Exercise

Marked questions are recommended for Revision.

PART - I : SUBJECTIVE QUESTIONS

1. How much time (in years) would it take to distribute one Avogadro number of wheat grains if 10^{10} grains are distributed each second ?

2. The weight of one atom of Uranium is 238 amu. Its actual weight is ..... g.

3. Calculate the weight of 12.044×10^{23} atoms of carbon.

4. How many grams of silicon is present in 35 gram atoms of silicon (Given at. wt. of Si = 28).

5. Find the total number of nucleons present in 12 g of ^{12}C atoms.

6. Find (i) the total number of neutrons, and (ii) the total mass of neutrons in 7 mg of ^{14}C. (Assume that the mass of a neutron = mass of a hydrogen atom)

7. Calculate the number of electrons, protons and neutrons in 1 mole of $^{16}O^{-2}$ ions.

8. How many atoms are there in 100 amu of He?

9. The density of liquid mercury is 13.6 g/cm^3. How many moles of mercury are there in 1 litre of the metal? (Atomic mass of Hg = 200.)

10. Calculate the atomic mass (average) of chlorine using the following data:

	% Natural Abundance	Molar Mass
^{35}Cl	75	35.0 g
^{37}Cl	25	37.0 g

11. Average atomic mass of Magnesium is 24.31 amu. This magnesium is composed of 79 mole % of ^{24}Mg and remaining 21 mole % of ^{25}Mg and ^{26}Mg. Calculate mole % of ^{26}Mg.

12. The number of molecules in 16 g of methane is :

13. Calculate the number of molecules in a drop of water weighing 0.09 g.

14. A sample of ethane has the same mass as 10.0 million molecules of methane. How many C_2H_6 molecules does the sample contain ?

15. The number of neutrons in 5 g of D_2O (D is $_1^2H$) are :

16. Calculate the weight of 6.022×10^{23} formula units of $CaCO_3$.

17. From 200 mg of CO_2, 10^{21} molecules are removed. How many moles of CO_2 are left ?

18. Find the total number of H, S and 'O' atoms in the following :
(a) 196 g H_2SO_4 (b) 196 amu H_2SO_4 (c) 5 mole $H_2S_2O_8$ (d) 3 molecules $H_2S_2O_6$.

19. If from 10 moles NH_3 and 5 moles of H_2SO_4, all the H-atoms are removed in order to form H_2 gas, then find the number of H_2 molecules formed.

20. If from 3 moles $MgSO_4.7H_2O$, all the 'O' atoms are taken out and converted into ozone find the number of O_3 molecules formed.

21. If the components of air are N_2 - 78%; O_2 - 21%; Ar - 0.9% and CO_2 - 0.1% by volume (or mole), what would be the molecular weight of air ?

22. Find the expression of Universal Gas Constant R in SI system in terms of the given properties of oxygen gas.
Pressure = p (kPa)
Volume = V (mL)
Temperature = t (ºC)
Mass of oxygen = w (g)

23. The volume of a gas at 0ºC and 700 mm pressure is 760 cc. The number of molecules present in this volume is :

24. The weight of 350 mL of a diatomic gas at 0ºC and 2 atm pressure is 1 g. The weight of one atom is :

25. Oxygen is present in a 1-litre flask at a pressure of 7.6×10^{-10} mm of Hg at 0ºC. Calculate the number of oxygen molecules in the flask.

26. Fill in the blanks :
(i) 1μm = ... nm (ii) 10 MJ = ... J (iii) 100 Pa = ... kPa
(iv) 1dm = ... mm (v) 10 pm = ... cm

PART - II : OBJECTIVE QUESTIONS

Single Correct Questions (SCQ)

1. Which is not a basic postulate of Dalton's atomic theory ?
(A) Atoms are neither created nor destroyed in a chemical reaction.
(B) Different elements have different types of atoms.
(C) Atoms of an element may be different due to presence of isotopes.
(D) Each element is composed of extermely small particles called atoms.

2. The modern atomic weight scale is based on :
(A) ^{12}C (B) ^{16}O (C) ^{1}H (D) ^{18}O

3. 1 amu is equal to
(A) $\frac{1}{12}$ of C–12 (B) $\frac{1}{14}$ of O–16 (C) 1 g of H_2 (D) 1.66×10^{-23} kg

4. If the atomic mass of sodium is 23, the number of moles in 46 g of sodium is :
(A) 1 (B) 2 (C) 2.3 (D) 4.6

5. How many grams are contained in 1 gram-atom of Na ?
(A) 13 g (B) 23 g (C) 1 g (D) $\frac{1}{23}$ g

6. 1.0 g of hydrogen contains 6×10^{23} atoms. The atomic weight of helium is 4. It follows that the number of atoms in 1 g of He is :
(A) $\frac{1}{4} \times 6 \times 10^{23}$ (B) $4 \times 6 \times 10^{23}$ (C) 6×10^{23} (D) 12×10^{23}

7. The atomic weights of two elements A and B are 40u and 80u respectively. If x g of A contains y atoms, how many atoms are present in 2x g of B?
(A) $\frac{y}{2}$ (B) $\frac{y}{4}$ (C) y (D) 2y

8. A sample of aluminium has a mass of 54.0 g. What is the mass of the same number of magnesium atoms? (At. wt. Al = 27, Mg = 24)
(A) 12 g (B) 24 g (C) 48 g (D) 96 g.

9. The number of atoms in 558.5 g of Fe (at wt.= 55.85) is :
(A) Twice that in 60 g carbon (B) 6.022×10^{22}
(C) Half in 8 g He (D) $558.5 \times 6.023 \times 10^{23}$

10. Which of the following has the Maximum mass ?
(A) 1 g-atom of C (B) $\frac{1}{2}$ mole of CH_4
(C) 10 mL of water (D) 3.011×10^{23} atoms of oxygen

11. The total number of protons, electrons and neutrons in 12 g of $^{12}_{6}C$ is :
(A) 1.084×10^{25} (B) 6.022×10^{23} (C) 6.022×10^{22} (D) 18

12. 1 mole of element X has mass, 3/10 times the mass of 1 mole of element Y. One average atom of element X has mass, 2 times the mass of one atom of ^{12}C. What is the atomic weight of Y ?
(A) 80 (B) 15.77 (C) 46.67 (D) 40.0

13. The charge on 1 gram ions of Al^{3+} is : (N_A = Avogadro number, e = charge on one electron)
(A) $\frac{1}{27} N_A e$ coulomb (B) $\frac{1}{3} \times N_A e$ coulomb (C) $\frac{1}{9} \times N_A e$ coulomb (D) $3 \times N_A e$ coulomb

14. It is known that an atom contains protons, neutrons and electrons. If the mass of neutron is assumed to half of its original value whereas that of proton is assumed to be twice of its original value, then the atomic mass of $^{14}_{6}C$ will be :
(A) same (B) 114.28 % less (C) 14.28 % more (D) 28.56 % less

15. The isotopic abundance of C–12 and C–14 is 98% and 2% by mass respectively. What would be the number of C–14 isotope in 12 g carbon sample ?
(A) 1.032×10^{22} (B) 3.01×10^{23} (C) 5.88×10^{23} (D) 6.02×10^{23}

16. In chemical scale, the relative mass of the isotopic mixture of X atoms (X^{20}, X^{21}, X^{22}) is approximately equal to : (X^{20} has 99 percent abundance)
(A) 20.002 (B) 21.00 (C) 22.00 (D) 20.00

17. Indium (atomic weight = 114.8) has two naturally occurring isotopes, the predominant one form has isotopic weight 115 and abundance of 95.00%. Which of the following isotopic weights is the most likely for the other isotope ?
(A) 111 (B) 112 (C) 113 (D) 114

18. The number of molecules of CO_2 present in 44 g of CO_2 is :
(A) 6.0×10^{23} (B) 3×10^{23} (C) 12×10^{23} (D) 3×10^{10}

19. The number of mole of ammonia in 4.25 g of ammonia is :
(A) 0.425 (B) 0.25 (C) 0.236 (D) 0.2125

20. Which one of the following pairs of gases contains the same number of molecules :
(A) 16 g of O_2 and 14 g of N_2 (B) 8 g of O_2 and 22 g of CO_2
(C) 28 g of N_2 and 22 g of CO_2 (D) 32 g of O_2 and 32 g of N_2

21. The weight of a molecule of the compound $C_{60}H_{22}$ is :
(A) 1.09×10^{-21} g (B) 1.24×10^{-21} g (C) 5.025×10^{-23} g (D) 16.023×10^{-23} g

22. Number of electrons in 1.8 mL of $H_2O(\ell)$ is about :
(A) 6.02×10^{23} (B) 3.011×10^{23} (C) 0.6022×10^{21} (D) 60.22×10^{20}

23. One mole of P_4 molecules contain :
(A) 1 molecule (B) 4 molecules
(C) $\frac{1}{4} \times 6.022 \times 10^{23}$ atoms (D) 24.088×10^{23} atoms

24. A sample of ammonium phosphate $(NH_4)_3PO_4$ contains 3.18 mole of H atoms. The number of mole of O atoms in the sample is :
(A) 0.265 (B) 0.795 (C) 1.06 (D) 3.18

25. Torr is unit of :
(A) Temperature (B) Pressure (C) Volume (D) Density

26. The atmospheric pressure on Mars is 0.61 kPa. What is the pressure in mm Hg ?
(A) 0.63 (B) 4.6 (C) 6.3 (D) 3.2

27. Centigrade and Fahrenheit scales are related as :
(A) $\frac{C}{5} = \frac{F-32}{9}$ (B) $\frac{C}{9} = \frac{F-32}{5}$ (C) $\frac{C}{8} = \frac{F-32}{5}$ (D) None of these

28. At what temperature, both Celsius and Fahrenheit scale read the same value :
(A) 100º (B) 130º (C) 60º (D) –40º

29. The value of universal gas constant R depends on :
(A) temperature of gas (B) volume of gas
(C) number of moles of gas (D) units of volume and pressure

30. The value of gas constant in calorie per degree temperature per mol is approximately :
(A) 1 cal (B) 2 cal (C) 3 cal (D) 4 cal

31. The value of R in SI unit is :
(A) 8.314×10^{-7} erg K^{-1} mol^{-1} (B) 8.314 JK^{-1} mol^{-1}
(C) 0.082 litre atm K^{-1} mol^{-1} (D) 2 cal K^{-1} mol^{-1}

32. The pressure of sodium vapour in a 1.0 L container is 9.5 torr at 927ºC. How many atoms are in the container ?
(A) 9.7×10^7 (B) 7.5×10^{19} (C) 4.2×10^{17} (D) 9.7×10^{19}

33. The pressure of a gas having 2 mole in 44.8 litre vessel at 546 K is :
(A) 1 atm (B) 2 atm (C) 3 atm (D) 4 atm

34. According to the ideal gas laws, the molar volume of a gas is given by :
(A) 22.4 litre (B) RT / P (C) 8RT / PV (D) RT / PV

35. Equal volumes of oxygen gas and a second gas weigh 1.00 and 19/8 grams respectively under the same experimental conditions. Which of the following is the unknown gas?
(A) NO (B) SO_2 (C) CS_2 (D) CO

36. A high altitude balloon contains 6.0 g of helium in 10^4 L at 240 K. Assuming ideal gas behaviour, how many grams of helium would have to be added to increase the pressure to 4.0×10^{-3} atm ?
(A) 1 (B) 1.2 (C) 1.5 (D) 2.0

37. Four 1-1 litre flasks are separately filled with the gases H_2, He, O_2 and O_3 at the same temperature and pressure. The ratio of total number of atoms of these gases present in different flask would be :
(A) 1 : 1 : 1 : 1 (B) 1 : 2 : 2 : 3 (C) 2 : 1 : 2 : 3 (D) 3 : 2 : 2 : 1

38. Under the same conditions, two gases have the same number of molecules. They must
(A) be noble gases (B) have equal volumes
(C) have a volume of 22.4 dm^3 each (D) have an equal number of atoms

39. 16 g of an ideal gas SO_x occupies 5.6 L. at STP. The value of x is
(A) x = 3 (B) x = 2 (C) x = 4 (D) none of these

40. The ratio of the weight of one litre of a gas to the weight of 1.0 L oxygen gas both measured at S.T.P. is 2.22. The molecular weight of the gas would be :
(A) 14.002 (B) 35.52 (C) 71.04 (D) 55.56

41. Avogadro number is :
(A) Number of atoms in one gram of the element
(B) Number of mililitre which one mole of a gaseous substance occupies at NTP (1 atm & 0ºC)
(C) Number of molecules present in one gram molecular mass of a substance.
(D) All are correct

42. The weight of 1×10^{22} molecules of $CuSO_4.5H_2O$ is **:**
(A) 41.59 g (B) 415.9 g (C) 4.159 g (D) None of these

43. How many moles of electron weigh one kilogram :
(A) 6.023×10^{23} (B) $\frac{1}{9.108} \times 10^{31}$ (C) $\frac{6.023}{9.108} \times 10^{54}$ (D) $\frac{1}{9.108 \times 6.023} \times 10^{8}$

44. Number of atoms in 560 g of Fe (atomic mass 56 $gmol^{-1}$) is :
(A) Twice that in 70 g N (B) Half that in 20 g H (C) Both (A) and (B) (D) None of these

45. Which has maximum number of atoms :
(A) 24 g of C (12) (B) 56 g of Fe (56) (C) 27 g of Al (27) (D) 108 g Ag (108)

46. If we consider that 1/6, in place of 1/12 mass of carbon atom is taken to be the relative atomic mass unit, the mass of one mole of a substance will :
(A) decrease twice
(B) increase two fold
(C) remain unchanged
(D) be a function of the molecular mass of the substance

47. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms ?
(A) 0.02 (B) 3.125×10^{-2} (C) 1.25×10^{-2} (D) 2.5×10^{-2}

48. Given that the abundances of isotopes ^{54}Fe, ^{56}Fe and ^{57}Fe are 5%, 90% and 5% respectively, the atomic mass of Fe is :
(A) 55.85 (B) 55.95 (C) 55.75 (D) 56.05

Multiple Correct Questions (MCQ)

49. Which property of an element may have non-integral value.
(A) Atomic weight (B) Atomic number (C) Atomic volume (D) None of these

50. Which of the following would contain 1 mole of particles :
(A) 0.5 mole of H_2 (B) 1 g of H-atoms (C) 16 g of O-18 (D) 16 g of methane

51. Which of the following will have the same number of electrons :
(A) 1 g Hydrogen (B) 2 g Oxygen (C) 2 g Carbon (D) 2 g Nitrogen

52. Which the following is equal to 10^{-2} atm :
(A) 0.76 cm of Hg (B) 7.6 torr (C) 0.076 dm of Hg (D) 0.0076 torr

53. Pressure exerted by a sample of oxygen is same for the following conditions :
(A) 2 L, 27ºC (B) 1 L, 150 K (C) 4 L, 54ºC (D) 10 L, 1227ºC

Assertion / Reasoning (A/R)

Each question has 5 choices (A), (B), (C), (D) and (E) out of which ONLY ONE is correct.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is not correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.
(E) Both statements are false.

54. **Statement-1 :** Gram molecular weight of O_2 is 32 g.
Statement-2 : Relative atomic weight of oxygen is 32.

55. **Statement-1 :** 1 mole of all ideal gases exert same pressure in same volume at same temperature.
Statement-2 : Behaviour of ideal gases is independent of their nature.

56. **Statement-1 :** Value of the universal gas constant depends upon the choice of sytem of units.
Statement-2 : Values of universal gas constant are 8.314 J/molK, 0.0821 L.atm/molK, 2 cal/molK.

Comprehension #

A vessel of 25 L contains 20 g of ideal gas X at 300K. The pressure exerted by the gas is 1 atm. 20 g of ideal gas Y is added to the vessel keeping the same temperature. Total pressure became 3 atm. Upon further addition of 20 g ideal gas Z the pressure became 7 atm. Answer the following questions. (Hint: Ideal gas equation is applicable on mixture of ideal gases) [Take, R = 1/12 L.atm / mol K]

57. Find the molar mass of gas X.
(A) 20 g (B) 10 g (C) 30 g (D) 5 g

58. Identify the correct statement(s) :
I. Gas Y is lighter than gas X.
II. Gas Z is lighter than gas Y
(A) I only (B) II only (C) Both I and II (D) None of the statements

59. Find the average molar mass of the mixture of gases X, Y and Z.
(A) 40/7 (B) 50/7 (C) 20 (D) 60/7

60. Match the column:

	Column-I				**Column-II**
	(Atomic mass (M))				**(% composition of heavier isotope)**
	Isotope-I	**Isotope-II**	**Average**		
(A)	(z – 1)	(z + 3)	z	(p)	25% by moles
(B)	(z + 1)	(z + 3)	(z + 2)	(q)	50% by moles
(C)	z	3z	2z	(r)	% by mass dependent on z
(D)	(z – 1)	(z + 1)	z	(s)	75% by mass

Answers

PART – I

1. 1.9×10^6 years (approx.) **2.** 3.95×10^{-22} **3.** 24 g

4. 980 g of Si **5.** $12 \times 6.022 \times 10^{23}$ **6.** 24.088×10^{20}, 0.004 g.

7. $10 \times 6.022 \times 10^{23}$, $8 \times 6.022 \times 10^{23}$, $8 \times 6.022 \times 10^{23}$. **8.** 25

9. 68 mole **10.** 35.5 **11.** 10

12. 6.02×10^{23} **13.** 3.01×10^{21} molecules of H_2O

14. 5.33×10^6 **15.** 2.5 N_A **16.** 100 g

17. 0.00288

18. (a) H = $4N_A$, S = $2N_A$, O = $8N_A$ atoms (b) H = 4 atoms, S = 2 atoms, O = 8 atoms.
(c) H = $10N_A$, S = $10N_A$, O = 40 N_A atoms (d) H = 6 atoms, S = 6 atoms, O = 18 atoms.

19. 20 N_A **20.** 11 N_A **21.** 28.964 u

22. $R = \dfrac{32pV}{1000 \times w \times (t + 273)}$ **23.** 1.88×10^{22} **24.** 16 amu

25. 2.647×10^{10}

26. (i) 1000 (ii) 10^7 (iii) 0.1 (iv) 100 (v) 10^{-9}

PART – II

1.	(C)	**2.**	(A)	**3.**	(A)	**4.**	(B)	**5.**	(B)
6.	(A)	**7.**	(C)	**8.**	(C)	**9.**	(A)	**10.**	(A)
11.	(A)	**12.**	(A)	**13.**	(D)	**14.**	(C)	**15.**	(A)
16.	(A)	**17.**	(A)	**18.**	(A)	**19.**	(B)	**20.**	(A)
21.	(B)	**22.**	(A)	**23.**	(D)	**24.**	(C)	**25.**	(B)
26.	(B)	**27.**	(A)	**28.**	(D)	**29.**	(D)	**30.**	(B)
31.	(B)	**32.**	(B)	**33.**	(B)	**34.**	(B)	**35.**	(C)
36.	(D)	**37.**	(C)	**38.**	(B)	**39.**	(B)	**40.**	(C)
41.	(C)	**42.**	(C)	**43.**	(D)	**44.**	(C)	**45.**	(A)
46.	(C)	**47.**	(B)	**48.**	(B)	**49.**	(AC)	**50.**	(BD)
51.	(ABCD)	**52.**	(ABC)	**53.**	(ABD)	**54.**	(C)	**55.**	(A)
56.	(B)	**57.**	(A)	**58.**	(C)	**59.**	(D)		

60. (A) - (p,r) ; (B) - (q,r) ; (C) - (q,s) ; (D) - (q,r)