DPP No. # B1 (JEE-MAIN)

Total Marks : 54 **Max. Time : 36 min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.18 **(3 marks, 2 min.) [54, 36]**

1. **S_1 :** Photoelectric effect can be explained on the basis of wave nature of electromagnetic radiations. **-**
S_2 : An orbital represented by n = 2, ℓ = 1 is dumb-bell shaped.
S_3 : d_{xy} orbital has zero probability of finding electrons along X-axis and Y-axis.
(A) FTF (B) FTT (C) TFT (D) TFF

2. For which of the following orbitals, the probability of finding the electrons along both X-axis and Y-axis is non-zero.
(A) d_{xy} (B) $d_{x^2-y^2}$ (C) p_z (D) d_{zx}

3. Which of the following sets of quantum numbers can be correct for an electron in 4f-orbital :
(A) n = 4, ℓ = 3, m = –2, s = 0 (B) n = 4, ℓ = 3, m = +4, s = $-\frac{1}{2}$
(C) n = 4, ℓ = 3, m = +1, s = $+\frac{1}{2}$ (D) n = 4, ℓ = 2, m = –1, s = $+\frac{1}{2}$

4. If electronic configuration of B is written as $1s^3\ 2s^2$. Which principle is violated during filling electrons?
(A) Aufbau principle
(B) Hund's maximum multiplicity rule
(C) Pauli's exclusion principle
(D) Hund's maximum multiplicity rule and Pauli's exclusion principle

5. In the electronic configuration of Mn (Z = 25) :
(A) the number of electrons having n + ℓ = 4 are 5.
(B) the number of electrons having m = 0 are 13.
(C) the magnetic moment is 1.73 BM
(D) Mn belongs to IIIrd period and d-Block in Modern periodic table.

6. Rearrange the following (I to IV) in the order of increasing masses:
I. 0.5 mole of O_3 **II.** 0.5 g atom of oxygen
III. 3.011×10^{23} molecules of O_2 **IV.** 5.6 litre of CO_2 at STP
(A) II < IV < III < I (B) II < I < IV < III (C) IV < II < III < I (D) I < II < III < IV

7. If a sample of Ferric sulphate $Fe_2(SO_4)_3$ contains 7.2 moles of O-atoms, then the number of S-atoms in the given sample are :
(A) 1.8 N_A (B) 0.9 N_A (C) 3.6 N_A (D) 3.1 N_A

8. A gas XH_2 has molar mass 34 g/mol. What is the molar mass of XO_3 (nearly) ?
(A) 64 g/mol (B) 82 g/mol (C) 80 g/mol (D) cannot be found

9. The respective ratio of weight of oxygen in samples of pure CuO and Cu_2O, if both samples contain the same mass of copper, is :
(A) 1 : 2 (B) 1 : 1 (C) 2 : 1 (D) none of these

10. Find the relative density of SO_3 gas with respect to methane:
(A) 8 (B) 3.5 (C) 2.5 (D) 5

11. The density of air at STP is 0.0013 g mL^{-1}. Its vapour density is :
(A) 0.01456 (B) 14.56 (C) 1.456 (D) Data insufficient

12. The atomic mass of a metal is 27 u. If its valency is 3, the vapour density of the volatile metal chloride will be:
(A) 66.75 (B) 321 (C) 267 (D) 80.25

13. Analysis of chlorophyll shows that it contains 2.64 percent magnesium. How many atoms of magnesium does 1.00 g of chlorophyll contains?
(A) 6.62×10^{23} (B) 6.62×10^{21} (C) 6.62×10^{24} (D) 6.62×10^{20}

14. What mass percentage of oxygen is present in the compound $CaCO_3.3Ca_3(PO_4)_2$?
(A) 23.3% (B) 45.36% (C) 41.94% (D) 17.08%

15. Compound have 1.15% sodium. What is the minimum molar weight (g/mol) of the compound?
(A) 4200 (B) 3750 (C) 2000 (D) 3000

16. 0.1 mole of a carbohydrate with empirical formula CH_2O contains 1 g of hydrogen. What can be its molecular formula ?
(A) $C_5H_{10}O_5$ (B) $C_6H_{12}O_6$ (C) $C_3H_6O_3$ (D) $C_4H_{10}O_4$

17. A compound contain equal masses of the elements X, Y and Z. If the atomic weights of X, Y and Z are 10, 20 and 30 respectively. The minimum molecular mass of compound is :
(A) 80 (B) 360 (C) 200 (D) 180

18. A gaseous organic compound has a density of 2.5 kg/m^3 at 2 atm and at 273ºC. The molecular formula of the compound can be :
(A) $C_3H_4O_2$ (B) C_4H_4 (C) C_3H_4O (D) C_4H_{10}

DPP No. # B2 (JEE-ADVANCED)

Total Marks : 64 **Max. Time : 40 min.**

Single choice Objective ('–1' negative marking) Q.1 to Q.6	**(3 marks, 2 min.)**	**[18, 12]**
Multiple choice objective ('–1' negative marking) Q.7 to Q.9	**(4 marks, 2 min.)**	**[16, 06]**
Comprehension ('–1' negative marking) Q.10 to Q.11	**(3 marks, 2 min.)**	**[06, 04]**
Integer type Questions ('–1' negative marking) Q.12 to Q.15	**(4 marks, 3 min.)**	**[16, 12]**
Match the column (no negative marking) Q.16	**(8 marks 6 min.)**	**[08, 06]**

1. The density of water at 4°C is 1×10^3 kg m^{-3}. Assuming no empty space to be present between water molecules, the volume occupied by one molecule of water is approximately :
(A) 3×10^{-23} mL (B) 6×10^{-23} mL (C) 3×10^{-22} mL (D) 6×10^{-22} mL

2. A sample of a compound contains 9.75 g Zn, 9×10^{22} atoms of Cr and 0.6 gram-atoms of O. What is empirical formula of compound ? (Atomic Mass Zn = 65)
(A) $ZnCrO_4$ (B) $ZnCr_2O_4$ (C) Zn_2CrO_4 (D) None of these

3. Assuming 100% yield of the reaction, how many moles of $NaHCO_3$ will produce 448 mL of CO_2 gas at STP according to the reaction : $NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$ (unbalanced)
(A) 0.04 (B) 0.4 (C) 4 (D) 40

4. When Dinitrogen pentaoxide (N_2O_5, a white solid) is heated, it decomposes into nitrogen dioxide and oxygen. If a sample of N_2O_5 produces 1.6 g O_2, then how many grams of NO_2 are formed ?

$$N_2O_5(s) \xrightarrow{\Delta} NO_2(g) + O_2(g) \text{ (not balanced)}$$

(A) 9.2 g (B) 4.6 g (C) 2.3 g (D) 18.4 g

5. Determine the empirical formula of Kevlar, used in making bullet proof vests, is 70.6% C, 4.2% H, 11.8% N and 13.4% O by mass.
(A) $C_7H_5NO_2$ (B) $C_7H_5N_2O$ (C) C_7H_9NO (D) C_7H_5NO

6. 1 mole of an organic compound containing C, H and O on complete combustion produces 134.4 L of CO_2 gas at STP and 108 g H_2O. Then, the molecular formula of organic compound could be :
(A) $C_6H_6O_6$ (B) $C_6H_{12}O_6$ (C) C_6H_6O (D) $C_8H_{12}O_2$

7.* According to Bohr atomic model, the angular momentum of electron can have the value(s) :
(A) $0.5\frac{h}{\pi}$ (B) $\frac{h}{\pi}$ (C) $\frac{h}{0.5\pi}$ (D) $2.5\frac{h}{2\pi}$

8.* For a reaction: $aA + bB \longrightarrow cC + dD$
If initially 'x' moles of 'A' are taken with 'y' moles of 'B', which of the following is/are correct :
(A) If $\frac{a}{b} = \frac{x}{y}$, then no reactant is left over (B) If $\frac{a}{b} > \frac{x}{y}$, then 'B' is limiting reagent
(C) If $\frac{a}{b} < \frac{x}{y}$, then 'B' is limiting reagent (D) If $\frac{x}{y} > \frac{a}{b}$, then 'A' is limiting reagent.

9.* In a gaseous reaction of type :

$$xA(g) + yB(g) \longrightarrow pC(g) + qD(g)$$

where x, y, p and q are stoichiometric coefficients. Which of the following statements is/are correct :
(A) At STP, x litre of A combine with y litre of B to give C and D.
(B) x mole of A combine with y mole of B to give C and D.
(C) x g of A combine with y g of B to give C and D.
(D) x molecules of A combine with y molecules of B to give C and D.

Comprehension

Significant Figures

When we measure a physical quantity, generally the measured value does not come out to be accurate. it may contain some error. When the measured value is expressed as a number, some digits which it contains are known reliably plus the first digit which is unreliable.

for example, let us measure the length of a glass plate using a scale. Let this length lie somewehre between 2.6 cm and 2.7 cm, and finally we write the length as 2.63 cm. Here digits 2 and 6 are reliable, but digit 3 is unreliable. Now the reliable digits and first unreliable digit are known as significant figures or significant digits. Thus, the measurement 2.63 cm contains three significant figures.

These signifificant figures are desired when the observations of any experiment have to be recorded and then to be used in calculations.

Rules for Counting Significant figures :

For a Number Greater than 1 :

Rule 1. All non-zero digits are significant. There may be decimal point in between and the location of decimal does not matter. Example :
(a) 2357 has four significant figures (b) 312 has three significant figures
(c) 325.23 has five significant figures (d) 23.523 has five significant figures.

Rule 2. All zeros between two non-zero digits are significant. Location of decimal does not matter. Example
(a) 2307 has four significant figures
(b) 320.03 has five significant figures
(c) 32.003 has five significant figures.

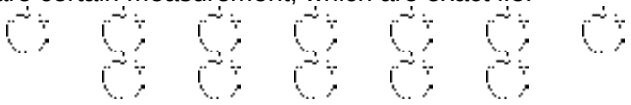
Rule 3. If the number is without decimal part, then the terminal of trailing zeros are not significant. Example :
(a) 23500 has three significant figures (b) 53000 has two significant figures

Rule 4. Trailing zeros in the decimal part are significant. Example :
(a) 3.700 has four significant figures (b) 2.50 has three significant figures

For a Number less than 1

Any zero to the right of a non-zero digit is significant, All zeros between decimal point and first non-zero digit are not significant. Example :
(a) 0.0074 has two significant figures (a) 0.0074
(b) 0.00704 has three significant figures. (b) 0.00704
(c) 0.007040 has four significant figures (c) 0.007040
(d) 0.07040 has four significant figures (d) 0.07040

Rule 5. There are certain measurement, which are exact i.e.



Number of apples are = 12 (exactly) = 12.000000..... ∞
This type of measurement is infinitely accurate so, it has ∞ S.F.
* Numbers of students in class = 125 (exact)
* Speed of light in the vacuum = 299,792,458 m/s (exact)

10. Write the number of significant figures in the following :
(a) 0.053 (b) 50.00 (c) 0.0500 (d) 5.7×10^6
(e) 5.70×10^6 (f) 2400 (g) 0.0305090

11. Count total number of S.F. in
(a) 3.0800 (b) 0.00418 (c) 3500 (d) 300.00
(e) 5.003020 (f) 6.020×10^{23} (g) 1.60×10^{-19}

12. A compound of Mg contains 6% Mg by mass. Minimum molar mass of the compound is $n \times 10^2$ g/mol, Caffeine 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 m. Give value of m/n

13. An oxide of Osmium (symbol Os) is pale yellow solid. If 2.794 g of the compound contains 2.09 g of osmium, what is its empirical formula ? (At. wt. of Os = 190) Report your answer as (x + y) if the empirical formula is Os_xO_y.

14. The hydrated salt $Na_2CO_3.xH_2O$ undergoes 63% loss in mass on heating and becomes anhydrous Calculate the value of x.

15. 1 g sample of alkaline earth metal react completely with 4.08 g H_2SO_4 and yield an ionic product MSO_4. Then find out the atomic mass of Alkaline earth metal (M) ?

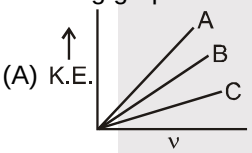
16. Match the column

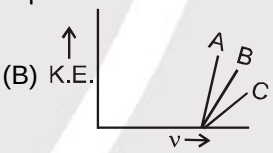
Column I		Column II	
(A)	Velocity	**(p)**	$\alpha < \beta$
(B)	Ionisation power	**(q)**	$\beta > \gamma$
(C)	Penetrating power	**(r)**	$\beta < \alpha$
(D)	mass	**(s)**	$\gamma > \beta$

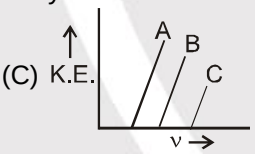
DPP No. # B3 (JEE-MAIN)

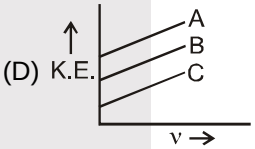
Total Marks : 64 **Max. Time : 40 min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.16 **(3 marks, 2 min.)** **[48, 32]**
ChemINFO : 4 Questions ('–1' negative marking) Q.17 to Q.20 **(4 marks, 2 min.)** **[16, 08]**

1. Photoelectron emission is observed for three different metals A, B and C. The kinetic energy of the fastest photoelectrons versus frequency of incident radiations ν is plotted for each metal. Which of the following graph shows the phenomenon most correctly :

(A) 

(B) 

(C) 

(D) 

2. Which particle must have been produced in the following processes respectively :
(I) $_7N^{14} + _2He^4 \rightarrow _8O^{17} + ...$ (II) $_{79}Au^{198} \rightarrow _{80}Hg^{198} + ...$
(III) $_{12}Mg^{24} + _2He^4 \rightarrow _{14}Si^{27} + ...$ (IV) $_{11}Na^{23} \rightarrow _{10}Ne^{23} + ...$
(A) Proton, Positron, Neutron, β-particle (B) Positron, β-particle, Neutron, Proton
(C) Proton, β-particle, Neutron, Positron (D) Positron, Neutron, β-particle, Proton

3. Compounds of boron with hydrogen are called boranes. One of these boranes has the empirical formula BH_3 and a molecular weight of 28 amu. What is its atomicity :
(A) 12 (B) 8 (C) 6 (D) 4

4. Given the numbers: 161 cm, 0.161 cm, 0.0161 cm. The number of significant figures for the three numbers are
(A) 3, 4 and 5 respectively (B) 3, 3 and 3 respectively
(C) 3, 3 and 4 respectively (D) 3, 4 and 4 respectively

5. A semiconductor $YBa_2Cu_3O_7$ is prepared by a reaction involving Y_2O_3, BaO_2 and Cu_2O. The mole ratio in which these compounds should combine, is :
(A) 1 : 2 : 4 (B) 1 : 4 : 3 (C) 1 : 2 : 3 (D) 1 : 3 : 4

6. Butane, C_4H_{10}, burns with the oxygen in air to give carbon dioxide and water.
What is the amount (in moles) of carbon dioxide produced from 0.15 mole C_4H_{10} ?
$C_4H_{10}(g) + O_2(g) \longrightarrow CO_2(g) + H_2O(g)$ (not balanced)
(A) 0.0375 (B) 0.15 (C) 0.6 (D) None of these

7. When oxygen gas is passed through Siemen's ozoniser, it completely gets converted into ozone gas. The volume of ozone gas produced at STP, if initally 96 g of oxygen gas was taken, is :
(A) 44.8 L (B) 89.6 L (C) 67.2 L (D) 22.4 L

8. Zinc and hydrochloric acid react according to the reaction :

$Zn(s) + 2HCl(aq.) \longrightarrow ZnCl_2(aq.) + H_2(g)$

If 0.3 mole of Zn are added to hydrochloric acid containing 0.52 mole HCl, how many moles of H_2 are produced:

(A) 0.26 (B) 0.52 (C) 0.14 (D) 0.3

9. If a solution containing 0.5 mole of $BaCl_2$ is mixed with another solution containing 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. If the percentage yield of given reaction is 30%, how many total moles of the gases will be produced, if 8 moles of $NaNO_3$ are taken initially :

$NaNO_3(s) \xrightarrow{\Delta} Na_2O(s) + N_2(g) + O_2(g)$ (unbalanced)

(A) 4.2 mole (B) 2.4 mole (C) 4.8 mole (D) 2.1 mole

11. From the following reaction sequence :

$Cl_2 + 2KOH \longrightarrow KCl + KClO + H_2O$

$3KClO \longrightarrow 2KCl + KClO_3$

$4KClO_3 \longrightarrow 3KClO_4 + KCl$

Calculate the mass of chlorine needed to produce 138.5 g of $KClO_4$:

(A) 142 g (B) 284 g (C) 432 g (D) None of these

12. 3L of N_2 gas are mixed with 6L of H_2 gas to form NH_3 gas. What volume of NH_3 gas can be produced if all volumes are measured under same temperature and pressure conditions :

(A) 6L (B) 4L (C) 9L (D) 2L

13. Calculate the volume in litre of 0.1 M solution of HCl which contains 0.365 g HCl ?

(A) 10^{-2} L (B) 0.1 L (C) 1 L (D) 10 L

14. What volume of a 0.8 M solution contains 100 millimoles of the solute ?

(A) 80 mL (B) 125 mL (C) 125 L (D) 80 L

15. Calculate the molarity when :

(a) 4.9 g H_2SO_4 acid dissolved in water to result 500 mL solution.

(b) 2 gram-molecules of KOH dissolved in water to result 500 mL solution.

(A) (a) 0.1 M (b) 0.07 M (B) (a) 0.4 M (b) 4 M

(C) (a) 0.4 M (b) 0.07 M (D) (a) 0.1 M (b) 4 M

16. Find the mass of solute and solvent in 100 mL, 1 M NaOH solution having density 1.5 g/mL.

(A) 40 g, 110 g (B) 4 g, 150 g (C) 4 g, 146 g (D) 40 g, 150 g

ChemINFO — Estimation of Sulphur

Daily Self-Study Dosage for mastering Chemistry — **Elemental analysis of Sulphur**

Estimation of Sulphur : Sulphur is estimated by Carius method.

Principle : When an organic compound containing sulphur is heated with fuming nitric acid, sulphur is oxidised to sulphuric acid. This is precipitated as barium sulphate by adding barium chloride solution. From the amount of barium sulphate, percentage of sulphur can be calculated.

Calculations : Mass of organic compound = W g

Mass of barium sulphate = W_1g

$BaSO_4 \equiv S$

233 g 32 g

233 g of barium sulphate contains sulphur = 32 g

W_1g of barium sulphate contains sulphur = $\frac{32}{233} \times W_1$g

Percentage of sulphur = $\frac{32}{233} \times \frac{W_1}{W} \times 10($

Memorize this theory as soon as you get the DPP. Revise it regularly and master this concept by practice.

17. Percentage of sulphur in organic compound can be determined by this method :
(A) Liebig's method (B) Duma's method (C) Kjeldahl's method (D) Carius method

18. In carius method for the estimation of sulphur, the formula used is
(A) Percentage of S = $\frac{16}{233}\times\frac{\text{Mass of barium sulphate}}{\text{Mass of organic compound}}\times 100$
(B) Percentage of S = $\frac{32}{233}\times\frac{\text{Mass of barium sulphate}}{\text{Mass of organic compound}}\times 100$
(C) Percentage of S = $\frac{32}{233}\times\frac{\text{Mass of organic compound}}{\text{Mass of barium sulphate}}\times 100$
(D) Percentage of S = $\frac{233}{32}\times\frac{\text{Mass of organic sulphate}}{\text{Mass of barium compound}}\times 100$

19. 0.2595 g of an organic compound in a qualitative analysis yielded 0.35 of the barium sulphate. The percentage of sulphur in the substance is :
(A) 18.52 (B) 26.52% (C) 17.5 (D) 32.2

20. On heating 0.32 of an organic compound with concentrated nitric acid and barium chloride, 0.932 g barium sulphate was obtained. Calculate the percentage of sulphur in the given compound.
(A) 10 % (B) 20 % (C) 30 % (D) 40 %

DPP No. # B4 (JEE-ADVANCED)

Total Marks : 55 **Max. Time : 36 min.**

Single choice Objective ('–1' negative marking) Q.1 to Q.4	**(3 marks, 2 min.)**	**[12, 08]**
Multiple choice objective ('–1' negative marking) Q.5 to Q.7	**(4 marks, 2 min.)**	**[12, 06]**
Comprehension ('–1' negative marking) Q.8 to Q.10 and Q.11 (a) & (b)	**(3 marks, 2 min.)**	**[15, 10]**
Single Integer type Questions ('–1' negative marking) Q.12 to Q.15	**(4 marks 3 min.)**	**[16, 12]**

1. 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) $\lambda \leq \lambda_0/2$

2. The orbital angular momentum of an electron corresponding to n = 4 and m = –3 is :
(A) 0 (B) $\frac{h}{\sqrt{2}\pi}$ (C) $\frac{\sqrt{6}h}{2\pi}$ (D) $\frac{\sqrt{3}h}{\pi}$

3. Manganese achieves its maximum oxidation state in which of these compounds :
(A) MnO_2 (B) Mn_3O_4 (C) $KMnO_4$ (D) K_2MnO_4

4. The oxidation number of sulphur in S_8, S_2F_2, H_2S and H_2SO_4 respectively are :
(A) 0, +1, –2 and 6 (B) +2, 0, +2 and 6 (C) 0, +1, +2 and 4 (D) –2, 0, +2 and 6

5.* For a mixture of 100 mL of 0.3 M $CaCl_2$ solution and 400 mL of 0.1 M HCl solution, select the correct options:
(A) Total concentration of cations = 0.14 M (B) $[Cl^-]$ = 0.2 M
(C) Moles of Ca^{2+} in mixture = 0.03 (D) None of these

6.* Which statement(s) is/are correct :
(A) Oxidation number of oxygen is –2 in most of its compounds.
(B) Oxidation number of oxygen is +2 in Oxygen difluoride.
(C) Oxidation number of oxygen is $-\frac{1}{2}$ in superoxides.
(D) Oxidation number of oxygen is +1 in peroxides.

7.* Identify the incorrect statement(s) :
(A) Halogens always have –1 oxidation state in their compounds.
(B) Oxidation number can be zero, negative, positive, integer or fractional.
(C) In OF_2, the oxidation number of F is +1.
(D) Hydrogen always has + 1 oxidation number in its compounds.

Comprehension # 1

Read the following passage carefully and answer the questions (8 to 10).

Iodine is an important substance needed by the body of a human being. We consume it in the form of salt, which has very-very small % content of iodine. Iodine has various industrial applications also. The following process has been used to obtain iodine from oil-field brines in California :

$NaI + AgNO_3 \longrightarrow AgI + NaNO_3$;

$2AgI + Fe \longrightarrow FeI_2 + 2Ag$

$2FeI_2 + 3Cl_2 \longrightarrow 2FeCl_3 + 2I_2$

8. If 381 kg of iodine is produced per hour, then mass of $AgNO_3$ required per hour will be :
(A) 170 kg (B) 340 kg (C) 255 kg (D) 510 kg

9. If 324 g of Ag is recovered in pure form, then minimum amount of NaI required will be :
(A) 450 g (B) 150 g (C) 300 g (D) 600 g

10. If above reaction is carried out by taking 150 kg of NaI and 85 kg of $AgNO_3$, then number of moles of iodine formed is :
(A) 0.5 (B) 500 (C) 250 (D) 0.25

Comprehension # 2

Rules for Rounding off the uncertain Digits :

When we do calculations using measured values, the result may contain more than one uncertain digits, which should be rounded off. The following rules are used for rounding off :

If the digit to be dropped is less than 5, then the preceding digit remains unchanged. Example :

(a) 6.32 after rounding off becomes 6.3

(b) 5.934 after rounding off becomes 5.93

If the digit to be dropped is more than 5, then the preceding digit is increased by one. Example :

(a) If it is only 5 or 5 followed by zero, then the preceding digit is raised by one if it is odd and left unchanged if it is even. Example :

(i) 4.750 after rounding off becomes 4.8 **(ii)** 4.75 after rounding off becomes 4.8

(iii) 4.650 after rounding off becomes 4.6 **(iv)** 4.65 after rounding off becomes 4.6

(b) If 5 is further followed by a non-zero digit, the preceding digit is raised by one. Example :

(i) 15.352 after rounding off becomes 15.4 **(ii)** 9.853 after rounding off becomes 9.9

Now answer the following questions :

11(a). Round off to two significant figures :
(a) 0.05857 (b) 0.05837 (c) 5.07×10^6 (d) 5.01×10^6

11(b). Round off the following numbers within three significant figures -
(i) 0.03927 kg (ii) 4.085×10^8 sec (iii) 5.2354 m (iv) 4.735×10^{-6} kg

12. 120 g Mg is burnt in air to give a mixture of MgO and Mg_3N_2. The mixture is now dissolved in HCl to form $MgCl_2$ and NH_4Cl. If 107 g NH_4Cl is produced, then determine the moles of $MgCl_2$ formed :

13. A 5 g mixture of SO_2 and O_2 gases is reacted to form SO_3 gas. What should be the mass ratio of SO_2 and O_2 gases in mixture to obtain maximum amount of SO_3 gas :

14. An impure sample of cuprite (Cu_2O) contains 66.6% Copper by mass. Find the ratio of % of pure Cu_2O to % of impurity by mass in the sample. Take = $\frac{66.6 \times 143}{254}$ = 37.5.

15. An isotope of chromium, on bombardment with neutron, undergoes a nuclear reaction yielding element X as shown below. Then find the atomic number of element X :

$${}^{52}_{24}Cr + {}^{1}_{0}n \rightarrow {}^{21}_{0}n + \alpha + {}^{1}_{1}H + X$$

DPP No. # B5 (JEE-MAIN)

Total Marks : 61 **Max. Time : 38 min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.15 **(3 marks, 2 min.)** **[45, 30]**
ChemINFO : 4 Questions ('–1' negative marking) Q.16 to Q.19 **(4 marks, 2 min.)** **[16, 08]**

1. According to Bohr model, the ratio of area covered by second orbit of H atom and first orbit of He^+ ion is
(A) 1 : 1 (B) 16 : 1 (C) 8 : 1 (D) 64 : 1

2. **S_1 :** For an electron, the given set of quantum numbers is not possible : n = 4, ℓ = 1, m = 0, s = +1/2.
S_2 : The total number of orbitals in a subshell is $2\ell + 1$, where ℓ = Azimuthal quantum number.
(A) T T (B) T F (C) F T (D) F F

3. If for any electron in an orbital, a parameter 'P' is defined as :
P = n – ℓ + m, where n, ℓ, m are the quantum numbers of that orbital.Then, what can be the maximum value of P for an unpaired electron of $_{24}Cr^{3+}$ ion ?
(A) 4 (B) 5 (C) 2 (D) 3

4. Potassium manganate is a dark green, crystalline substance whose composition is 39.6% K, 27.9% Mn and 32.5% O by mass. What is its empirical formula: (Atomic mass of Mn = 55 u)
(A) K_2MnO_4 (B) $KMnO_4$ (C) $KMnO_3$ (D) K_2MnO_2

5. In the reaction $4A + 2B + 3C \longrightarrow A_4B_2C_3$ what will be the number of moles of product formed. Starting from 2 moles of A, 1.2 moles of B & 1.44 moles of C :
(A) 0.5 (B) 0.6 (C) 0.48 (D) 4.64

6. An alloy of iron and carbon is treated with sulphuric acid, in which only iron reacts :
$$2Fe(s) + 3H_2SO_4(aq) \longrightarrow Fe_2(SO_4)_3(aq) + 3H_2(g)$$
If a sample of alloy weighing 140 g gave 6 g of hydrogen, what is the percentage of iron in the alloy ?
(A) 40% (B) 60% (C) 80% (D) 30%

7. Oxidation number of underlined elements in $\underline{N}_2O_5$, $\underline{S}O_3^{2-}$, $\underline{N}H_4^+$ are :
(A) +5, +2, –3 (B) +6, –2, +3 (C) +6, +2, –3 (D) +5, +4, –3

8. What volume of water is required to make 0.2 M solution from 16 mL of a 0.5 M solution ?
(A) 24 mL (B) 40 mL (C) 6.4 mL (D) 20 mL

9. $K_2Cr_2O_7 + C_2O_4^{2-} + H_2SO_4 \longrightarrow K_2SO_4 + CO_2 + Cr_2(SO_4)_3 + H_2O$
In above reaction, identify the elements which do not undergo change in their oxidation state :
(A) K, C & O (B) S, H, O & Cr (C) K, O, S & H (D) Cr & C

10. A, B and C elements have the oxidation number of +6, –2 and –1 repectively. The possible molecular formula when these atoms combine can be :
(A) A_2BC (B) AB_2C_2 (C) ABC_2 (D) AB_2C

11. Calculate the amount of 75% pure NaI required to prepare 5 litre of 0.5 M solution.
(A) 281.25 g (B) 500 g (C) 923.33 g (D) 519.375 g

12. 5 g of K_2SO_4 was dissolved in water to prepare 250 mL of solution. What volume of this solution should be used so that 2.33 g of $BaSO_4$ may be precipitated from $BaCl_2$ solution.
$$K_2SO_4 + BaCl_2 \longrightarrow BaSO_4 + 2KCl$$
(A) 87 mL (B) 174 mL (C) 8.7 mL (D) 17.4 mL

13. Concentrated HNO_3 is 63% HNO_3 by mass and has a density of 1.4 g/mL. How many millilitres of this solution are required to prepare 250 mL of a 1.20 M HNO_3 solution?
(A) 18.0 (B) 21.42 (C) 20.0 (D) 14.21

14. What volume of 0.25 M HNO_3 (nitric acid) solution reacts with 50 mL of 0.15 M Na_2CO_3 (sodium carbonate) solution in the following reaction :
$$2HNO_3(aq) + Na_2CO_3(aq) \longrightarrow 2NaNO_3(aq) + H_2O(\ell) + CO_2(g)$$
(A) 30 mL (B) 60 mL (C) 120 mL (D) 100 mL

15. Composition of a sample is $Fe_{0.93}O_{1.00}$. If Fe is present in +2 & +3 oxidation state in this sample then % of Fe present in +3 oxidation state
(A) 85% (B) 30% (C) 15% (D) 60%

ChemINFO — Duma's Method

Daily Self-Study Dosage for mastering Chemistry — **Elemental Analysis of Nitrogen by duma's method**

Duma's method : This method can be applied in case of all nitrogeneous compounds :

Principle : A nitrogenous compound of formula $C_xH_yN_z$ when strongly heated with cupric oxide, in the atmosphere of CO_2. Nitrogen is set free along with the formational carbon dioxides of nitrogen may be oxidised into oxides of nitrogen. When the gaseous mixutre is passed over a roll of heated bright copper gauze, the oxides of nitrogen are reduced again into nitrogen.

$$C_xH_yN_z + CuO\ (Excess) \longrightarrow xCO_2 + \frac{y}{2}H_2O + N_2 + \frac{z}{2}\ (Cu)$$

Oxides of nitrogen + Cu $\longrightarrow N_2 + CuO$

The resultant mixture is collected over KOH solution in a nitrometer.All the gases except nitrogen are absorbed. The volume of nitrogen collected over KOH solution is measured.

Observations :

(i) Mass of the organic substance taken = W g (ii) Volume of moist nitrogen in nitrometer = v mL

(iii) Room temperature = t°C = (t + 273) K (iv) Atmospheric tension at room temperature = P_1mm

$\therefore$ Pressure of dry nitrogen = $(p - p_1)$ mm

Calculation : Volume of N_2 at NTP (by gas equation) = $\frac{(p-p_1)\times v}{(t+273)}\times\frac{273}{760} = V mL$

Percentage of Nitrogen : V mL of N_2 at NTP = $\frac{28}{22400}\times v g$ (22400 mL of N_2 weight at NTP = 28 g)

$\therefore$ **Percentage of nitrogen in the given compound** = $\frac{28}{22400}\times\frac{V}{W}\times 100$ (Reff: Disha publication)

Memorize this theory as soon as you get the DPP. Revise it regularly and master this concept by practice.

16. Nitrogen is estimated in organic compound by :
(A) Carius method (B) Duma's method
(C) Lassaigne's method (D) None of these

17. In Duma's method for the estimation of nitrogen in an organic compound, nitrogen is determined in the form of:
(A) Gaseous nitrogen (B) Sodium cyanide
(C) Ammonium sulphate (D) Gaseous ammonia

18. 0.25 g of the organic compound on analysis by Duma's method gave 32 ml of nitrogen gas at STP, the percentage of nitrogen in the compound is :
(A) 8% (B) 16% (C) 20% (D) 25

19. 0.45 g of an organic compound on analysis by Duma's method gave 44 ml of nitrogen gas at STP percentage of nitrogen in the compound is :
(A) 6% (B) 12% (C) 18% (D) 25%

DPP No. # B6 (JEE-ADVANCED)

Total Marks : 58 — **Max. Time : 36 min.**

Single choice Objective ('–1' negative marking) Q.1 to Q.6	**(3 marks, 2 min.)**	**[18, 12]**
Multiple choice objective ('–1' negative marking) Q.7 to Q.9	**(4 marks, 2 min.)**	**[12, 06]**
Comprehension ('–1' negative marking) Q.10 (a) & (b) to Q.13	**(3 marks, 2 min.)**	**[12, 08]**
Match the column (no negative marking) Q.14	**(8 marks, 6 min.)**	**[08, 06]**
ChemINFO : 2 Questions ('–1' negative marking) Q.15 to Q.16	**(4 marks, 2 min.)**	**[08, 04]**

1. Which of the following compounds have sulphur atom in its maximum oxidation state :
$X = H_2SO_4$; $Y = H_2SO_5$; $Z = H_2S_2O_8$
(A) Z only (B) X only (C) Y only (D) X, Y and Z

2. Fe shows an oxidation state of +1 in :
(A) $Fe(CO)_5$ (B) $[Fe(H_2O)_5(NO^+)]SO_4$
(C) $Fe_4[Fe(CN)_6]_3$ (D) $[FeCl_4]^-$

3. 0.8 mole of a mixture of CO and CO_2 requires exactly 40 gram of NaOH in solution for complete conversion of all the CO_2 into Na_2CO_3, if the mixture (0.8 mole) is completely oxidised to CO_2, find further required moles of NaOH
(A) 0.2 (B) 0.6 (C) 1 (D) 1.5

4. The molar ratio of Fe^{2+} to Fe^{3+} in a mixture of ferrous sulphate and ferric sulphate having equal number of sulphate ions from both components of mixture is :
(A) 1 : 2 (B) 3 : 2 (C) 2 : 3 (D) 3 : 1

5. In which of the following compounds, nitrogen has an oxidation state of –1?
(A) N_2O (B) NO_2^- (C) NH_2OH (D) N_2H_4

6. A solution containing 0.1 mole of a metal chloride MCl_x requires 500 mL of 0.8 M $AgNO_3$ solution for complete precipitation. The value of x is :
(A) 1 (B) 2 (C) 4 (D) 3

7.* The following transitions occur when sodium atoms are sprayed into hot flame. The various steps are numbered.

$$3s \xrightarrow{I} 3p \xrightarrow{II} 4d \xrightarrow{III} 4s \xrightarrow{IV} 3p \xrightarrow{V} 3s$$

Which of these steps result in emission of photon ?
(A) III (B) V (C) IV (D) I

8.* Dichromate ion in acidic medium oxidizes stannous ion as :

$$xSn^{2+} + yCr_2O_7^{2-} + zH^+ \longrightarrow aSn^{4+} + bCr^{3+} + cH_2O$$

(A) the value of x : y is 1 : 3 (B) the value of x + y + z is 18
(C) a : b is 3 : 2 (D) the value of z – c is 7

9.* Identify the correct options for the following reaction

$$A + B \longrightarrow A_nB_m$$

(A) n mol A react with m mol B
(B) $\left(\frac{1}{m}\right)$ moles of A react with $\left(\frac{1}{n}\right)$ moles of B
(C) If m mol A is limiting then $\left(\frac{n}{m}\right)$ moles of A_nB_m is formed
(D) (n + m) mol mixture of A & B can produce maximum of 1 mol of A_nB_m

Comprehension # 1

Significant Figures in Calculations :-

When we do calculation using measured values, the result cannot be more accurate than any of the measured values. The result must possess the accuracy level as that of original measurements. So to have proper accuracy in the final result, we need to follow some rules during different arithmetical operations.

(A). **Addition and subtraction :** The number of decimal places in the final result of any of these operations has to be equal to the smallest number of decimal places in any of the terms involved in calculations. Example:
a. Sum of 2.29 and 62.7 is 64.99. After rounding off to one place of decimal it will become 65.0.
b. Subtraction of 62.7 from 82.29 gives 19.59. After rounding off to one place of decimal, it will become 19.6.
Note : During the subtraction of quantities of nearly equal magnitude, accuracy is almost destroyed, e.g., 3.28 - 3.23 = 0.05. Result 0.05 has only one significant figure whereas original measurements have three significant figures each.
So it is advised that the difference should be measured directly instead of measuring the quantities first and then finding their difference.

(B). **Multiplication and division :** In these operations, the number of significant figures in the result is the same as the smallest number of significant figures in any of the fac-tors. Example :
a. 1.3 × 1.2 = 1.56. After rounding off to two significant figures, it becomes. 1.6.
b. $\frac{3500}{7.52}$ = 465.42. As 3500 has minimum number of significant figures. i.e. two, the quotient must have two significant figures. So 465.42 = 470 (after rounding off)
c. If we divide 3500 m by 7.52, 3500 m has four significant figures, then final result should be 465 (after rounding off to three significant figures).

Now answer the following questions (Q.10) :

10(a). With due regard to significant figures, add the following
(a) 953 and 0.324 (b) 953 and 0.625 (c) 953.0 and 0.324 (d) 953.0 and 0.374

10(b). With due regard to significant figures, subtract
(a) 0.35 from 7 (b) 0.65 from 7 (c) 0.35 from 7.0 (d) 0.65 from 7.0

Comprehension # 2

Molarity(mol/L)	Molality(mol/Kg)	Density (g/mL)	Gram molecular	mass of solute
Solution-1	a	–	d_1	P
Solution-2	–	b	d_2	Q
Solution-3	1	–	1.060	60

Now answer the following questions :

11. What is molality of solution-1 :
(A) $\frac{(1000\times a)}{(1000\times d_1)-aP}$ (B) $\frac{1000\,d_1}{1000\,a-P}$ (C) $\frac{a}{1000\,d_1-aP}$ (D) None of these

12. What is the molarity of solution-2 :
(A) $\frac{b\times d_2}{1000+bQ}$ (B) $\frac{b\times 1000\times d_2}{1000+bQ}$ (C) $\frac{1000\times bQ}{1000+bd_2}$ (D) None of these

13. Which of the followig statements is/are true :
(I) For solution-3, molarity and molality are equal.
(II) Mole fraction and molality of solution are independent of temperature.
(III) If same mass of an impure solute is dissolved instead of pure solute, then molarity of solution with respect to solute compound will be equal in two cases .
(A) I, II & III (B) Only II (C) II & III (D) I & II

14. Match the following :

Column I		Column II	
(A)	1 M glucose solution	(p)	1 mole solute per litre of solution
(B)	3 M urea solution	(q)	180 g solute per litre of solution
(C)	3 M CH_3COOH solution	(r)	% w/v = 18%
(D)	1 M H_2SO_4 solution	(s)	% w/v = 9.8%

ChemINFO — Estimation of Phosphorus

Daily Self-Study Dosage for mastering Chemistry — **Estimation of Phosphorous**

First method :
A known mass of compound is heated with fuming HNO_3 which converts phosphorous to H_3PO_4 (phosphoric acid). It is precipitated as ammonium phospho molybdate [$(NH_4)_3.PO_4.12\ MoO_3$] by adding NH_3 and ammonium molybdate [$(NH_4)_2\ MoO_2$]. It is filtered, dried, and weighed. (Molar mass of ammonium phospho molybdate = 1877 gram)

Percentage of P = $\frac{\text{Atomic mass of P}}{\text{Molecular mass of ammonium phospho molybdate}} \times \frac{\text{Mass of ammonium phospho molybdate}}{\text{Mass of compound}} \times 100$

Second Method :
A known mass of compound is heated with fuming HNO_3 which converts phosphorous to H_3PO_4. Magnesia mixture ($MgCl_2$ + NH_4Cl) is then added, which gives the precipitate of magnesium ammonium phosphate ($MgNH_4.PO_4$) which on heating gives magnesium pyrophosphate ($Mg_2P_2O_7$), which is weighed.

Percentage of P = $\frac{2\times \text{Atomic mass of P}}{\text{Molecular mass of } Mg_2P_2O_7} \times \frac{\text{mass of } Mg_2P_2O_7}{\text{mass of compound}} \times 100$

Memorize this theory as soon as you get the DPP. Revise it regularly and master this concept by practice.

15. In the quantitative estimation of phosphorous by using magnesia mixture, the formula used is where (w = mass of $Mg_2P_2O_7$ W = mass of compound)

(A) Percentage of $P=\frac{62}{222}\times\frac{w\times100}{W}$ (B) Percentage of $P=\frac{31}{222}\times\frac{W\times100}{w}$

(C) Percentage of $P=\frac{62}{222}\times\frac{W\times100}{w}$ (D) Percentage of $P=\frac{31}{222}\times\frac{w\times100}{W}$

where w is the mass of $Mg_2P_2O_7$ and W is the mass of the compound.

16. In the quantitative estimation of phosphorous by using ammonium molybdate, the formula used is where w = mass of ammonium phospho molybdate.
W = Mass of compound) :

(A) Percentage of $P=\frac{62}{1877}\times\frac{w\times100}{W}$ (B) Percentage of $P=\frac{62}{1877}\times\frac{W\times100}{w}$

(C) Percentage of $P=\frac{31}{1877}\times\frac{w\times100}{W}$ (D) Percentage of $P=\frac{31}{1877}\times\frac{W\times100}{w}$

where w is the mass of ammonium phospho molybdate and W is the mass of the compound.

DPP No. # B7 (JEE-ADVANCED)

Total Marks : 42 **Max. Time : 29 min.**

Single choice Objective ('–1' negative marking) Q.1 to Q.5	**(3 marks, 2 min.)**	**[15, 10]**
Multiple choice objective ('–1' negative marking) Q.6	**(4 marks, 2 min.)**	**[04, 02]**
Single Integer type Questions ('–1' negative marking) Q.7 to Q.11	**(4 marks 3 min.)**	**[20, 15]**
Matching List Type (Only One options correct) ('–1' negative marking) Q.12	**(3 marks, 2 min.)**	**[03, 02]**

1. Which series of subshells is arranged in the order of increasing energy for multi-electron atoms ?
(A) 6s, 4f, 5d, 6p (B) 4f, 6s, 5d, 6p (C) 5d, 4f, 6s, 6p (D) 4f, 5d, 6s, 6p

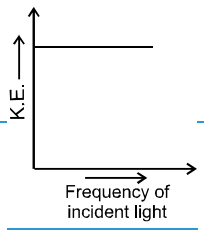
2. If the uncertainty in velocity and position is same, then the uncertainty in momentum will be :
(A) $\sqrt{\frac{hm}{4\pi}}$ (B) $m\sqrt{\frac{h}{4\pi}}$ (C) $\sqrt{\frac{h}{4\pi m}}$ (D) $\frac{1}{m}\sqrt{\frac{h}{4\pi}}$

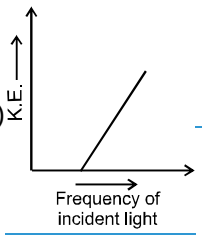
3. 10 moles of CO_2 do not contain :
(A) 120 g of C (B) 20 gram-atoms of O
(C) 30 N_A atoms (D) 160 g of O

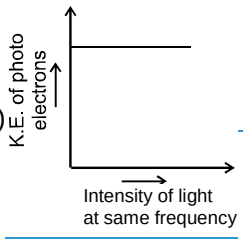
4. Maximum number of electrons in a subshell with ℓ = 3 and n = 4 is :
(A) 14 (B) 16 (C) 10 (D) 12

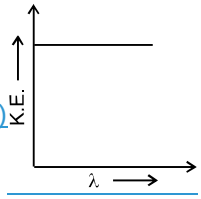
5. Photoelectric emission is observed from a surface for frequencies ν_1 and ν_2 of the incident radiation ($\nu_1 > \nu_2$). If the maximum kinetic energies of the photoelectrons in the two cases are in the ration 1: k then the threshold frequency ν_0 is given by
(A) $\frac{\nu_2-\nu_1}{k-1}$ (B) $\frac{k\nu_1-\nu_2}{k-1}$ (C) $\frac{k\nu_2-\nu_1}{k-1}$ (D) $\frac{\nu_2-\nu_1}{k}$

6.* Which is/are correct graph(s) ?

(A) 

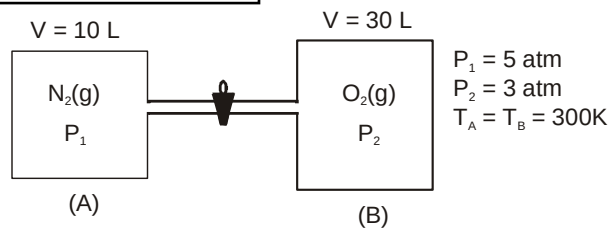
(B) 

(C) 

(D) 

7. The potential difference applied on the metal surface to reduce the velocity of photoelectron to zero is known as Stopping Potential. When a beam of photons of wavelength 40 nm was incident on a surface of a particular pure metal, some emitted photoelectrons had stopping potential equal to 18.6 V, some had 12 V and rest had lower values. Calculate the threshold wavelength (λ_0) of the metal (in Å) assuming that at least one photoelectron is ejected with maximum possible kinetic energy. (hc = 12400eVÅ) Report your answer after dividing by 200.

8. When the valve connecting (A) and (B) is opened, the gases mix. The mixture is then sparked and 50% of N_2 reacts to give NO(g). If final temperature of the vessels is two times initial temperature, find final pressure in the vessel. (Give answer in atm)



9. The stopcock, connecting the two bulbs of volume 8 litre and 10 litre containing an ideal gas at 6.25 atm and 4 atm respectively, is opened. What is the final gas pressure, if the temperature remains same ?

10. Two glass bulbs of equal volume are filled with an ideal gas at 500 K and pressure of 76 cm of Hg and are connected by a narrow tube. One of the bulb is then placed in a water bath maintained at 700 K and the other bulb is maintained at 500 K. What is the new value of the pressure (in cm of Hg) inside the bulbs? The volume of the connecting tube is negligible. Report your answer after multiplying by $\frac{6}{7}$.

11. If oxidation number per atom of phosphorous is x on reactant side and that of silicon is y on product side, find 2x – y.

$$Ca_3(PO_4)_2 + SiO_2 + C \rightarrow CaSiO_3 + P_4 + CO$$

12. **Match the following :**

Column I		Column II	
(A)	Binding energy of 5th excited state of Li^{2+} sample	(p)	10.2 V
(B)	I^{st} excitation potential of H-atom	(q)	3.4 eV
(C)	2^{nd} excitation potential of He^+ ion	(r)	13.6 eV
(D)	I.E. of H-atom	(s)	48.4 V

(A) [A → r] ; [B → p] ; [C → s] ; [D → q] (B) [A → s] ; [B → p] ; [C → q] ; [D → r]
(C) [A → q] ; [B → r] ; [C → s] ; [D → p] (D) [A → q] ; [B → p] ; [C → s] ; [D → r].

DPP No. # B8 (JEE-MAIN)

Total Marks : 48 **Max. Time : 32 min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.16 **(3 marks, 2 min.) [48, 32]**

1. Equal masses of Sulphur dioxide and Oxygen gases are mixed in an empty container at 25°C. The fraction of the total pressure exerted by sulphur dioxide is : (Assume no chemical reaction)
(A) 1/3 (B) 1/2 (C) 2/3 (D) 1/5

2. At constant volume and temperature conditions, the rates of diffusion r_A and r_B of gases A and B having densities ρ_A and ρ_B are related by the expression :
(A) $r_A = r_B (\rho_A / \rho_B)$ (B) $r_A = r_B (\rho_B / \rho_A)^{1/2}$ (C) $r_A = r_B (\rho_B / \rho_A)$ (D) $r_A = r_B (\rho_A / \rho_B)^{1/2}$

3. The ratio of rates of diffusion of SO_2, O_2 and CH_4 under identical conditions is :
(A) 1 : $\sqrt{2}$: 2 (B) 1 : 2 : 4 (C) 2 : $\sqrt{2}$: 1 (D) 1 : 2 : $\sqrt{2}$

4. The molecular weight of a gas, which diffuse through a porous plug at 1/6th of the speed of hydrogen under identical conditions, is :
(A) 12 u (B) 72 u (C) 36 u (D) 24 u

5. Molecular weight of a gas that diffuses twice as rapidly as the gas with molecular weight 64 is : (assume identical conditions)
(A) 16 (B) 8 (C) 256 (D) 32

6. The ratio of the rate of diffusion of a given element to that of helium is 1.414. The molecular weight of the element is: (assume same temperature and pressure)
(A) 2 (B) 4 (C) 8 (D) 16

7. 5 mL of He gas diffuses out in 1 second from a hole. Find the volume of SO_2 that will diffuse out from the same hole under identical conditions in 2 seconds.
(A) 2.5 mL (B) 1.25 mL (C) 1.77 mL (D) 5 mL

8. The rate of effusion of helium gas at a pressure of 1000 torr is 10 torr min^{-1}. What will be the rate of effusion of hydrogen gas at a pressure of 2000 torr at the same temperature ?
(A) 20 torr min^{-1} (B) 40 torr min^{-1} (C) $20\sqrt{2}$ torr min^{-1} (D) 10 torr min^{-1}

9. A bottle of dry NH_3 & a bottle of dry HCl connected through a long tube are opened simultaneously under identical conditions at both ends. The white ammonium chloride ring first formed will be :
(A) at the centre of the tube (B) near the HCl bottle
(C) near the NH_3 bottle (D) throughout the length of tube

10. At room temperature, A_2 gas (vapour density = 40) and B_2 gas are allowed to diffuse through identical pinholes from opposite ends of a glass tube of 1m length and of uniform cross-section. The two gases first meet at a distance of 60 cm from the A_2 end. The molecular mass of B_2 gas is :
(A) 90 u (B) 180 u (C) 45 u (D) 35.5 u

11. A mixture containing 2 moles of He and 1 mole of CH_4 is taken in a closed container and made to effuse through a small orifice of container. Then, which is the correct effused volume percentage of He and CH_4 initially, respectively :
(A) 40%, 60% (B) 20%, 80% (C) 80%, 20% (D) 60%, 40%

12. At same temperature and pressure, which of the following gases will have same average translational kinetic energy per mole as N_2O :
(A) He (B) H_2S (C) CO_2 (D) All of these

13. At what temperature, will hydrogen molecules have the same average translational kinetic energy as nitrogen molecules have, at 35°C?
(A) $\left(\frac{28\times35}{2}\right)$°C (B) $\left(\frac{2\times35}{28}\right)$°C (C) $\left(\frac{2\times28}{35}\right)$°C (D) 35 °C

14. Average translational K.E. of one mole of helium gas at 273 K in calories is :
(A) 819 (B) 81.9 (C) 3412.5 (D) 34.125

15. A sample of gas contains N_1 molecules and the average translational kinetic energy at – 123°C is E_1 ergs. Another sample of gas at 27°C has average translational kinetic energy as $2E_1$ ergs. Assuming gases to be ideal, the number of gas molecule in the second sample will be
(A) N_1 (B) $\frac{N_1}{4}$ (C) $2N_1$ (D) $4N_1$

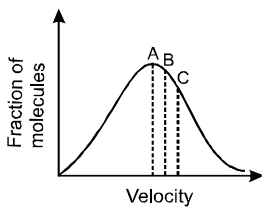
16. If average kinetic energy of the molecules in 5 L of He at 2 atm is E, then average kinetic energy of the same number of molecules in 15 L of Ne at 3 atm in terms of E is:
(A) 4.5 E (B) E (C) 0.9 E (D) 22.5 E

DPP No. # B9 (JEE-ADVANCED)

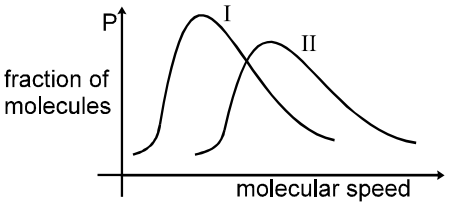
Total Marks : 63		**Max. Time : 39 min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.5	**(3 marks, 2 min.)**	**[15, 10]**
Multiple choice objective ('–1' negative marking) Q.6 to Q.8	**(4 marks, 2 min.)**	**[12, 06]**
Integer type Questions ('–1' negative marking) Q.9 to Q.11	**(4 marks, 3 min.)**	**[12, 09]**
Match the column (no negative marking) Q.12	**(8 marks 6 min.)**	**[08, 06]**
ChemINFO : 4 Questions ('–1' negative marking) Q.13 to Q.16	**(4 marks, 2 min.)**	**[16, 08]**

1. Equal amount (mass) of methane and ethane have their total translational kinetic energy in the ratio 3 : 1 then their temperatures are in the ratio.
(A) 5 : 8 (B) 45 : 8 (C) 15 : 8 (D) 8 : 5

2. At a definite temperature (T), the distribution of velocities is given by the curve. The curve that indicates that the velocities corresponding to points A, B and C are :
(A) most probable, average and root mean square
(B) average, root mean square and most probable
(C) root mean square, average and most probable
(D) most probable, root mean square and average



3. The graphs representing distribution of molecular speeds at 300 K for gases Cl_2 and N_2 are as shown below (Atomic mass N = 14, Cl = 35.5)



(A) I graph is for N_2 and II is for Cl_2
(B) II graph is for N_2 and I is for Cl_2
(C) either graph can be taken for N_2 or Cl_2
(D) information is not sufficient

4. The root mean square velocity of an ideal gas at constant pressure varies with density (d) as :
(A) d^2 (B) d (C) $\sqrt{d}$ (D) $1/\sqrt{d}$

5. In Haber process, 30 litres of dihydrogen and 30 litres of dinitrogen were taken for reaction which yielded only 50% of the expected product. What will be the composition of gaseous mixture under the given condition in the end ?
(A) 20 litres ammonia, 25 litres dinitrogen, 15 litres dihydrogen
(B) 20 litres ammonia, 20 litres dinitrogen, 20 litres dihydrogen
(C) 10 litres ammonia, 25 litres dinitrogen, 15 litres dihydrogen
(D) 20 litres ammonia, 10 litres dinitrogen, 30 litres dihydrogen

6.* An equimolar mixture of CO and O_2 is exploded to produce CO_2. Which of the following is/are correct ?
(A) The initial vapour density of the mixture is 15.
(B) The average molar mass of final mixture is less than that of initial mixture.
(C) CO is limiting reagent.
(D) Mole % of CO_2 in the final mixture is 50%.

7.* Which of the following are examples of disproportionation reactions ?
(A) $Ag(NH_3)_2^+ + 2H^+ \longrightarrow Ag^+ + 2NH_4^+$
(B) $Cl_2 + OH^- \longrightarrow ClO^- + Cl^- + H_2O$
(C) $Cu_2O + 2H^+ \longrightarrow Cu + Cu^{+2} + H_2O$
(D) $2HCuCl_2 \xrightarrow{\text{dil. with } H_2O} Cu + Cu^{2+} + 4Cl^- + 2H^+$

8.* The time taken for effusion of 32 mL of oxygen gas will be the same as the time taken for effusion of which gas sample under identical conditions : (Take $\sqrt{2}$ = 1.4, $\sqrt{3}$ = 1.7)
(A) 64 mL H_2 (B) 50 mL N_2 (C) 44.8 mL CH_4 (D) 22.4 mL SO_2

9. Let the total number of orbitals in a^{th} shell be 16 and value of azimuthal quantum number for the unpaired electron in vanadium atom (Z = 23) be 'b', then find the sum (a + b).

10. 100 mL of sulphuric acid solution (sp. gr. = 1.84) contains 98% by weight of pure acid. Calculate the volume of 0.46 M NaOH solution (in L) required to just neutralize the above acid solution.

11. The given reaction is an important step in Ostwald's method for manufacturing of HNO_3. If we start with 6.8 g of NH_3 and 40 g of O_2, then what mass % of excess reagent will be left behind ?

$$NH_3 + O_2 \longrightarrow NO + H_2O$$

12. Match the following :

Column I		Column II	
(A)	50 mL of 3M HCl solution + 150 mL of 1M $FeCl_3$ solution	(p)	4.17 m
(B)	An aqueous solution of NaCl with mole fraction of NaCl as 0.1	(q)	$[Cl^-]$ = 3 M
(C)	20% (w/w) propanol (C_3H_7OH) solution	(r)	$[H^+]$ = 0.75 M
(D)	10.95% (w/v) HCl solution	(s)	6.1 m

Estimation of Halogens : The estimation of halogens (Cl, Br or I) in organic compounds is usually done by **Carius method**.

Principle : The method is based on the fact that when an organic compound containing halogen (Cl, Br or I) is heated in a sealed tube with fuming nitric acid in presence of silver nitrate, silver halide is formed. From the mass of silver halide formed, the precentage of the halogen can be calculated.

Calculations : Mass of the organic substance = W g

Mass of the silver halide = W_1g

(a) Chlorine : Percentage of chlorine = $\frac{35.5}{143.5} \times \frac{W_1}{W} \times 100$

W_1 is mass of silver chloride

W is mass of organic substance

(b) Bromine : Percentage of bromine = $\frac{80}{188} \times \frac{W_1}{W} \times 100$

W_1 is mass of silver bromide

W is mass of organic substance

(c) Iodine : Percentage of iodine = $\frac{127}{235} \times \frac{W_1}{W} \times 100$

W_1 is mass of silver Iodide

W is mass of organic substance

Memorize this theory as soon as you get the DPP. Revise it regularly and master this concept by practice.

13. In carius method for estimation of chlorine, the formula used is :

(A) Percentage of Cl = $\frac{80}{188} \times \frac{\text{mass of AgCl}}{\text{Mass of organic substance}} \times 100$

(B) Percentage of Cl = $\frac{127}{235} \times \frac{\text{mass of AgCl}}{\text{Mass of organic substance}} \times 100$

(C) Percentage of Cl = $\frac{35.5}{143.5} \times \frac{\text{mass of AgCl}}{\text{Mass of organic compound}} \times 100$

(D) Percentage of Cl = $\frac{35.5}{143.5} \times \frac{\text{mass of organic compound}}{\text{Mass of AgCl}} \times 100$

14. 0.5264 g silver bromide is obtained from 0.5124 g of an organic compound. The percentage of bromine in the compound is :

(A) 23.71 % (B) 43.71 % (C) 35.2 % (D) 53.6 %

15. 0.156 g of an organic compound of heating with fuming HNO_3 and $AgNO_3$ gives 0.235g of AgI. The percentage of iodine in the compound.

(A) 52.1 % (B) 63.2 % (C) 71.3 % (D) 81.4 %

16. 0.1171 g of an organic compound on heating with conc. HNO_3 and silver nitrate in Carius furnace gave 0.42 g of AgCl. The percentage of chlorine in the compound is

(A) 38.2 % (B) 54.3 % (C) 71.4 % (D) 88.8 %

DPP No. # B10 (JEE-MAIN)

Total Marks : 60 **Max. Time : 38 min.**

Single choice Objective ('–1' negative marking) Q.1 to Q.20 (3 marks, 2 min.) [60, 40]

1. Two vessels, A and B, contain the same gas. If the pressure, volume and absolute temperature of the gas in A are two times as compared with those of gas in B, and if mass of the gas in B is x g, the mass of the gas in A will be :
(A) 4x g (B) x/2 g (C) 2x g (D) x g

2. A gas mixture contains 50% helium and 50% methane by volume. What is the percent by weight of methane in the mixture ?
(A) 88.89% (B) 20% (C) 71.43% (D) 80%

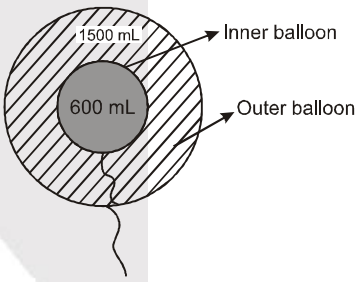
3. A mixture of He and SO_2 at one bar pressure contains 20% by weight of He. Partial pressure of He will be :
(A) 0.2 bar (B) 0.4 bar (C) 0.6 bar (D) 0.8 bar

4. The density of gas A is twice that of a gas B at the same temperature. The molecular weight of gas B is thrice that of A.The ratio of the pressure exerted on A and B will be :
(A) 6 : 1 (B) 3 : 2 (C) 2 : 3 (D) 1 : 6

5. A 4.0 dm^3 flask containing N_2 at 4.0 bar was connected to a 6.0 dm^3 flask containing helium at 6.0 bar, and the gases were allowed to mix isothermally. Then the total pressure of the resulting mixture will be :
(A) 4.8 bar (B) 5.2 bar (C) 5.6 bar (D) 5.4 bar

6. What volume of oxygen gas (O_2) measured at 0°C and 1 atm is needed to burn completely 1 L of propane gas (C_3H_8) measured under the same conditions?
(A) 7 L (B) 6 L (C) 5 L (D) 10 L

7. Two inflated ballons I and II (thin skin) having volume 600 mL and 1500 mL at 300 K are taken as shown in diagram. If maximum volume of inner and outer balloons are 800 mL and 1800 mL respectively then find the balloon which will burst first on gradual heating.



(A) inner balloon
(B) outer balloon
(C) both simultaneously
(D) unpredictable

8. If an ideal gas is allowed to expand at constant tempeature then-
(A) the kinetic energy of the gas molecules decreases
(B) the kinetic energy of the gas molecules increases
(C) the kinetic energy of the gas molecules remains the same
(D) None

9. 3 g of carbon and 5 g of oxygen react with each other completely. Which of the following options is true regarding composition of final mixture :
(A) $n_{CO_2} = 0.15625$; $n_C = 0.09375$ (B) $n_{CO} = 0.0625$; $n_{CO_2} = 0.1875$
(C) $n_{CO} = 0.25$; $n_{O_2} = 0.03125$ (D) $n_{CO} = 0.1875$; $n_{CO_2} = 0.0625$

10. Consider three one-litre flasks labeled A, B and C filled with the gases NO, NO_2 and N_2O, respectively, each at STP, In which flask do the molecules have the highest average kinetic energy?
(A) Flask C (B) Flask B (C) Flask A (D) All are the same

11. If a gas expands at constant temperature, it indicates that :
(A) kinetic energy of molecules decreases.
(B) pressure of the gas increases.
(C) kinetic energy of molecules remains the same.
(D) number of the molecules of gas increases.

12. Express the average kinetic energy per mole of a monoatomic gas of molar mass M, at temperature T K in terms of the mean speed of the molecules ($\bar{c}$) :

(A) $\frac{8M}{3\pi}(\bar{c})^2$ (B) $\frac{3M}{16}(\bar{c})^2$ (C) $\left(\frac{2M}{\pi}\right)(\bar{c})^2$ (D) $\left(\frac{3\pi M}{16}\right)(\bar{c})^2$

13. The correct relationship between average translational kinetic energy per mole (KE) and most probable speed (v_{mp}) for an ideal gas is : (M is molar mass of gas)

(A) $v_{mp} = \sqrt{\frac{16KE}{3\pi M}}$ (B) $v_{mp} = \sqrt{\frac{2KE}{M}}$ (C) $v_{mp} = \sqrt{\frac{2KE}{3M}}$ (D) $v_{mp} = \sqrt{\frac{4KE}{3M}}$

14. Consider three electron jumps described below for the hydrogen atom.

x : n = 3 to n = 1
y : n = 4 to n = 2
z : n = 5 to n = 3

The photon emitted in which transition will have smallest wave number :

(A) z (B) y (C) x (D) All have same value

15. In the electronic configuration of Mn (Z = 25) :

(A) the number of electrons having $n + \ell = 4$ are 5
(B) the number of electrons having m = 0 are 13.
(C) the magnetic moment is 1.73 BM
(D) Mn belongs to IIIrd period and d-Block in Modern periodic table.

16. If rate of diffusion of A is 5 times that of B, what will be the density ratio of A and B :

(A) 1/25 (B) 1/5 (C) 25 (D) 4

17. On increasing temperature of a particular gaseous sample, the fraction of total gas molecules which have speed equal to most probable speed will :

(A) increase (B) decrease
(C) remains constant (D) nothing can be said with certainty

18. The mean transitional kinetic energy per unit volume, E and the pressure, P of a perfect gas are related as:

(A) P = E/2 (B) P = 2E/3 (C) $P = E\sqrt{3}/2$ (D) P = 3E/2

19. Calculate the temperature at which the root mean square speed of sulphur dioxide molecules is the same as that of oxygen gas molecules at 300 K :

(A) 150 K (B) 600 K (C) 300 K (D) 1200 K

20. A sample of air is saturated with benzene (vapour pressure = 100 mm of Hg at 298 K) at 298 K and partial pressure of air is 650 mm of Hg. If it is isothermally compressed to half of its initial volume, the final pressure of the system is :

(A) 1500 torr (B) 425 torr (C) 1400 torr (D) 1200 torr

DPP No. # B11 (JEE-MAIN)

Total Marks : 60 **Max. Time : 38 min.**

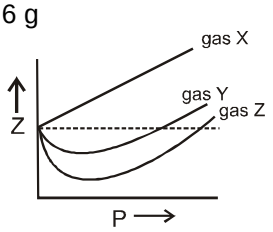
Single choice Objective ('–1' negative marking) Q.1 to Q.20 **(3 marks, 2 min.)** **[60, 40]**

1. 224 mL of CO_2 at N.T.P. is passed through 100 mL of 0.2 M solution of NaOH. What is the weight of Na_2CO_3 formed ? $2NaOH + CO_2 \longrightarrow Na_2CO_3 + H_2O$

(A) 1.06 g (B) 0.53 g (C) 2.12 g (D) 10.6 g

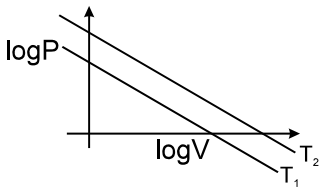
2. A graph between compressibility factor (Z) & pressure is drawn for three gases at the same temperature then correct order of boyles temperature (T_b) of X, Y and Z is.

[Assume that Vander Waal's constant 'b' is nearly same for all three gases.]



(A) $T_{b(x)} < T_{b(y)} < T_{b(z)}$ (B) $T_{b(x)} = T_{b(y)} = T_{b(z)}$
(C) $T_{b(x)} > T_{b(y)} > T_{b(z)}$ (D) can not be predicted

3. For the following two isotherms drawn at two different temperature T_1 and T_2. Which of the following statement is true? (number of moles are constant)



(A) $T_2 > T_1$ (B) $T_1 > T_2$ (C) $T_1 = T_2$
(D) $T_1 = 2\ T_2$ (E) Cannot be predicted

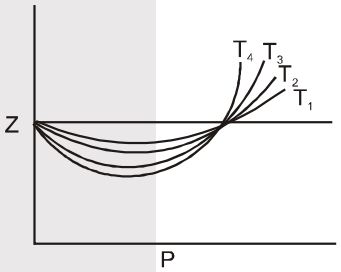
4. For the four gases A, B, E and D, the value of the excluded volume per mole is same. If the order of the critical temperature is $T_B > T_D > T_A > T_E$, then the order of their liquefaction pressure at a temperature T ($T < T_E$) will be :
(A) $P_A < P_B < P_E < P_D$ (B) $P_B < P_D < P_A < P_E$ (C) $P_E < P_A < P_D < P_B$ (D) $P_D < P_E < P_A < P_B$

5. Gases deviate from the ideal gas behavior because their molecules :
(A) Possess negligible volume (B) Have forces of attraction between them
(C) Are polyatomic (D) Are not attracted to one another

6. The compressibility factor for an ideal gas is :
(A) 0 (B) 1 (C) 3/8 (D) ∞

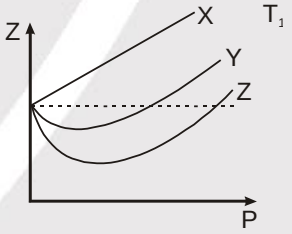
7. A real gas most closely approaches the behaviour of an ideal gas at :
(A) low pressure & low temperature (B) high pressure & high temperature
(C) low pressure & high temperature (D) high pressure & low temperature

8. Which of the following is correct order of temperature shown in the following Z Vs P graph for the same gas:

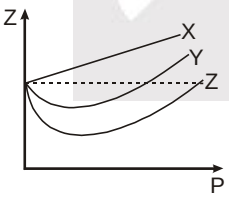


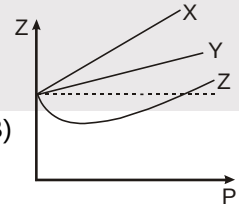
(A) $T_1 < T_2 < T_3 < T_4$
(B) $T_4 < T_3 < T_2 < T_1$
(C) $T_1 < T_3 < T_2 < T_4$
(D) $T_4 < T_2 < T_3 < T_1$

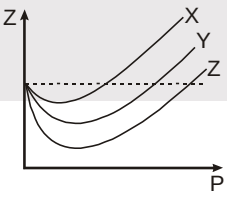
9. Z vs P graph is plotted for 1 mole of three different gases X, Y and Z at temperature T_1.

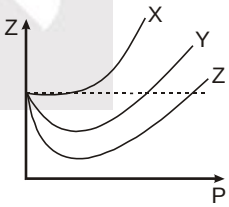


Then, which of the following graph is incorrect if the above plot is made for 1 mole of each gas at T_2 temperature ($T_2 < T_1$) :

(A) 

(B) 

(C) 

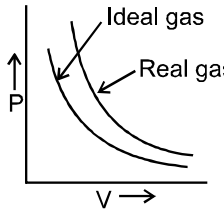
(D) 

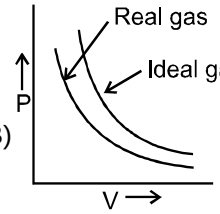
10. One litre gas at 400 K and 300 atm pressure is compressed to a pressure of 600 atm and 200 K. The compressibility factor is changed from 1.2 to 1.6 respectively. Calculate the final volume of the gas.
(A) 2 litre (B) $\frac{2}{3}$ litre (C) $\frac{1}{3}$ litre (D) $\frac{4}{3}$ litre

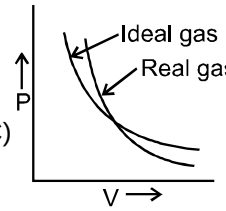
11. The compressibility of a gas is less than unity at S.T.P. Therefore :
(A) $V_m > 22.4$ litres (B) $V_m < 22.4$ litres (C) $V_m = 22.4$ litres (D) $V_m = 44.8$ litres

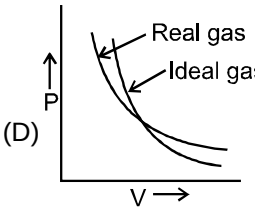
12. Compressibility factor (Z) for N_2 at – 23°C and 820 atm pressure is 1.9. Find the number of moles of N_2 gas required to fill a gas cylinder of 95 L capacity under the given conditions.
(A) 2000 (B) 200 (C) 2×10^4 (D) Cannot be determined

13. Which of the following graph is correct for real gases other than hydrogen and helium?

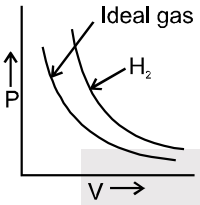
(A) 

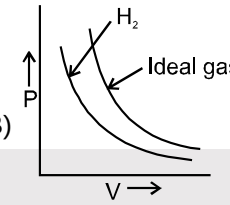
(B) 

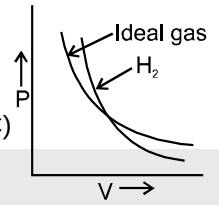
(C) 

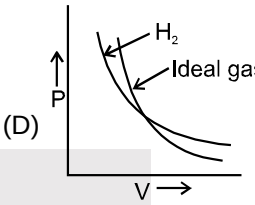
(D) 

14. Which of the following graph is commonly correct for hydrogen gas?

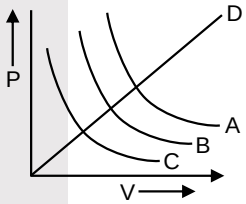
(A) 

(B) 

(C) 

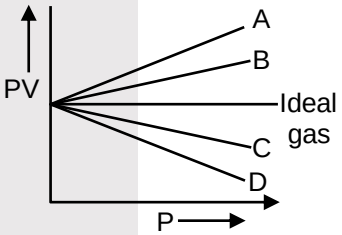
(D) 

15. For a real gas Z is greater than one and curve B represents ideal gas behaviour. Then the curve for the real gas is :



(A) A
(B) B
(C) C
(D) D

16. In the graph shown, which of the statements is correct.



(A) for A, B, C & D the compressibility factor is > 1

(B) for A, B, C & D the value of z is less than one

(C) for A, B, z is greater than one & C, D, z is less than one

(D) for A, B, z is less than one & C, D, z is greater than one

17. Consider the equation $Z = \frac{pV}{RT}$. Which of the following statements is correct?

(A) When Z > 1, real gases are easier to compress than the ideal gas.
(B) When Z = 1, real gases get compressed easily as compared to ideal gas.
(C) When Z > 1, real gases are difficult to compress as compared to ideal gas.
(D) When Z = 1, real gases are difficult to compress as compared to ideal gas.

18. Compressibility factor for He behaving as real gas generally is :

(A) 1 (B) $\left(1-\frac{a}{RTV}\right)$ (C) $\left(1+\frac{Pb}{RT}\right)$ (D) $\frac{RTV}{(1-a)}$

19. The density of Nitrogen gas is maximum at :

(A) STP (B) 273 K and 0.5 atm (C) 546 K and 4 atm (D) 546 K and 1 atm

20. The rms velocity of hydrogen is $\sqrt{7}$ times the rms velocity of nitrogen. If T is the temperature of the gas, then

(A) $T_{(H_2)} = T_{(N_2)}$ (B) $T_{(H_2)} > T_{(N_2)}$ (C) $T_{(H_2)} < T_{(N_2)}$ (D) $T_{(H_2)} = \sqrt{7}T_{(N_2)}$

DPP No. # B12 (JEE-ADVANCED)

Total Marks : 77 **Max. Time : 51 min.**

Single choice Objective ('–1' negative marking) Q.1 to Q.4	**(3 marks, 2 min.)**	**[12, 08]**
Multiple choice objective ('–1' negative marking) Q.5 to Q.9	**(4 marks, 2 min.)**	**[20, 10]**
Comprehension ('–1' negative marking) Q.10 to Q.12	**(3 marks, 2 min.)**	**[09, 06]**
Integer type Questions ('–1' negative marking) Q.13 to Q.19	**(4 marks, 3 min.)**	**[28, 21]**
Match the column (no negative marking) Q.20	**(8 marks, 6 min.)**	**[08, 06]**

1. A vessel has nitrogen gas and water vapours in equilibrium with liquid water at a total pressure of 1 atm. The partial pressure of water vapours is 0.3 atm. The volume of this vessel is reduced to one-third of the original volume, at the same temperature, then total pressure of the system is : (Neglect volume occupied by liquid water)

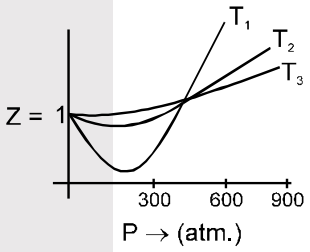
(A) 3 atm (B) 1 atm (C) 0.53 atm (D) 2.4 atm

2. Given the value of their van der Waals' constant 'a' arrange the following gases in the order of their expected liquification pressure at a temperature T. T is below the critical point of all the gases.

Gas	CH_4	Kr	N_2	Cl_2
'a' ($atmL^2.mol^{-1}$)	2.283	2.439	1.408	6.579

(A) $CH_4 < Kr < N_2 < Cl_2$ (B) $N_2 < CH_4 < Kr < Cl_2$ (C) $Cl_2 < Kr < CH_4 < N_2$ (D) $Cl_2 < N_2 < Kr < CH_4$

3. The variation of compressibility factor 'Z' with pressure at different temperatures T_1, T_2 and T_3 is given as follows. Match the temperature in Column I with the Column II values.

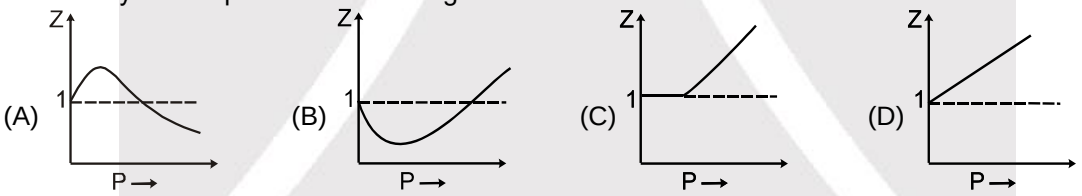


Column I		Column II	
(a)	T_1	1.	500 K
(b)	T_2	2.	1000 K
(c)	T_3	3.	200 K

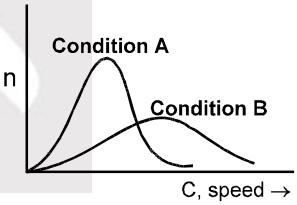
(A) a → 3, b → 1, c → 2 (B) a → 1, b → 2, c → 3

(C) a → 2, b → 3, c → 1 (D) Information is in sufficient

4. Plot at Boyle's temperature for a real gas will be :



5.* The curves in the Fig. represents two different Maxwell – Boltmann velocity distributions for the same gas sample under two different conditions, A and B. Which of the following statements about conditions A and B is/are false?



(A) The temperature for B is greater than for A.

(B) The average kinetic energy for A is greater than for B.

(C) The intermolecular attractive forces are greater for A than for B.

(D) A and B correspond to the same temperature but different volumes.

6.* Which of the following statements is/are correct about Boyle temperature (T_B):

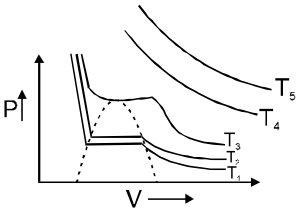
(A) Temperature at which 1st virial cofficient of Vander waal equation becomes Zero.

(B) Temperature at which 2nd virial cofficient of Vander waal equation becomes Zero.

(C) According to Vander waal's equation, value of $T_B = \frac{a}{Rb}$.

(D) T_B of a gas depends upon the nature of gas.

7.* The given plot represents the P-V plot of a gas at different temperatures. Then which of the following statements are true.



(A) vapour liquid equilibrium can exist at T_5

(B) vapour liquid equilibrium can exist at T_1

(C) vapour liquid equilibrium can exist at T_2

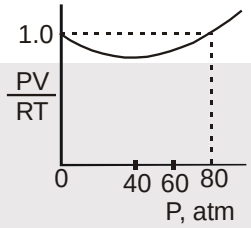
(D) vapour liquid equilibrium can exist at T_4

8.* One way of writing the equation of state PV = RT[A + $\frac{B}{V}$ + ...]. which is true for constant A & B in equation. When compare to Vander Waal's equation.

(A) expression for B is a – $\frac{b}{RT}$ (B) expression for B is b – $\frac{a}{RT}$

(C) unit of B is cm^3 and it is temperature dependent (D) constant A must be 1

9.* The Vander waal's equation of state for a non-ideal gas can be rearranged to give $\frac{PV}{RT} = \frac{V}{V-b} - \frac{a}{VRT}$ for 1 mole of gas. The constants a & b are positive numbers. When applied to H_2 at 80K, the equation gives the curve as shown in the figure. Which one of the following statements is (are) correct:



(A) At 40 atm, the two terms V/(V – b) & a/VRT are equal.
(B) At 80 atm, the two terms V/(V – b) & a/VRT are equal.
(C) At a pressure greater than 80 atm, the term V/(V – b) is greater than a/VRT.
(D) At 60 atm, the term V/(V – b) is smaller than $1+\frac{a}{VRT}$.

Comprehension #

Vanderwaal equation for real gas is given as :

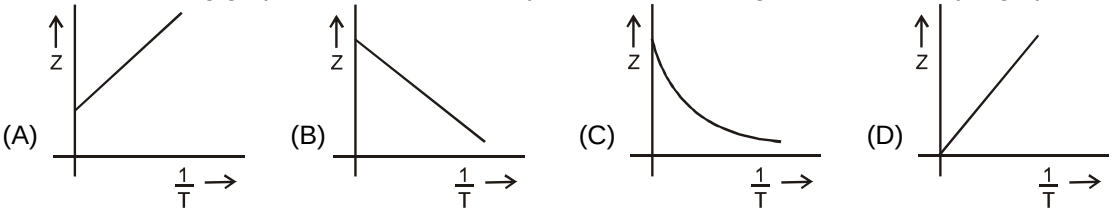
$$\left(P+\frac{an^2}{V^2}\right)(V-nb) = nRT$$

Where 'a' and 'b' are constant for pressure and volume correction. If factor Z = $\frac{PV_m}{RT}$ is to be calculated, where V_m is molar volume.

10. For a real gas with very large value of molar volume, which of the following equation can most suitably be applied:

(A) $Z = 1 - \frac{a}{V_m RT}$ (B) $PV_m = RT$ (C) $Z = 1 + \frac{Pb}{RT}$ (D) $PV_m - RT = \frac{a}{V_m}$

11. Which of following graph is correct for a sample of 1 mol of real gas at a fixed very high pressure.



12. Which of the following statement is correct.

(A) When Z > 1, real gases are easier to compress than ideal gas
(B) When Z = 1, real gases get compressed easily
(C) When Z > 1, real gases are difficult to compress
(D) Ideal gases easier to compress than real gases.

13. If the value of Avogadro number is 6.023×10^{23} mol^{-1} and the value of Boltzmann constant is 1.380×10^{-23} J K^{-1}, then the number of significant digits in the calculated value of the universal gas constant is:

14. Determine the total number of electrons with clockwise spin and $n + \ell + m = 3$ in Ar (Z = 18) atom.

15. A bottle of 1 litre capacity is labelled as 1 molar $Al_2(SO_4)_3$(aq). If the bottle is half filled and density of solution is 1.342 g/mL, then what will be molality of Al^{3+}(aq) in this solution.

16. Let Z be the compressibility factor for a real gas at critical conditions and Vander Waal constant 'b' is dependent as $b = \frac{R}{m}\left(\frac{T_C}{P_C}\right)$, then find the product (Z × m).

17. A certain quantity of an ideal gas occupied 128 mL when collected over water at 15°C and 754 mm pressure. It occupies 118.3 mL in dry state at NTP. Find the vapour pressure of water (in mm) at 15°C.

18. A certain organic compound contains carbon, hydrogen, oxygen and nitrogen. Weight % of carbon in the compound is 20. The weight ratio N : H : O = 7 : 1 : 4. What is the least possible molecular mass of the compound?

19. Dihydrogen gas was collected over water in a 20 L vessel at 27ºC at a total pressure of one atmosphere. On analysis, it was found that the quantity of H_2 collected was 0.775 mole. If this vessel is now connected with another 10 L evacuated vessel, find the final pressure (in Torr) when equilibrium is established. Take $R = \frac{1}{12}$ L atm/K/mole

Report your answer after dividing it by 10 and rounding it off to the nearest whole number.

20. **Match the following :**

Column I		Column II	
(A)	For a gas, repulsive tendency dominates	(p)	Effects of 'a' and 'b' compensate each other.
(B)	At T_B = – 3°C for a gas in high pressure region	(q)	There is no difference between physical properties in liquid and gas state.
(C)	At T_C	(r)	Z > 1
(D)	For He gas at 0°C in all pressure region	(s)	T_C = 80 K