PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 56

Total Marks : 120

Max. Time : 120 min.

Topic : Mole Concept and Atomic Structure

Type of Questions		M.M., Min.
Topic : Mole Concept		
Single choice Objective ('–1' negative marking) Q.1 to Q.20	(3 marks, 3 min.)	[60, 60]
Topic : Atomic Structure		
Single choice Objective ('–1' negative marking) Q.1 to Q.20	(3 marks, 3 min.)	[60, 60]

1. The weight of a molecule of the compound $C_6H_{12}O_6$ is about :
(A) 180 g (B) 3×10^{-22} g (C) 22×10^{-23} g (D) 132 g

2. A person adds 1.71 gram of sugar ($C_{12}H_{22}O_{11}$) in order to sweeten his tea. The number of carbon atoms added are : (Mol. mass of sugar = 342)
(A) 3.6×10^{22} (B) 3×10^{21} (C) 3.6×10^{23} (D) 3×10^{22}

3. If V ml of the vapours of substance at NTP weight W mg, then mol. wt. of substance in amu is :
(A) (W/V) × 22400 (B) $\frac{V}{W} \times 22.4$ (C) (V/W) × 22400 (D) $\frac{W}{V} \times 22.4$

4. Percentage of Se in peroxidase anhydrous enzyme is 0.5% by weight. Then min. mol. wt. of peroxidase anhydrous enzyme is : (at. wt. of Se = 78.4 amu)
(A) 1.568×10^4 (B) 1.568×10^3 (C) 15.68 (D) 1.568×10^2

5. Caffine has a molecular weight of 194. It contains about 30% by mass of nitrogen. The number of atoms of nitrogen in one molecule of it is :
(A) 2 (B) 3 (C) 4 (D) 5

6. Vapour density of a gas, if its density is $\frac{1}{5.6}$ g/L at NTP, is :
(A) 1 (B) 2 (C) 4 (D) 8

7. Assuming that petrol is iso-octane (C_8H_{18}) and has a density 0.8 g ml^{-1}, 1.425 litre of petrol on complete combustion will consume what amount of oxygen :
(A) 250 L (B) 125 L (C) 125 mole (D) 250 mole

8. The volume of gas at NTP produced by reaction of 128 g of CaC_2 with excess of water is :
(A) 44.8 litre (B) 89.6 litre (C) 67.2 litre (D) 22.4 litre

9. If 0.5 mole of $BaCl_2$ is mixed with 0.1 mole of Na_3PO_4, the maximum number of mole of $Ba_3(PO_4)_2$ that can be formed is :
(A) 0.166 (B) 0.05 (C) 0.6 (D) 0.1

10. A 21.6 g silver coin is dissolved in HNO_3. When NaCl is added to this solution, all silver is precipitated as AgCl. The weight of AgCl is found to be 14.35 g. Then % of silver in coin is :
(A) 50% (B) 75% (C) 100% (D) 15%

11. What is the concentration of nitrate ions if equal volumes of 0.1 M $AgNO_3$ and 0.1 M NaCl solutions are mixed together :
(A) 0.1 M (B) 0.2 M (C) 0.05 M (D) 0.25 M

12. 300 ml of 3.0 M NaCl is added to 200 ml of 4.0 M $BaCl_2$ solution. The concentration of Cl^- ions in the resulting solution is :
(A) 4.5 M (B) 3.4 M (C) 6 M (D) 5 M

13. One mole of potassium chlorate is thermally decomposed and excess of aluminium is burnt in the gaseous product. How many mole of aluminium oxide are formed :
(A) 1 (B) 1.5 (C) 2 (D) 3

14. Calculate the mole of FeO produced from 1.34 g VO & 4.8 g Fe_2O_3 :
$VO + Fe_2O_3 \longrightarrow FeO + V_2O_5$ (At. wt. of V = 51)
(A) 0.06 (B) 0.03 (C) 0.12 (D) 0.015

15. Mole fraction of A in aqueous solution is 0.2. The molality of solution is :
(A) 13.9 (B) 15.5 (C) 14.5 (D) 16.8

16. What is the quantity of water that should be added to 16 g methanol to make the mole fraction of methanol in solution as 0.25 :
(A) 27 g. (B) 12 g. (C) 18 g. (D) 36 g.

17. If 100 ml of 1M H_2SO_4 solution is mixed with 100 ml of 9.8%(w/w) H_2SO_4 solution (d = 1 g/ml), then :
(A) concentration of solution increases (B) concentration of solution decreases
(C) mass of H_2SO_4 in the solution is 1.96 g (D) mass of H_2SO_4 in the solution is 19.6 g

18. Match List-I (Compounds) with List-II (Oxidation states of Nitrogen) and select answer using the codes given below the lists :

	List-I		List-II
(a)	NaN_3	(1)	+5
(b)	N_2H_2	(2)	+2
(c)	NO	(3)	–1/3
(d)	N_2O_5	(4)	–1

(Code) :

	(a)	(b)	(c)	(d)		(a)	(b)	(c)	(d)
(A)	3	4	1	2	(B)	4	3	2	1
(C)	3	4	2	1	(D)	4	3	1	2

19. The incorrect order of decreasing oxidation number of S in compounds is :
(A) $H_2S_2O_7 > Na_2S_4O_6 > Na_2S_2O_3 > S_8$
(B) $H_2SO_5 > H_2SO_3 > SCl_2 > H_2S$
(C) $H_2SO_4 = H_2S_2O_8 > SO_2 > H_2S$
(D) $SO_3 > SO_2 > H_2S > S_8$

20. For the redox reaction $MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$,
the correct whole number stoichiometric coefficients of MnO_4^-, $C_2O_4^{2-}$ and H^+ are respectively :
(A) 2, 5, 16 (B) 5, 2, 8 (C) 2, 5, 8 (D) 5, 2, 16

Topic : Atomic Structure

1. The charge-to-mass ratio for A^{3+} ion is about $\frac{1}{9} \times 10^8$ C kg^{-1}. Calculate the approximate mass of A atom :
(A) 4.5×10^{-26} kg (B) 1.5×10^{-26} kg (C) 1.5×10^{-28} kg (D) 4.5×10^{-28} kg

2. Which of the following is isoelectronic with P^{3-} :
(A) Cl^- (B) Mg^{2+} (C) Both (A) & (B) (D) None of these

3. Light of wavelength λ falls on metal having work function hc/λ_0. Photoelectric effect will take place only if :
(A) $\lambda \geq \lambda_0$ (B) $\lambda \geq 2\lambda_0$ (C) $\lambda \leq \lambda_0$ (D) $\lambda \leq \lambda_0/2$

4. A photon of X region is more energetic than of the visible region. X may be :
(A) Infrared (B) Ultra violet (C) Microwave (D) Radio wave

5. A bulb of 40 W is producing a light of wavelength 620 nm with 80% of efficiency. Then the number of photons emitted by the bulb in 20 seconds are :
(A) 2×10^{18} (B) 10^{18} (C) 10^{21} (D) 2×10^{21}

6. The ionization energy of He^+ is 19.6×10^{-18} J ion^{-1}. The energy of the first stationary state of Be^{3+} will be :
(A) 15.68×10^{-17} J/ion (B) 78.4×10^{-18} J/ion (C) 4.9×10^{-18} J/ion (D) 39.2×10^{-18} J/ion

7. Which of the following electron transition in a hydrogen atom will require the largest amount of energy :
(A) From n = 1 to n = 2 (B) From n = 2 to n = 3 (C) From n = ∞ to n = 1 (D) From n = 3 to n = 5

8. **S_1 :** Potential energy of the two opposite charge system increases with the decrease in distance.
S_2 : When an electron make transition from higher orbit to lower orbit, its kinetic energy increases.
S_3 : When an electron make transtition from lower energy to higher energy state, its potential energy increases.
S_4 : 11eV photon can free an electron from the 1^{st} excited state of He^+ ion.
(A) T T T F (B) F T T F (C) F T F T (D) T F F T

9. If r_1 is the radius of the first orbit of hydrogen atom, then the radii of second, third and fourth orbits in terms of r_1 are :
(A) r_1^2, r_1^3, r_1^4 (B) $8r_1, 27r_1, 64r_1$ (C) $4r_1, 9r_1\ 16r_1$ (D) $2r_1, 3r_1, 4r_1$

10. If the series limit wavelength of the Lyman series for the hydrogen atom is 912 Å, then the series limit wavelength for the Balmer series of the Li^{2+} ion is :
(A) $912 \times \frac{9}{4}$ Å (B) $912 \times \frac{4}{9}$ Å (C) $912 \times \frac{2}{9}$ Å (D) $912 \times \frac{4}{3}$ Å

11. In hydrogen spectrum, which of the following has some of its lines in the wavelength range 350 –700 nm :
(A) Balmer series (B) Lyman series (C) Brackett series (D) Paschen series

12. In a sample of H-atom, electrons make transition from 5^{th} excited state upto ground state, producing all possible types of photons. Then, maximum number of lines in infrared region are :
(A) 4 (B) 5 (C) 6 (D) 3

13. Calculate wavelength of 3^{rd} line of Bracket series in hydrogen spectrum :
(A) $\frac{33}{784R}$ (B) $\frac{33R}{784}$ (C) $\frac{784R}{33}$ (D) $\frac{784}{33R}$

14. A ball weighs 25 g and moves with a velocity of 6.6×10^4 cm/sec. Then find out the de Broglie wavelength :
(A) 0.4×10^{-33} cm (B) 0.4×10^{-31} cm (C) 0.4×10^{-35} cm (D) 0.4×10^{-37} cm

15. Calculate the de-Broglie wavelength of the electron in the ground state of hydrogen atom :
(A) 3.3284×10^{-10} m (B) 1.6642×10^{-10} m (C) 6.6568×10^{-10} m (D) Cannot be determined.

16. The uncertainity in position and velocity of an object are 10^{-10} m and 5.27×10^{-24} ms^{-1} respectively. Calculate the mass of the object :
(A) 0.1 g (B) 1 g (C) 10 g (D) 100 g

17. A given orbital is labelled by the magnetic quantum number m = –1. This could be :
(A) p-orbital (B) d-orbital (C) f-orbital (D) All of these

18. An electron with n = 3 is in an orbital with only one radial node. The orbital angular momentum of the electron will be :
(A) 0 (B) $\sqrt{6}\frac{h}{2\pi}$ (C) $\sqrt{2}\frac{h}{2\pi}$ (D) $\sqrt{6}\frac{h}{\pi}$

19. After np orbitals are filled, the next orbital filled will be :
(A) nd (B) (n + 1) p (C) (n + 1) s (D) (n – 1) s

20. The correct set of four quantum numbers for the valence electron of Rubidium (Z = 37) is :
(A) n = 6, ℓ = 0, m = 0, s = + $\frac{1}{2}$ (B) n = 5, ℓ = 1, m = 0, s = + $\frac{1}{2}$
(C) n = 6, ℓ = 1, m = 1, s = + $\frac{1}{2}$ (D) n = 5, ℓ = 0, m = 0, s = + $\frac{1}{2}$

Answer Key

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1.	(B)	**2.**	(A)	**3.**	(D)	**4.**	(A)	**5.**	(C)
6.	(B)	**7.**	(C)	**8.**	(A)	**9.**	(B)	**10.**	(A)
11.	(C)	**12.**	(D)	**13.**	(A)	**14.**	(A)	**15.**	(A)
16.	(A)	**17.**	(D)	**18.**	(C)	**19.**	(D)	**20.**	(A)

Topic : Atomic Structure

1.	(A)	**2.**	(A)	**3.**	(C)	**4.**	(B)	**5.**	(D)
6.	(B)	**7.**	(A)	**8.**	(B)	**9.**	(C)	**10.**	(B)
11.	(A)	**12.**	(C)	**13.**	(D)	**14.**	(A)	**15.**	(A)
16.	(D)	**18.**	(C)	**19.**	(C)	**20.**	(D)		

Hints & Solutions

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1. Gram mol. wt. of $C_6H_{12}O_6$ = 180 g
i.e. wt. of 6.023×10^{23} molecules = 180

so wt. of 1 molecules = $\frac{180}{6.023 \times 10^{23}} = 2.988 \times 10^{-22}$ g.

2. No. of carbon atom in glucose = $\frac{1.71}{342} \times 12\ N_a$

$= 3.6 \times 10^{22}$

4. $x \times \frac{0.5}{100} = 78.4 \quad \Rightarrow \quad x = \frac{78.4 \times 10^2}{5 \times 10^{-1}} = \frac{78.4}{5} \times 10^3 = 1.568 \times 10^4.$

6. At NTP, weight of 1 litre gas = 0.178 gm
so weight of 22.4 litre gas = weight of 1 mole gas = molar mass of gas = 0.178×22.4 gm
vapour denstiy = molar mass of gas / 2

so V.D. = $\frac{0.178 \times 22.4}{2} = 2$

7. $C_8H_{18} + \frac{25}{2} O_2 \longrightarrow 8CO_2 + 9\,H_2O$

$M = 1.425 \times 1000 \times 0.8 = 1140$ g

$\text{mol} = \frac{1140}{114} = 10$ mol

Now from mole–mole analysis

$\frac{\text{mole of } C_8H_{18}}{1} = \frac{\text{mole of } O_2}{25/2}$

$\frac{10}{1} = \frac{\text{mole of } O_2}{25/2} \quad \Rightarrow \text{mole of } O_2 = \frac{25}{2} \times 10 = 125 \text{ mol.}$

8. $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

$\frac{100}{64}$ (excess)

From mole-mole analysis

$\frac{100}{64} = \frac{n_{C_2H_2}}{1}$ (here n = mole)

vol. $= n_{C_2H_2} \times 22.4$ (at N.T.P) (N.T.P पर)

$= \frac{100}{64} \times 22.4 = 35$ lit.

9. $3BaCl_2 + 2Na_3PO_4 \longrightarrow Ba_3(PO_4)_2 + 6\,NaCl$

mole 0.5 0.1

$\frac{0.5}{3} \quad \frac{0.1}{2}$ (L.R is Na_3PO_4)

Now from mole– mole analysis अब मोल–मोल विश्लेषण से

$\frac{\text{mole of } Na_3PO_4}{2} = \frac{\text{mole of } Ba_3(PO_4)_2}{1}$

$= \frac{0.1}{2} = \text{mole of } Ba_3(PO_4)_2$ $Ba_3(PO_4)_2$ के मोल

$\Rightarrow$ mole of $Ba_3(PO_4)_2 = 0.05$ mol. $Ba_3(PO_4)_2$ के मोल $= 0.05$ mol.

10. $Ag + HMO_3 \xrightarrow{NaCl} AgCl$

21.6 14.35

mole $\frac{21.6}{108} = 0.2$

Ag Atom remain conseved

So No. of mole of Ag = No. of mole of Ag Cl

So. No. of mole of AgCl = 0.2

Weight of AgCl = 28.7

% Yield $= \frac{14.35}{28.7} \times 100 = 50\ \%.$

11. $[NO_3^-] = \frac{0.1V + 0}{2V} = \frac{0.1}{2} = 0.05$ M.

12. $[Cl^-] = \frac{300 \times 3 + 200 \times 4 \times 2}{500}$

$= \frac{2500}{500} = 5$ M

13. $2Al + KClO_3 \longrightarrow Al_2O_3 + KCl$

(excess) 1 mole ($KClO_3$ is L.R.) 1 mole ($KClO_3$ L.R. है)

From mole-mole analysis

$$\frac{n_{KClO_3}}{1} = \frac{n_{Al_2O_3}}{1}$$

$\Rightarrow$ $n_{Al_2O_3} = 1$ mole.

15. Mole fraction of A i.e. $X_A = \frac{n_A}{\text{Total moles}}$

So $X_{H_2O} = \frac{n_{H_2O}}{\text{Total moles}}$

Now $\frac{X_A}{X_{H_2O}} = \frac{n_A}{n_{H_2O}}$

and molality $= \frac{n_A \times 1000}{n_{H_2O} \times 18} = \frac{X_A \times 1000}{X_{H_2O} \times 18} = \frac{0.2 \times 1000}{0.8 \times 18} =$ **13.9 Ans.**

16. Let wg water in added to 16 g CH_3OH

molality $= \frac{16 \times 1000}{W \times 32} = \frac{500}{W}$

$\frac{500}{W} = \frac{x_A \times 1000}{(1 - x_A)m_B} = \frac{0.25 \times 1000}{0.75 \times 18}$ W = 27 gm.

17. (A) Molarity of second solution is $= \frac{10 \times d \times x}{M} = 1$ M (B) Volume = 100 + 100 = 200 ml

(D) Mass of $H_2SO_4 = \frac{200 \times 1}{1000} \times 98 = 19.6$ gm.

18. $NaN_3 \Rightarrow 1(+1) + 3(x) = 0 \therefore x = -1/3$

$N_2H_2 \Rightarrow 2(x) + 2(+1) = 0 \therefore x = -1$

$NO \Rightarrow 1(x) + 1(-2) = 0 \therefore x = +2$

$N_2O_5 \Rightarrow 2(x) + 5(-2) = 0 \therefore x = +5$

19. (D)

SO_3	SO_2	H_2S	S_8
6	4	–2	0

20. $MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$

V.f. = 5 V.f. = 2

$\therefore$ Balanced equation : $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

Topic : Atomic Structure

3. For photoelectric effect to take place, $E_{light} \geq W$ $\therefore$ $\frac{hc}{\lambda} \geq \frac{hc}{\lambda_0}$ or $\lambda \leq \lambda_0$.

4. More energy means less wavelength.

5. Power = $\frac{nhC}{\lambda \times t}$ $\Rightarrow$ $40 \times \frac{80}{100} = \frac{n \times 6.62 \times 10^{-34} \times 3 \times 10^8}{620 \times 10^{-9} \times 20}$ $\Rightarrow$ $n = 2 \times 10^{21}$

9. $r \propto n^2$

11. This is the range of visible region.

12. infrared lines = total lines – visible lines – UV lines $= \frac{6(6-1)}{2} - 4 - 5 = 15 - 9 = 6.$

(visible lines = 4 $6\rightarrow2$, $5\rightarrow2$, $4\rightarrow2$, $3\rightarrow2$) (UV lines = 5 $6\rightarrow1$, $5\rightarrow1$, $4\rightarrow1$, $3\rightarrow1$, $2\rightarrow1$)

13. For third line of Bracket series $(4 \rightarrow 7)$

$$\frac{1}{\lambda} = R\left(\frac{1}{16} - \frac{1}{49}\right) \Rightarrow \lambda = \frac{784}{33R}$$

14. $\lambda = \frac{h}{mv} = 0.4 \times 10^{-33}$ cm

15. $\lambda = \frac{h}{\sqrt{2mK}} = 3.328 \times 10^{-10}$ m.

18. Number of radial nodes = $n - \ell - 1 = 1$, $n = 3$. $\therefore$ $\ell = 1$.

Orbital angular momentum = $\sqrt{\ell(\ell+1)}\,\frac{h}{2\pi} = \sqrt{2}\,\frac{h}{2\pi}$.

19. After np orbital, (n + 1) s orbital is filled.

20. Rb_{37} : [Kr] $5s^2$. $\therefore$ $n = 5$, $\ell = 0$, $m = 0$, $s = \pm\frac{1}{2}$.