

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) 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. $\text{C}_3\text{H}_6\text{O}_2$
- 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



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?



- 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) $\text{Li} + \text{N} \rightarrow \text{LiN}$
- B) $6\text{Li} + \text{N}_2 \rightarrow 2\text{Li}_3\text{N}$
- C) $\text{Li} + \text{N}_2 \rightarrow \text{LiN}_2$
- D) $2\text{Li} + \text{N}_2 \rightarrow 2\text{LiN}$
- E) $2\text{Li} + \text{N}_2 \rightarrow \text{Li}_2\text{N}_2$

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:



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 ?



- 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?



- 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) $\text{C}_3\text{H}_2\text{O}$
- D) $\text{C}_3\text{H}_7\text{O}_3$
- E) CH_2O

Question 23

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



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%