Some Basic Concepts of Chemistry: Chapter Introduction

One drop of water holds about 1.7 × 10^{21} molecules. The chapter shows how chemists measure matter and count its particles with the mole.

Name: Date: Score: ____ / 21

A. Fill in the blanks

1. One mole contains ____ particles.

2. A pure substance made of only one kind of atom is an ____.

3. Lavoisier showed that in a chemical reaction mass is neither created nor ____.

4. Working out the amounts of reactants and products from a balanced equation is called ____.

5. Dalton said that all matter is made of ____.

B. True or False

6. Air is a compound. True / False

7. Water is a compound. True / False

8. In a chemical reaction the total mass of the products equals the total mass of the reactants. True / False

9. One mole of every substance has the same mass. True / False

C. Assertion and reason

10. Assertion (A): The mole is a counting unit.
Reason (R): One mole always means 6.022 × 10^{23} entities, just as one dozen means 12.

(a) Both A and R are true, and R explains A
(b) Both A and R are true, but R does not explain A
(c) A is true, R is false
(d) A is false, R is true

Answer: _____

11. Assertion (A): Burning paper appears to lose mass.
Reason (R): Mass is destroyed when a substance burns.

(a) Both A and R are true, and R explains A
(b) Both A and R are true, but R does not explain A
(c) A is true, R is false
(d) A is false, R is true

Answer: _____

D. Choose the correct option

12. Which of these is a mixture?

(a) water
(b) oxygen
(c) air
(d) carbon dioxide

Answer: _____

13. One mole of particles is:

(a) 6.022×10^{23} (b) 6.022×10^{22}

(c) 12 (d) 1000

Answer: _____

14. In $2H_2 + O_2 \rightarrow 2H_2O$, how many moles of O_2 react with 4 mol of H_2?

(a) 1 (b) 2

(c) 4 (d) 8

Answer: _____

15. Who proposed the atomic theory in 1808?

(a) Lavoisier (b) Dalton

(c) Avogadro (d) Proust

Answer: _____

E. Numerical problems

16. How many molecules are in one drop of water (0.05 g, molar mass 18 g mol^{-1})?

17. In $2H_2 + O_2 \rightarrow 2H_2O$, how many moles of water form from 4 mol of H_2?

18. Find the molar mass of water (H = 1, O = 16).

F. Short answer questions

19. What is the chapter Some Basic Concepts of Chemistry about?

20. Why do chemists need the mole?

G. Match the columns

21. Match each item in Column A with the correct item in Column B.

Column A	Column B	Your answer
1. Air	(a) Element	1 → ____
2. Water	(b) One mole	2 → ____
3. Oxygen	(c) Compound	3 → ____
4. 6.022×10^{23}	(d) Mixture	4 → ____

Detailed solutions

1. 6.022×10^{23}

2. element

3. destroyed

4. stoichiometry

5. atoms

6. False. Air is a mixture: its gases keep their own properties and their proportion can vary.

7. True. Hydrogen and oxygen are combined in a fixed ratio.

8. True. This is the law of conservation of mass.

9. False. One mole always has the same number of particles, but molar masses differ.

10. (a) R explains why the mole counts particles.

11. (c) A is true because the gases formed escape; R is false: mass is conserved.

12. (c) air. Air is a mixture of gases.

13. (a) 6.022×10^{23}. This is the Avogadro constant.

14. (b) 2. $H_2 : O_2 = 2 : 1$, so 4 mol H_2 needs 2 mol O_2.

15. (b) Dalton. John Dalton, building on the laws of chemical combination.

16. $n = 0.05 \div 18 = 2.78 \times 10^{-3}$ mol; $N = 2.78 \times 10^{-3} \times 6.022 \times 10^{23}$. **Answer: about 1.7×10^{21} molecules**

17. $H_2 : H_2O = 2 : 2 = 1 : 1$. **Answer: 4 mol of H_2O**

18. $2 \times 1 + 16$. **Answer: 18 g mol^{-1}**

19. Matter and its kinds, measurement (SI units, significant figures), the laws of chemical combination that led to Dalton's atoms, the mole concept and stoichiometry: chemistry as counting particles.

20. Atoms are too small and too many to count one by one, so they are counted in groups of 6.022×10^{23}, just as eggs are counted in dozens.

21. 1 → (d), 2 → (c), 3 → (a), 4 → (b). Elements have one kind of atom, compounds a fixed combination, mixtures any proportion; a mole is a fixed number of particles.