Chapter Three

Stoichiometry

Question 1

Indium has atomic number 49 and atomic mass 114.8 g. Naturally occurring indium contains a mixture of indium-112 and indium-115, respectively, in an atomic ratio of **approximately**

a) 7:93.
b) 25:75.
c) 50:50.
d) 75:25.
e) 93:7.

Question 2

The element oxygen consists of three naturally occurring isotopes: ^{16}O, ^{17}O, and ^{18}O. The atomic mass of oxygen is 16.0 amu. What can be implied about the relative abundances of these isotopes?

A) More than 50% of all O atoms are ^{17}O.

B) Almost all O atoms are ^{18}O.

C) Almost all O atoms are ^{17}O.

D) The isotopes all have the same abundance, i.e. 33.3%.

E) The abundances of ^{17}O and ^{18}O are very small.

Question 3

What is the average mass of one S atom?

A) 32.07 g

B) 5.32×10^{-23} amu

C) 32.07 amu

D) 1.93×10^{25} g

E) 32.07 g/mol

Question 4

What is the mass of 3.50×10^{24} Ti atoms?

A) 47.9 amu

B) 47.9 g

C) 5.81 g

D) 278 g

E) 5.81 amu

Question 5

How many Cl atoms are in 0.0728 g of PCl_3?

A) 4.38×10^{22} Cl atoms

B) B) 1.32×10^{23} Cl atoms

C) 3.19×10^{20} Cl atoms

D) 9.58×10^{20} Cl atoms

E) 1.81×10^{24} Cl atom

Question 6

You have a sample of zinc (Zn) and a sample of aluminum (Al). Each sample contains the same number of atoms. Which of the following statements concerning the masses of the samples is true?

A. The mass of the zinc sample is more than twice as great as the mass of the aluminum sample.
B. The mass of the zinc sample is more than the mass of the aluminum sample, but it is not twice as great.
C. The mass of the aluminum sample is more than twice as great as the mass of the zinc sample.
D. The mass of the aluminum sample is more than the mass of the zinc sample, but it is not twice as great.
E. The masses of the two samples are equal.

Question 7

Which of the following 100.0-g samples contains the greatest number of atoms?

A. Magnesium
B. Zinc
C. Silver
D. Calcium
E. All samples contains the same number of atoms.

Question 8

For which of the following compounds does 1.0 g represent 2.27×10^{-2} mol?

a) H_2O

b) CO_2

c) NH_3

d) C_2H_6

Question 9

The mass of 0.82 mol of a diatomic molecule is 131.3 g. Identify the molecule.

a) F_2

b) Cl_2

c) Br_2

d) I_2

Question 10

Which of the following 100.0-g samples contains the greatest number of oxygen atoms?

A. H_2O
B. N_2O
C. $C_3H_6O_2$
D. CO_2
E. All of the samples have the same number of oxygen atoms.

Question 11

The empirical formula of styrene is CH; its molar mass is 104.1. What is the molecular formula of styrene?

a) C_2H_4
b) C_8H_8
c) $C_{10}H_{10}$
d) C_6H_6

Question 12

Calculate the mass of O in 4.36 g of Cl_2O_7?

A) 30.5 g O
B) 48.8 g O
C) 11.2 g O
D) 69.8 g O
E) 2.67 g O

Question 13

An unknown compound with a molar mass of 223.94 g/mol consists of 32.18% C, 4.50% H, and 63.32% Cl. Find the molecular formula for the compound.

A) CHCl

B) $C_6H_{10}Cl_4$

C) $C_3H_5Cl_2$

D) $C_9H_{15}Cl_6$

E) $C_6H_{10}Cl_2$

Question 14

When the equation

$$NH_3 + O_2 \rightarrow NO + H_2O$$

is balanced with the smallest set of integers, the sum of the coefficients is

a) 4
b) 12
c) 14
d) 19
e) 24

Question 15

What is the coefficient for O_2 when the following combustion reaction of a fatty acid is properly balanced?

$$\_\_\ C_{18}H_{36}O_2 + \_\_\ O_2 \xrightarrow{\text{®}} \_\_\ CO_2 + \_\_\ H_2O$$

A) 1
B) 8
C) 9
D) 26
E) 27

Question 16

Lithium metal reacts with nitrogen gas to form lithium nitride. Identify the balanced reaction that describes this process.

A) $Li + N \rightarrow LiN$

B) $6Li + N_2 \rightarrow 2Li_3N$

C) $Li + N_2 \rightarrow LiN_2$

D) $2Li + N_2 \rightarrow 2LiN$

E) $2Li + N_2 \rightarrow Li_2N_2$

Question 17

How many of the following statements are true concerning balanced chemical equations?

i. The number of molecules is conserved.

ii. Coefficients indicate mass ratios of the substances involved.

iii. Atoms are neither created nor destroyed.

iv. The sum of the coefficients on the left side equals the sum of the coefficients on the right side.

a) 0 b) 1 c) 2 d) 3 e) 4

Question 18

The limiting reactant in a reaction

a) has the smallest coefficient in a balanced equation.

b) is the reactant for which you have the fewest number of moles.

c) has the lowest ratio of [moles available/ coefficient in the balanced equation].

d) has the lowest ratio of [coefficient in the balanced equation/moles available].

e) none of these

Question 19

Ammonia reacts with oxygen to form nitric oxide and water vapor:

$$4NH_3 + 5O_2 \text{ ® } 4NO + 6H_2O$$

When 40.0 g NH_3 and 50.0 g O_2 are allowed to react, which is the limiting reagent?

A) NH_3
B) O_2
C) NO
D) H_2O
E) No reagent is limiting.

Question 20

Phosphorus pentachloride reacts with water to form hydrochloric acid and phosphoric acid. How many total moles of acid are formed when starting with 4.5 g of PCl_5 and excess H_2O?

$$PCl_5 + 4H_2O \text{ ® } 5HCl + H_3PO_4$$

A) 0.022 moles
B) 0.12 moles
C) 0.13 moles
D) 27 moles
E) 23 moles

Question 21

The reaction of 44.1 g of Cr_2O_3 with 35.0 g of Al produced 25.6 g of Cr. What is the percent yield for this reaction?

$$2Al + Cr_2O_3 \rightarrow Al_2O_3 + 2Cr$$

A) 37.9 %

B) 58.0 %

C) 73.1 %

D) 84.9%

E) 100. %

Question 22

A 1.375 g sample of mannitol, a sugar found in seaweed, is burned completely in oxygen to give 1.993 g of carbon dioxide and 0.9519 g of water. The empirical formula of mannitol is

A) CHO
B) CH_7O_3
C) C_3H_2O
D) $C_3H_7O_3$
E) CH_2O

Question 23

The first step in the Ostwald process for producing nitric acid is

$$4NH_3(g) + 5O_2(g) \text{ ® } 4NO(g) + 6H_2O(g).$$

If the reaction of 150. g of ammonia with 150. g of oxygen gas yields 87. g of nitric oxide (NO), what is the percent yield of this reaction?

A) 33%
B) 49%
C) 62%
D) 77%
E) 100%