with 7.8 g of O_2, therefore the molar mass of X is _____

$X + O_2 \rightarrow XO_2$

13.4g 7.8g

?? 32 g/mol

(A) 83.5 g/mol (B) 54.9 g/mol (C) 47.2 g/mol (D) 37.5 g/mol

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11) The molar volume of a gas at STP is _____

(A) 22.4 L (B) 22.4 mL (C) 2.24 L (D) 44.8 L

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12) The volume occupied by 88.02 g of CO_2 at 6.54 atm and 75 °C is _____

(A) 8.74×10^3 mL
(B) 1.88×10^3 mL
(C) 8.74×10^{-3} mL
(D) 8.74 mL

$PV = nRT \Rightarrow V = \frac{nRT}{P} = \frac{(2) \times 0.0821 \times 348.15}{6.54} = 8.74\ L$

$= 8.74 \times 10^3\ L$

$\frac{88.02}{44}$

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13) The combustion of butane (C_4H_{10}) is shown in the equation below

$$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$$

What is the volume of O_2 required for the complete combustion of 12.9 L of C_4H_{10} at constant temperature and pressure?

$\frac{V_1}{n_1} = \frac{V_2}{n_2}$

$\frac{12.9}{2} = \frac{V_2}{13}$

$V_2 = \frac{13 \times 12.9}{2} =$

(A) 0.99 L (B) 1.01 L (C) 1.98 L (D) 83.85 L

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14) The pressure of a mixture of N_2, CO_2, and O_2 is 150 kPa. If the partial pressures of N_2 and CO_2 are 100 kPa and 24 kPa , respectively, the partial pressure of O_2 in this gaseous mixtures is _____

$P_{O_2} = 150 - (100 + 24) = 26\ kPa$

$26\ kPa \times \frac{1000\ Pa}{1\ kPa} \times \frac{1\ atm}{101325\ Pa} =$

(A) 26.0 atm (B) 2.60×10^{-1} atm (C) 2.74×10^2 atm (D) 2.63×10^3 atm

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15) H_2 gas generated when Ca metal reacts with water. If the volume of H_2 gas collected at 25 °C and pressure of 988 mmHg is 461 mL, what is the mass of the H_2 gas obtained? (The pressure of water vapor at 25 °C is 23.76 mmHg)?

(A) 9.6×10^2 g (B) 3.3×10^{-2} g (C) 6.7×10^{-2} g (D) 4.78×10^{-2} g

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$P_{H_2} = 988 - 23.76 = 964.24\ mmHg \times \frac{1\ atm}{760\ mmHg} =$

$T = 298.15\ K,\ V = 0.461\ L,\ M = 2$