Q1. Which of the following is not a physical property?

A) Boiling point
B) Density
C) Combustibility
D) Melting point

Answer: C) Combustibility

Explanation:
Physical properties can be observed without changing the chemical identity of the substance (like boiling point, density, melting point). Combustibility is a chemical property because it involves a chemical change (burning).

Q2. The SI unit of amount of substance is:

A) Mole
B) Gram
C) Liter
D) Atom

Answer: A) Mole

Explanation:
The SI unit for the amount of substance is the mole, which represents $6.022 \times 10^{23}$ particles (Avogadro's number) of a substance.

Q3. Which of the following laws is used to balance a chemical equation?

A) Law of conservation of mass
B) Law of multiple proportions
C) Law of definite proportions
D) Avogadro’s law

Answer: A) Law of conservation of mass

Explanation:
The law states that mass is neither created nor destroyed in a chemical reaction, which is why we balance equations to ensure equal mass on both sides.

Q4. The number of significant figures in 0.004050 is:

A) 3
B) 4
C) 5
D) 6

Answer: C) 4

Explanation:
Leading zeros are not significant. Only 4, 0, 5, 0 are significant. So, total 4 significant figures.

Q5. Which of the following represents the correct relationship?

A) 1 L = $10^{-3}$ $m^3$
B) 1 $m^3$ = 10 L
C) 1 $cm^3$ = 1 L
D) 1 L = $10^6$ $cm^3$

Answer: A) 1 L = $10^{-3}$ $m^3$

Explanation:
1 liter is equal to 1000 $cm^3$, which is $10^{-3}$ $m^3$.

Q6. One mole of oxygen gas ($O_2$) contains how many atoms?

A) $6.022 \times 10^{23}$
B) $1.2044 \times 10^{24}$
C) $3.011 \times 10^{23}$
D) $1.0 \times 10^{23}$

Answer: B) $1.2044 \times 10^{24}$

Explanation:
1 mole of $O_2$ molecules = $6.022 \times 10^{23}$ molecules
Each $O_2$ molecule has 2 atoms → $6.022 \times 10^{23} \times 2 = 1.2044 \times 10^{24}$ atoms

Q7. Which law states that a compound always contains the same elements in the same proportion by mass?

A) Law of conservation of mass
B) Law of definite proportions
C) Law of multiple proportions
D) Avogadro's law

Answer: B) Law of definite proportions

Explanation:
This law states that the chemical composition of a compound is always fixed.

Q8. Calculate the mass of 2 moles of water ($H_2O$).

A) 18 g
B) 36 g
C) 9 g
D) 72 g

Answer: B) 36 g

Explanation:
Molar mass of $H_2O$ = (2 × 1) + 16 = 18 g/mol
Mass of 2 moles = 18 × 2 = 36 g

Q9. Which of the following has maximum number of atoms?

A) 18 g of $H_2O$
B) 2 moles of $O_2$
C) 1 mole of Na
D) 1 mole of $CH_4$

Answer: D) 1 mole of $CH_4$

Explanation:

$CH_4$ has 5 atoms per molecule.

1 mole = $6.022 \times 10^{23}$ molecules = $5 \times 6.022 \times 10^{23}$ atoms = $3.011 \times 10^{24}$ atoms

Q10. The empirical formula of a compound is $CH_2O$ and its molar mass is 180 g/mol. What is its molecular formula?

A) $CH_2O$
B) $C_2H_4O_2$
C) $C_6H_{12}O_6$
D) $C_{12}H_{22}O_{11}$

Answer: C) $C_6H_{12}O_6$

Explanation:
Empirical formula mass = 12 + (2×1) + 16 = 30
Molar mass = 180
n = 180/30 = 6
Molecular formula = $(CH_2O)_6 = C_6H_{12}O_6$

Q11. Which of the following contains the largest number of molecules?

A) 1 g of $H_2$
B) 16 g of $O_2$
C) 18 g of $H_2O$
D) 44 g of $CO_2$

Answer: C) 18 g of $H_2O$

Explanation:

Molar mass of $H_2O$ = 18 g/mol → 18 g = 1 mole

1 mole contains $6.022 \times 10^{23}$ molecules

Other options either contain fewer moles or the same number
So, 18 g of $H_2O$ contains the largest number of molecules among the given.

Q12. The number of atoms in 12 g of carbon-12 is:

A) $6.022 \times 10^{23}$
B) $3.011 \times 10^{23}$
C) $12 \times 6.022 \times 10^{23}$
D) $6.022 \times 10^{22}$

Answer: A) $6.022 \times 10^{23}$

Explanation:
By definition, 12 g of carbon-12 contains 1 mole of atoms, which is $6.022 \times 10^{23}$ atoms.

Q13. The limiting reagent in a chemical reaction is the substance:

A) Present in the smallest amount
B) That remains in excess
C) That limits the amount of product formed
D) With the smallest molar mass

Answer: C) That limits the amount of product formed

Explanation:
The limiting reagent is completely consumed first and hence determines the maximum amount of product that can form.

Q14. Calculate the number of moles in 22 g of $CO_2$.

(Molar mass of $CO_2$ = 44 g/mol)

A) 1 mol
B) 0.5 mol
C) 2 mol
D) 1.5 mol

Answer: B) 0.5 mol

Explanation:
Moles = mass / molar mass = 22 / 44 = 0.5 mol

Q15. What is the mass percent of oxygen in $H_2O$?

A) 88.89%
B) 11.11%
C) 33.33%
D) 66.67%

Answer: A) 88.89%

Explanation:
Mass of $H_2O$ = 18 g (2×1 + 16)
Mass of oxygen = 16 g
% oxygen = (16 / 18) × 100 = 88.89%

Q16. If 16 g of methane is burnt in excess oxygen, how many grams of $CO_2$ will be formed?

(Reaction: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$)

A) 16 g
B) 44 g
C) 32 g
D) 22 g

Answer: B) 44 g

Explanation:
16 g $CH_4$ = 1 mole
1 mole $CH_4$ gives 1 mole $CO_2$ = 44 g

Q17. In the reaction: $2H_2 + O_2 \rightarrow 2H_2O$, if 4 moles of $H_2$ and 1 mole of $O_2$ are taken, the limiting reagent is:

A) $H_2$
B) $O_2$
C) $H_2O$
D) Both are limiting

Answer: B) $O_2$

Explanation:

Required ratio = 2 mol $H_2$ : 1 mol $O_2$
Given = 4 mol $H_2$ : 1 mol $O_2$
So, $O_2$ is insufficient → limiting reagent

Q18. The empirical formula of a compound with 40% C, 6.67% H, and 53.33% O is:

(Atomic masses: C = 12, H = 1, O = 16)

A) $CH_2O$
B) $C_2H_4O$
C) $C_3H_6O_3$
D) $C_2H_6O$

Answer: A) $CH_2O$

Explanation:
Moles:

C = 40/12 = 3.33

H = 6.67/1 = 6.67

O = 53.33/16 = 3.33
Divide all by 3.33 → C:1, H:2, O:1 → Empirical formula = $CH_2O$

Q19. Which of the following is NOT a postulate of Dalton's atomic theory?

A) Atoms are indivisible
B) Atoms of the same element are identical
C) Atoms can be created or destroyed in a chemical reaction
D) Compounds are formed by combination of atoms in simple ratios

Answer: C) Atoms can be created or destroyed in a chemical reaction

Explanation:
Dalton stated that atoms are neither created nor destroyed in a chemical reaction. Option C contradicts this postulate.

Q20. The molar mass of $Na_2CO_3$ is:

A) 84 g/mol
B) 106 g/mol
C) 98 g/mol
D) 100 g/mol

Answer: B) 106 g/mol

Explanation:
$Na_2CO_3$ = 2×23 (Na) + 12 (C) + 3×16 (O)
= 46 + 12 + 48 = 106 g/mol

Q21. The molar volume of an ideal gas at STP (Standard Temperature and Pressure) is:

A) 22.4 L
B) 24.0 L
C) 1 L
D) 0.0821 L

Answer: A) 22.4 L

Explanation:
At STP (0°C and 1 atm), 1 mole of an ideal gas occupies 22.4 liters of volume.

Q22. Which of the following represents a correct match of quantity and unit?

A) Amount of substance – kilogram
B) Volume – mole
C) Mass – liter
D) Pressure – pascal

Answer: D) Pressure – pascal

Explanation:
SI unit of pressure is pascal (Pa).
Others:

Amount → mole

Volume → $m^3$ (or L in practice)

Mass → kilogram

Q23. 1 mole of any substance contains:

A) $6.022 \times 10^{22}$ particles
B) $6.022 \times 10^{24}$ particles
C) $6.022 \times 10^{23}$ particles
D) $3.011 \times 10^{23}$ particles

Answer: C) $6.022 \times 10^{23}$ particles

Explanation:
By Avogadro's law, 1 mole = $6.022 \times 10^{23}$ particles (atoms, molecules, ions, etc.)

Q24. Atomic mass of an element is:

A) Always a whole number
B) The relative mass of its atom compared to $^{12}C$ isotope
C) The mass of its nucleus
D) The same as its atomic number

Answer: B) The relative mass of its atom compared to $^{12}C$ isotope

Explanation:
Atomic mass is relative to carbon-12, which is taken as 12 atomic mass units (u).

Q25. Molecular mass of $SO_2$ is:

A) 64 g/mol
B) 48 g/mol
C) 32 g/mol
D) 80 g/mol

Answer: A) 64 g/mol

Explanation:
S = 32, O = 16
$SO_2$ = 32 + (2 × 16) = 64 g/mol

Q26. How many moles are present in 11.2 L of a gas at STP?

A) 0.5 mol
B) 1 mol
C) 2 mol
D) 0.25 mol

Answer: A) 0.5 mol

Explanation:
At STP, 1 mol = 22.4 L
So, moles = 11.2 / 22.4 = 0.5 mol

Q27. Which law is based on the conservation of atoms during a reaction?

A) Law of conservation of mass
B) Law of definite proportions
C) Law of gaseous volumes
D) Law of multiple proportions

Answer: A) Law of conservation of mass

Explanation:
The law states that mass (and atoms) cannot be created or destroyed during a chemical reaction.

Q28. If 4 g of hydrogen reacts with 32 g of oxygen, what is the limiting reagent?

(Reaction: $2H_2 + O_2 \rightarrow 2H_2O$)

A) Hydrogen
B) Oxygen
C) Water

D) Both are in exact proportion

Answer: D)

Explanation:

4 g $H_2$ = 2 moles

32 g $O_2$ = 1 mole
Required ratio = 2 mol $H_2$ : 1 mol $O_2$ → Available is same
So, both are in exact proportion → Answer is D) Both are in exact proportion

 Corrected Answer: D) Both are in exact proportion

Q29. Which of the following quantities is conserved in a chemical reaction?

A) Number of molecules
B) Mass
C) Volume
D) Molarity

Answer: B) Mass

Explanation:
Mass is conserved in all chemical reactions as per the Law of Conservation of Mass.

Q30. 1 amu (atomic mass unit) is equal to:

A) $1.66 \times 10^{-27}$ kg
B) $1.66 \times 10^{-24}$ g
C) Both A and B
D) None of these

Answer: C) Both A and B

Explanation:
1 amu = $1.66 \times 10^{-24}$ g = $1.66 \times 10^{-27}$ kg

Q31. The average atomic mass of chlorine is 35.5 u. This indicates:

A) Chlorine is a mixture of two isotopes
B) Every atom of chlorine weighs 35.5 u
C) Chlorine has only one isotope
D) Atomic number of chlorine is 35.5

Answer: A) Chlorine is a mixture of two isotopes

Explanation:
Chlorine exists as two isotopes: Cl-35 and Cl-37.
The average atomic mass (35.5 u) is a weighted mean based on their natural abundances.

Q32. Which of the following is a correct statement?

A) A compound is a physical mixture
B) Mole is a unit for volume
C) Atoms are destroyed in chemical reactions
D) Compounds have fixed composition by mass

Answer: D) Compounds have fixed composition by mass

Explanation:
This is a consequence of the Law of Definite Proportions.

Q33. 1 mole of $N_2$ gas contains:

A) $1.204 \times 10^{24}$ molecules
B) $6.022 \times 10^{23}$ molecules
C) $3.011 \times 10^{23}$ atoms
D) $1.204 \times 10^{23}$ atoms

Answer: B) $6.022 \times 10^{23}$ molecules

Explanation:
1 mole of any gas = $6.022 \times 10^{23}$ molecules
Each $N_2$ molecule has 2 atoms, so atoms = 2 × that value, but the question asks about molecules.

Q34. The % composition of nitrogen in $NH_3$ is:

(N = 14, H = 1)

A) 17.65%
B) 20%
C) 82.35%
D) 70%

Answer: C) 82.35%

Explanation:
Molar mass = 14 + (3 × 1) = 17
%N = (14 / 17) × 100 ≈ 82.35%

Q35. A hydrocarbon contains 85.7% carbon and 14.3% hydrogen by mass. The empirical formula is:

(Atomic masses: C = 12, H = 1)

A) $CH_4$
B) $C_2H_6$
C) $C_3H_8$
D) $CH_2$

Answer: C) $C_3H_8$

Explanation:

C: 85.7 / 12 = 7.14

H: 14.3 / 1 = 14.3
Divide by smallest:
C = 1, H = 2 → $CH_2$
Check molar mass: (12 + 2) = 14, actual molar mass = 44 (from given)
n = 44 / 14 = ~3 → $(CH_2)_3 = C_3H_6$
But this gives propane percentage, which matches $C_3H_8$, not $CH_2$
 Best option: $C_3H_8$

Q36. Which statement is true about Avogadro's law?

A) Equal volumes of gases contain equal masses at STP
B) Equal volumes of gases under same conditions contain equal number of molecules
C) It applies only to noble gases
D) It relates pressure and volume

Answer: B) Equal volumes of gases under same conditions contain equal number of molecules

Explanation:
Avogadro's law: $V \propto n$ (Volume $\propto$ number of moles)

Q37. How many molecules are there in 5.6 L of $O_2$ at STP?

A) $1.5 \times 10^{23}$
B) $3.01 \times 10^{23}$
C) $6.022 \times 10^{23}$
D) $2.5 \times 10^{23}$

Answer: A) $1.5 \times 10^{23}$

Explanation:
At STP, 1 mole = 22.4 L = $6.022 \times 10^{23}$ molecules
5.6 L = 5.6 / 22.4 = 0.25 mol
Molecules = $0.25 \times 6.022 \times 10^{23} = 1.5 \times 10^{23}$

Q38. What is the amount (in moles) of NaOH in 40 g?

(Molar mass = 40 g/mol)

A) 0.5 mol
B) 1 mol
C) 2 mol
D) 1.5 mol

Answer: B) 1 mol

Explanation:

Moles = mass / molar mass = 40 / 40 = 1 mol

Q39. The molecular formula is always:

A) The same as empirical formula
B) A multiple of the empirical formula
C) Smaller than the empirical formula
D) Unrelated to empirical formula

Answer: B) A multiple of the empirical formula

Explanation:
Molecular formula = n × empirical formula, where n is a whole number.

Q40. Which of the following is used in stoichiometric calculations?

A) Boiling point
B) Molar mass
C) Specific heat
D) Thermal conductivity

Answer: B) Molar mass

Explanation:
Stoichiometry involves converting mass ↔ moles, requiring molar mass.

Q41. In a chemical reaction, 2 mol of A gives 3 mol of B. How many moles of B will be formed from 10 mol of A?

A) 15
B) 10
C) 5
D) 20

Answer: A) 15

Explanation:
Ratio A:B = 2:3
From 10 mol A → (3/2) × 10 = 15 mol B

Q42. A compound contains 53.5% Na, 29.1% Cl, and 17.4% O. What is its empirical formula?

(Atomic masses: Na = 23, Cl = 35.5, O = 16)

A) $NaClO_4$
B) $NaClO_3$
C) NaClO
D) $Na_2Cl_2O_3$

Answer: B) $NaClO_3$

Explanation:
Na = 53.5/23 = 2.326
Cl = 29.1/35.5 = 0.82
O = 17.4/16 = 1.087
Divide all by 0.82
Na ≈ 2.83 → 3
Cl ≈ 1
O ≈ 1.33 → 3
Approximate ratio ≈ $NaClO_3$

Q43. What volume will 2 moles of an ideal gas occupy at STP?

A) 11.2 L
B) 22.4 L
C) 44.8 L
D) 33.6 L

Answer: C) 44.8 L

Explanation:
1 mole = 22.4 L at STP → 2 moles = 2 × 22.4 = 44.8 L

Q44. The mass of 0.5 mole of oxygen molecules ($O_2$) is:

(Molar mass = 32 g/mol)

A) 8 g
B) 16 g
C) 32 g
D) 64 g

Answer: B) 16 g

Explanation:
Mass = moles × molar mass = 0.5 × 32 = 16 g

Q45. Which law supports the concept of atoms combining in whole number ratios to form compounds?

A) Law of conservation of mass
B) Law of multiple proportions
C) Avogadro's law
D) Law of reciprocal proportions

Answer: B) Law of multiple proportions

Explanation:
Law of multiple proportions states that elements combine in small whole-number ratios when forming different compounds.