विध्न विचारत भीरु जन, नहीं आरम्भे काम, विपति देख छोड़े तुरंत मध्यम मन कर श्याम।
पुरुष सिंह संकल्प कर, सहते विपति अनेक, 'बना' न छोड़े ध्येय को, रघुबर राखे टेक।।

*रचितः मानव धर्म प्रणेता*

*सद्गुरु श्री रणछोड़दासजी महाराज*

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## Subject : CHEMISTRY

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**PART - A**



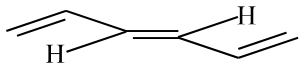


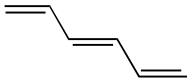
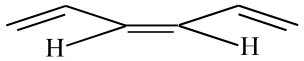
## ORGANIC CHEMISTRY

Q.1 Which of the following are constitutional isomers?

(A) $CH_3COOCH_3$ (B) $C_2H_5COOH$ (C) $C_2H_5CHO$ (D) $CH_3OC_2H_5$

Q.2 Which of the following represents the structure having cis arrangement around each double bond?

(A)  (B) 

(C)  (D) 

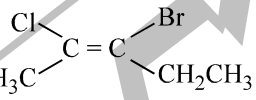
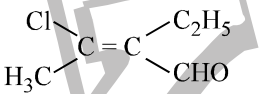
Q.3 How many isomeric aldehydes are possible with formula $C_5H_{10}O$

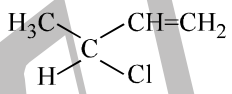
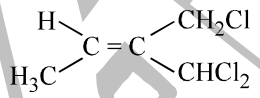
(A) 4 (B) 7 (C) 6 (D) 8

Q.4 The structures $CH_3\overset{\overset{O}{\|}}{C}CH_3$ and $CH_2=C(OH)CH_3$ represent

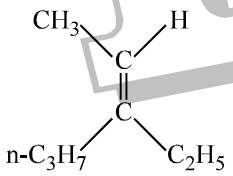
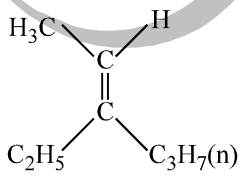
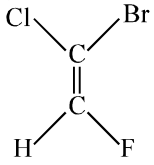
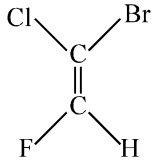
(A) tautomers (B) resonating forms (C) functional isomers (D) position isomers

Q.5 Which of the following represent E isomer?

(A)  (B) 

(C)  (D) 

Q.6 Among the structures given below which represents E–configuration?

(i)  (ii)  (iii)  (iv) 

(A) (i), (iii), (iv) (B) (i) and (iii) (C) only (ii) (D) (ii) and (iv)

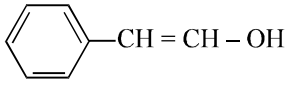
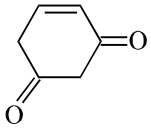
Q.7 Maleic acid and fumeric acid are

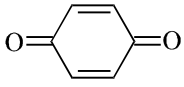
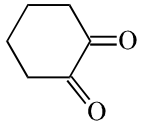
(A) homologues (B) geometrical isomers
(C) enantiomers (D) diastereomers

Q.8 Which of the following compounds will show geometrical isomerism?

(A) 2-butene (B) propene (C) 1-phenyl propene (D) 2-methyl-2-butene

Q.9 Tautomerism will not be shown by

(A)  (B) 

(C)  (D) 

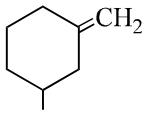
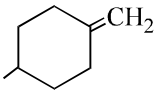
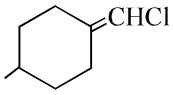
 

Q.10 The number of isomers of the compound with molecular formula $C_2BrClFI$ is
(A) 3 (B) 4 (C) 5 (D) 6

Q.11 Metamerism is present in which one of the following
(A) $CH_3CH_2CHO$ and $CH_3COCH_3$ (B) $CH_3CH_2CH = CH_2$ and $CH_3CH = CHCH_3$
(C) $(CH_3)_3CH$ and $CH_3CH_2CH_2CH_3$ (D) $CH_3–NH–C_3H_7$ and $C_2H_5 – NH – C_2H_5$

Q.12 The no. of isomers formed by $C_7H_8O$ are
(A) 2 (B) 3 (C) 4 (D) 5

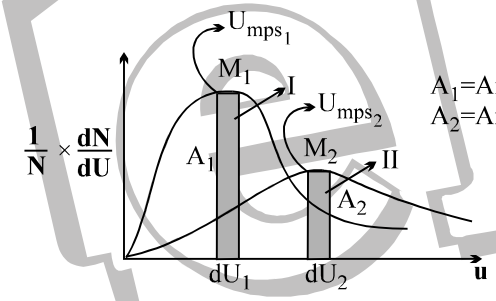
Q.13 The geometrical isomerism is shown by

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

Q.14 How many alkene an catalytic hydrogenation give iso-pentane as a product.
(A) 2 (B) 3 (C) 4 (D) 5

## PHYSICAL CHEMISTRY

Q.15 Following represents the Maxwell distribution curve for two ideal gases at temperature T K. Which of the following option(s) are true?




(A) Total area under the two curves is independent of moles of gas
(B) If $dU_1$= f $Umps_1$ & $dU_2$ = f $Umps_2$ then $A_1 = A_2$
(C) $M_2 > M_1$ and hence higher the temperature, sharper the curve.
(D) The fraction of molecules having speed = Umps decreases as molar mass decreases.

Q.16 Which of the following sets of quantum numbers is/are allowed?
(A) n = 1, $l$ = 0 and m = 0 (B) n = 2, $l$ = 1 and m = +1
(C) n = 1, $l$ = 0 and m = +1 (D) n = 2, $l$ = 2 and m = 0

Q.17 The relative ratio $u_{av} : u_{mp} : u_{rms}$ of a gas at a given temperature is (u stands for speed):
(A) $\sqrt{56/22} : \sqrt{2} : \sqrt{3}$ (B) $\sqrt{56/22} : \sqrt{3} : \sqrt{2}$ (C) $\sqrt{3} : \sqrt{56/22} : \sqrt{2}$ (D) $\sqrt{2} : \sqrt{56/22} : \sqrt{3}$

Q.18 Electron affinity of iodine w.r.t given data.
$U_{NaI}$ = –691 kJ/mol $\Delta H_{f(NaI)}$ = –271 kJ/mol
$\Delta H_{sub(Na)}$ = 108 kJ/mol $IE_{Na}$ = 495 kJ/mol
$[\Delta H_{sub}(I_2) + \Delta H_{diss}\ [I_2]]$ = 214 kJ/mol
(A) 290 kJ/mol (B) 142.5 kJ/mol (C) 117 kJ/mol (D) 490 kJ/mol

Q.19 $H_2O_2$ acts as both oxidising as well as reducing agent. As oxidising agent, its product is $H_2O$, but as reducing agent, its product is $O_2$. Volume strength has great significance for chemical reactions.

The strength of '10V' means 1 volume (or litre) of $H_2O_2$ on decomposition ($H_2O_2 \rightarrow H_2O + \frac{1}{2}O_2$) gives 10 volumes (or litre) of oxygen at NTP.

15 gm $Ba(MnO_4)_2$ sample containing inert impurity is completely reacting with 100 ml of '11.2V' $H_2O_2$, in acidic medium then what will be the % purity of $Ba(MnO_4)_2$ in the sample?
(Atomic mass Ba = 137, Mn = 55)

(A) 5% (B) 10% (C) 50% (D) none

Q.20 At what temperature will R.M.S speed of the molecules of the second member of the homologous series $C_nH_{2n+2}$ be the same as that of oxygen at 527°C

(A) 750°C (B) 477°C (C) 580.3°C (D) 1227°C

Q.21 The volume of two gases X and Y (having different molecular masses) are the same under identical conditions of temperature and pressure. They would differ in

(A) kinetic energy (B) number of molecules
(C) rate of diffusion (D) critical temperature

Q.22 A particle initially at rest having charge q coulomb. & mass m kg is accelerated by a potential difference of V volts. What would be its K.E & de broglie wavelength respectively after acceleration

(A) qV , $\frac{h}{\sqrt{2qVm}}$ (B) $\frac{h}{\sqrt{2qVm}}$ , qV (C) qV , $\frac{h}{mV}$ (D) $\frac{h}{mV}$ , qV

Q.23 Miss Ritika has two correct informations from Mr. Gupta and Mr. Agarwal about a particular orbital of hydrogen atom. Identify the orbital

**Mr. Gupta**: $\Psi_{(angular)}$ of orbital is $\left(\frac{1}{4\pi}\right)^{1/2}$

**Mr. Agarwal**: The orbital has two radial nodes.

(A) 's' orbital with any principal quantum number
(B) any orbital with principal quantum number 3
(C) 3s orbital
(D) Mr. gupta & Mr. Agarwal are "naughty", together their information cannot predict the orbital.

Q.24 Which of the following do(es) not represent $\Delta H$ formation of the product.

(I) $\frac{1}{2}H_2(g) + (aq) \longrightarrow H^+(aq)$ (II) $\frac{2}{3}O_3(g) \longrightarrow O_2(g)$

(III) $NH_4^+(g) + Cl^-(g) \longrightarrow NH_4Cl(s)$ (IV) $P_4(black) + 5O_2(g) \longrightarrow P_4O_{10}(s)$

(V) Reaction representing $\Delta H_{combustion}$ of C (graphite).

(A) I, IV, V (B) II, IV (C) II, III, IV (D) II, III, IV, V



**Read the comprehension carefully & answer the questions (Q.25 & Q.26) that follow.**

Analysis of distribution of molecular speeds of an ideal gas can be mathematically represented by the equation

$$\frac{\Delta N}{N} = 4\pi\left(\frac{M}{2\pi RT}\right)^{3/2} e^{-Mu^2/2RT} u^2 du$$

where $\frac{\Delta N}{N}$ **is fraction of molecule** having speed between u to u + du **M molecular mass, T is absolute temperature.**

The graph of 'fraction of molecules' vs 'speed' when plotted was found to be 'unsymmetrical' with **very few molecules with very high or low speed** & mostly molecules possesssing speeds in the range of **270-330 m/s**.

The plotting of the graph & the variation of fraction of molecules with mass of the gas & temperature of the gas can be compared by identifying the 'influencing' terms. At higher speeds the nature of graph is influenced by the exponential term $[e^{-\frac{Mu^2}{2RT}}]$ & at lower speed it is influenced by the parabolic term $\left(\frac{M}{2\pi RT}\right)^{3/2} u^2$. Using the above expression values of $U_{mps}$, $U_{avg}$ and $U_{rms}$ can also be established.

Q.25 Mark the **correct statement**

(A) Number of molecules having speed around 300 m/s will be greater than number of molecules possessing either very low speed or very high speed.

(B) The speed possessed by most of the molecules & average speed has the same value.

(C) At lower speed the fraction of the molecules decrease with increasing speed.

(D) At higher speed the fraction of molecules increases with increasing speed.

Q.26 For a sample containing $O_2$ and $SO_2$ mark out the **incorrect** statement

(A) At same temperature average speed of $O_2$ is greater than that of $SO_2$.

(B) If absolute temperature of $O_2$ is half to that of $SO_2$ gas than the speed distribution curves will be different.

(C) At same temperature & at lower speed, fraction of molecules of $SO_2$ will be greater.

(D) At same temperature & at higher speed, fraction of molecules of $O_2$ will be greater than that of $SO_2$.

Q.27 To a 10 ml 1 M aqueous solution of $Br_2$, excess of NaOH is added so that all $Br_2$ is disproportional to $Br^-$ and $BrO_3^-$. The resulting solution is freed from $Br^-$, by extraction and excess of $OH^-$ neutralised by acidifing the solution. The resulting solution is sufficient to react with 1.5 gm of impure $CaC_2O_4$ (M =128 gm/mol ) sample. The % purity of Oxalate sample is

The relevant reactions are $Br_2\,(aq.) + OH^- \longrightarrow Br^-\,(aq.) + BrO_3^-$

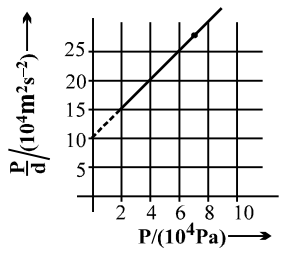
$$BrO_3^- + C_2O_4^{2-} \longrightarrow Br^- + CO_2$$

(A) 85.3% (B) 12.5% (C) 90% (D) 50%

Q.28 From the given graph of $\frac{P}{d}$ Vs. P for gas at constant temp. 300 K, the molecular weight of gas can be concluded to be (gm/mole)

(A) ~50 (B) ~25

(C) ~75 (D) ~100





Q.29 The number of revolution $(n_r / 10^{15}\,Hz)$ an electron make in 3rd Bohr orbit of H atom is

Given $E_n = \frac{-Z^2}{n^2}(21.8\times10^{-19}\,J/atom)$ $\quad h = 6.625 \times 10^{-34}$ J/sec.

(A) $\frac{21.8\times6.625}{3\times2}$ (B) $\frac{21.8}{6.625}\times\frac{2}{3}$ (C) $\frac{21.8}{6.625}\times\frac{3}{2}$ (D) $\frac{6.625}{21.8}\times\frac{3}{2}$

Q.30 What volume of air at STP contaning 21% of oxygen by volume is required to completely burn sulphur ($S_8$) present in 100 g of sample, which contains 4% inert material which does not burn. Sulphur burns according to the reaction

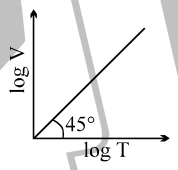
$$\frac{1}{8}S_8(s) + O_2(g) \longrightarrow SO_2(g)$$

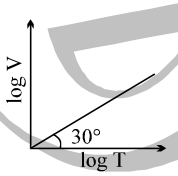
(A) 67.2 Litre (B) 320 Litre (C) 0.3125 Litre (D) None

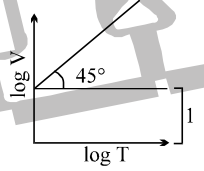
Q.31 The distance between 3rd & 2nd Bohr orbit of $He^+$ is
(A) $2.645\times10^{-10}$m (B) $1.322\times10^{-10}$m (C) $0.2645\times10^{-8}$m (D) None

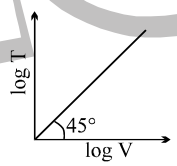
Q.32 For a real gas (mol. mass = 30) if density at critical point is 0.40 g/cm$^3$ and its $T_c = \frac{2\times10^5}{821}$ K, then Vander Waal's constant a (in atm $L^2mol^{-2}$) is
(A) 5.695 (B) 1.6875 (C) 0.1687 (D) None

Q.33 For a closed (not rigid) container containing **n = 10 moles** of an ideal gas, fitted with movable, frictionless, weightless piston operating such that **pressure of gas remains constant at 0.821 atm**, which graph represents correct variation of **log V vs log T** where V is in lit. & T in Kelvin.

(A) 

(B) 

(C) 

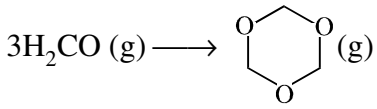
(D) 


Q.34 $SO_2Cl_2$, sulphuryl chloride reacts with water to give a mixture of $H_2SO_4$ and HCl. What volume of 0.1 M $Ba(OH)_2$ is needed to completely neutralize 25 ml of 0.2 M $SO_2Cl_2$ solution
(A) 100 ml (B) 50 ml (C) 200 ml (D) 25 ml

Q.35 Find $\Delta_f H°$ for HCl(g) from the following data:
$NH_3(g) + HCl(g) \longrightarrow NH_4Cl(s)$; $\Delta_r H° = -176$ kJ/mole
$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$; $\Delta_r H° = -92$ kJ/mole
$N_2(g) + 4H_2(g) + Cl_2(g) \longrightarrow 2NH_4Cl(\mathbf{s})$; $\Delta_r H° = -629$ kJ/mole
(A) 536.5 kJ/mol (B) –361 kJ/mol (C) –92.5 kJ/mol (D) None

Q.36 For the reaction
$N_2H_4(g) \longrightarrow N_2H_2(g) + H_2(g)$ $\quad \Delta_r H° = 109$ kJ / mol
Calculate the bond enthalpy of N = N.
Given : B.E. (N–N) = 163 kJ/mol, B.E. (N–H) = 391 kJ/mol, B.E. (H–H) = 436 kJ/mol
(A) 182 kJ/mol (B) 218 kJ/mol (C) 400 kJ/mol (D) None

Q.37 The enthalpy of gas phase trimerization of one mole of gaseous fermaldehyde in (kJ/mole)




Bond energies (kJ/mole)

| $\in_{C=O}$ | $\in_{C-O}$ | $\in_{C-H}$ |
|---|---|---|
| 700 | 360 | 410 |

(A) –20 (B) –60 (C) –10 (D) –50

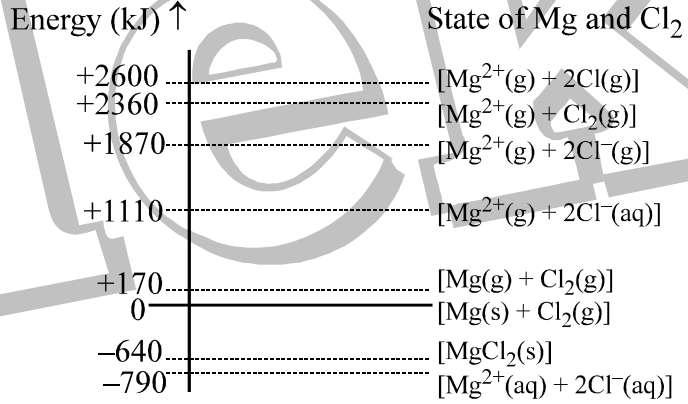
Q.38 $XeF_2(g) + H_2(g) \longrightarrow 2HF(g) + Xe(g)$ $\Delta H° = -430$ kJ
using the following bond energies : H–H = 435 kJ/mol
H–F = 565 kJ/mol
Calculate the average bond energy of Xe–F in $XeF_2$.
(A) 267 kJ/mol (B) 562.5 kJ/mol (C) 132.5 kJ/mol (D) None

Q.39 Calculate the resonance energy of $C_6H_6$ (g) using Kekule formula for benzene from the following data.

$\Delta H^{\circ}_f$ for $C_6H_6$ (g) = –358 kJ/mol

Heat of atomization of carbon = 716 kJ/mol
Bond energy of C–H, C–C, C=C and H–H bonds are 490, 340, 620, 436 kJ/mol respectively.
(A) –150 kJ/mol (B) –142 kJ/mol (C) – 158 kJ/mol (D) none of these

Q.40 Carefully observe the given diagrams which indicates standard heat of formation of different states of one mole Mg and 2 mole Cl atom and match the entries in column A and B provided.




| | **Column I** | | **Column II** |
|---|---|---|---|
| (A) | $\Delta H_f [Mg^{2+}(aq)]$ | (P) | – 1900 kJ/mole |
| (B) | $\Delta H_f [Cl^-(aq)]$ | (Q) | + 460 kJ/mole |
| (C) | $\Delta H_{hydration} [Mg^{2+}(g)]$ | (R) | – 625 kJ/mole |
| (D) | $\left\lvert L.E._{MgCl_2(s)} \right\rvert$ | (S) | + 2510 kJ/mole |

L.E. = Lattice energy

## INORGANIC CHEMISTRY

Q.41 A compound contains atoms of A, B, C & may or may not have water. The oxidation number of A, B & C are +2, +5 & –2 respectively. The possible formulae formed when these atoms combine is/are:
(A) $A_3(BC_4)_2$ (B) $A_3(B_4C)_2$ (C) $A_2(BC_7)_2$ (D) $A[B_2(C)_6H_2O_2]$



Q.42 The geometry of azide ion is:
(A) linear (B) Tetrahedral (C) Triangular planar (D) Square pyramidal

Q.43 Match column I (atomic number) with column II (position in the Periodic Table) and select the correct answer using the codes given below:

| | **Column I** | | **Column II** |
|---|---|---|---|
| I. | 52 | P. | s-block |
| II. | 56 | Q. | p-block |
| III. | 57 | R. | d-block |
| IV. | 60 | S. | *f*-block |

(A) I – P, II – Q, III – S, IV – R (B) I – Q, II – P, III – S, IV – R
(C) I – P, II – Q, III – R, IV – S (D) I – Q, II – P, III – R, IV – S

Q.44 Which of the following set of species have planar structures
(A) $I_3^-$, $\dot{C}H_3$, $ClO_3^-$, $SiF_6^{2-}$ (B) $I_3^+$, $ICl_4^-$, $Al_2Cl_6$, $TeCl_4$
(C) $SCl_2$, $N_2O_5$, $SF_4$, $XeOF_4$ (D) $I_2Cl_6$, $XeF_2$, $BrF_4^-$, $XeF_5^-$

Q.45 Select pair of compounds in which both have different hybridisation but have same molecular geometry.
(A) $BF_3$, $BrF_3$ (B) $ICl_2^{\square}$, $BeCl_2$ (C) $BCl_3$, $PCl_3$ (D) $PCl_3$, $NCl_3$

Q.46 Select equations having Exothermic step:
(I) $S^-(g) \longrightarrow S^{2-}(g)$ (II) $Na^+(g) + Cl^-(g) \longrightarrow NaCl(s)$
(III) $N(g) \longrightarrow N^-(g)$ (IV) $Al^{2+}(g) \longrightarrow Al^{3+}(g)$
(V) P (red) $\longrightarrow$ P (black)
Choose the correct code
(A) II & V (B) I, II & V (C) III , IV & V (D) II & III

Q.47 The geometry with respect to the central atom of the following molecules are:
$N(SiH_3)_3$ ; $Me_3N$ ; $(SiH_3)_3P$
(A) planar, pyramidal, planar (B) planar, pyramidal, pyramidal
(C) pyramidal, pyramidal, pyramidal (D) pyramidal, planar, pyramidal

Q.48 A compound contains three elements A, B and C, if the oxidation number of A = +2, B = +5 and C = –2, the possible formula of the compound is
(A) $A_3(B_4C)_2$ (B) $A_3(BC_4)_2$ (C) $A_2(BC_3)_2$ (D) $ABC_2$

Q.49 The ratio of σ-bond and π-bond in tetracyano ethylene is
(A) 2 : 1 (B) 1 : 1 (C) 1 : 2 (D) None

Q.50 "Solubility of **Alkali metal fluorides** increases down the group" Select correct explanation for given statement.
(A) Hydration energy increases and lattice energy decreases down the group
(B) Both energy decrease down the group but decrease in hydration energy is rapid
(C) Both energy decrease down the group but decrease in lattice energy is rapid
(D) Both energy increase down the group but increase in hydration energy is rapid



**PART - B**

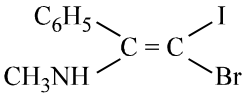
## ORGANIC CHEMISTRY

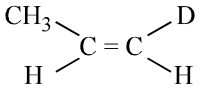
Q.1 How many constitutional isomers can you draw for $C_4H_{10}O$?

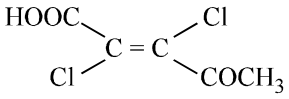
Q.2 Draw the structure of (Z, Z)-Nona-2,4-diene

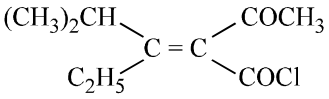
Q.3 How many cyclic isomer structures are possible for $C_3H_6O$?

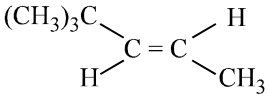
Q.4 Assign E and Z specifications to the following:

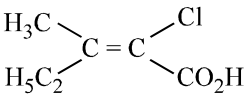
(i) 

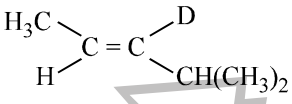
(ii) 

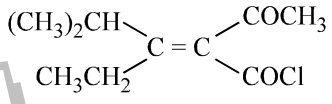
(iii) 

(iv) 

(v) 

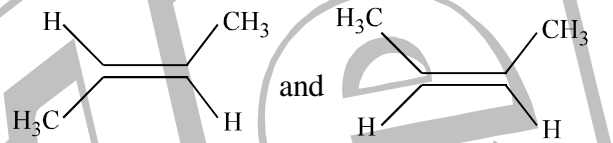
(vi) 

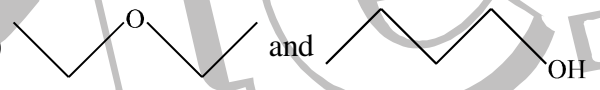
(vii) 

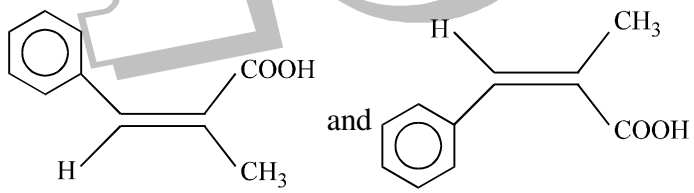
(viii) 

Q.5 Give two structural isomers of $C_3H_4Br_2$ which can exhibit geometrical isomerism.

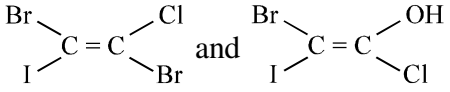
Q.6 Classify the following pair of compounds as structural, geometrical or same compounds.

(a) 

(b) 

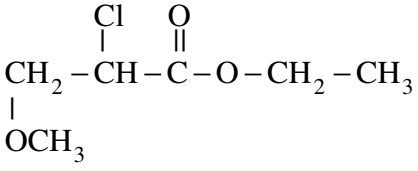
(c) 

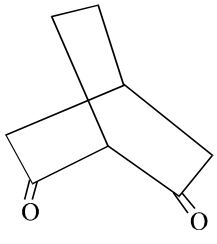
Q.7 Give the IUPAC name of the following using E, Z notation



Q.8 Draw the structure of (2Z, 4Z)-2,4-Hexadine.

Q.9 Write the IUPAC name of the following compound.

(i) 

(ii) 



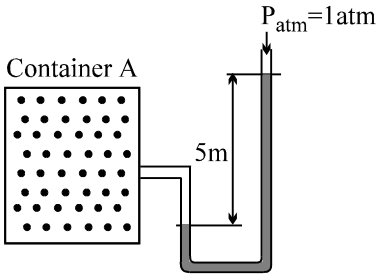
Q.10 Find the Bond enthalpy **(in kJ/mol)** of one "three centre two electron bond" in $B_2H_6$ {B–H–B $\rightarrow$ 2B(g) + H(g)} from the given data.

$\Delta H_f^0$ [$BH_3$(g)] = 100 kJ/mole $\quad\quad$ $\Delta H_f^0$ [$B_2H_6$(g)] = 36 kJ/mole

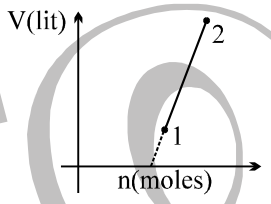
$\Delta H_{atm}$ [B(s)] = 565 kJ/mole $\quad\quad$ $\Delta H_{atm}$ = [$H_2$(g)] = 218 kJ/mole

Q.11 25 balloons of volume 82.1 lit. required to lift a payload to a height of 831 m. Given: molar mass of air = 29 g/mol, temperature is constant at 290 K and mass of each balloon is 50 g. Find the mass of payload.
[Use $e^{-0.1} = 0.9$, pressure at sea level = 1 atm, acceleration due to gravity (g) = 10 m/s$^2$]

Q.12 0.94 moles of a gas present in the container A of volume 10 lit at 300 K. If the manometer containing glycerin show *h* m difference in level as shown in diagram. Find the height difference h.
Given: $d_{glycerin}$ = 2.72 gm/ml, $d_{mercury}$ = 13.6 gm/ml.




Q.13 State whether the following statements are **True** or **False** with proper reasoning for the given curve.(Assuming ideal gas)




(i) Both P (atm) and T (K) must vary.
(ii) If P (atm) is constant then T (K) must be constant.
(iii) If pressure (atm) is constant then temperature (in K) at point (2) must be greater than at point (1).

Q.14 Give balanced equations for
(i) $As_2S_5$ reacts with conc. $HNO_3$ to produce $H_3AsO_4$, $H_2SO_4$, $NO_2$ and $H_2O$.
(ii) $Bi_2O_3$ reacts with sodium hypochlorite (NaOCl) in presence of NaOH to form Sodium bismuthate ($NaBiO_3$), NaCl and water.

Q.15 A sample of acetone undergoes 40% dimerization. Find the mole fraction and weight fraction of the dimer.

Q.16 At 300 K and 1 atmp, the density of HF is 3.23 g/lit. Calculate the approximate no. of HF molecules associated in a cluster by hydrogen bonding.

Q.17 1 gm of an iron ore containing 50% ferrous ($Fe^{2+}$) and ferric ion ($Fe^{3+}$) and rest 50% impurities was dissolved in concentrated hydrochloric acid and the filtered solution was raised to 100 ml in flask. 50 ml of the solution were treated with M/10 $K_2Cr_2O_7$, which give titre value of 5 ml. Find the percentage of ferric ion in the ore.

Q.18 5 moles of a tetra-atomic non-linear gas 'A' at 10 atm & T K are mixed with 10 moles of another monoatomic gas B at $\frac{T}{3}$ K & 5 atm in a closed, rigid vessel without energy transfer with surroundings. Find final temperature of mixture. Assume all modes of energy are completely manifested.

Q.19 The lattice energy of $CaBr_2$ = –2162 kJ/mole
Heat of formation of $CaBr_2$ = – 675 kJ/mole
$IE_1$ and $IE_2$ of Ca are 590 kJ/mole and 1145 kJ/mole respectively
Heat of sublimation of Ca = 178 kJ/mole
Bond Energy of $Br_2$ = 193 kJ/mole
Heat of vapourization of liquid $Br_2$ = 31 kJ/mole
Calculate electron affinity of bromine, write equations to represent all these changes indicating corresponding energies properly.

Q.20 0.10 g of a sample containing $CuCO_3$ and some inert impurity was dissolved in dilute sulphuric acid and volume made up to 50 ml. This solution was added into 50 ml of 0.04 M KI solution where copper precipitates as CuI and $I^-$ is oxidized into $I_3^-$. A 10 ml portion of this solution is taken for analysis, filtered & made up free $I_3^-$ and then treated with excess of acidic permangagnate solution. Liberated iodine required 20 ml of 2.5 **mM** sodium thiosulphate solution to reach the end point. Determine weight percentage of $CuCO_3$ in the original sample.

Q.21 1.4 g of a complex $[Co(NH_3)_x]Cl_3$ was treated with 50 mL of 2N NaOH solution and boiled. Ammonia gas evolved was passed through 50 mL of 1N $H_2SO_4$. After the reaction was over, excess acid required 37.2 mL of 0.5 N NaOH. Calculate
(i) The percentage of ammonia in the sample. (ii) The value of x in the formula.

Q.22 A 2.50g sample containing $As_2O_5$ and $Na_2HAsO_3$, and inert material is dissolved and the pH is adjusted to neutral with excess $NaHCO_3$. The As(III) is titrated with 0.150 M $I_2$ solution, requiring 11.3 mL to just reach the end point. Then, the solution (all the arsenic in the +5 state now) is acidified with HCl, excess KI is added, and the liberated $I_2$ is titrated with 0.120 M $Na_2S_2O_3$, requiring 41.2 mL. Calculate the per cent $As_2O_5$ and $Na_2HAsO_3$ in the sample?

Q.23 Reducing sugars are sometimes characterized by a number $R_{Cu}$, which is defined as the number of mg of copper reduced by 1 gm of sugar, in which half reaction for the copper is

$$Cu^{2+} + OH^- \longrightarrow Cu_2O + H_2O$$

It is sometimes more convenient to determine the reducing power of a carbohydrate by an indirect method. In this method 43.2 mg of the carbohydrate was oxidized by an excess of $K_3(Fe(CN)_6)$. The $Fe(CN)_6^{4-}$ formed in this reaction required 5.29 ml of 0.0345 N $Ce(SO_4)_2$ for reoxidation to $Fe(CN)_6^{3}$. Determine the $R_{Cu}$ value for the sample.

## INORGANIC CHEMISTRY

Q.24 Explain the following
(a) Why $ClF_3$ exists whereas $FCl_3$ does not?
(b) $Li^+$ ion is far smaller than the other alkali metal ions, but moves through solution less rapidly than the other alkali metal ions under the influence of electric current.

Q.25

| **Elements** | **$IE_1$** | **$IE_2$** |
|---|---|---|
| S | 2372 kJ/mole | 5251 kJ/mole |
| T | 520 kJ/mole | 7300 kJ/mole |
| U | 900 kJ/mole | 1760 kJ/mole |
| V | 1680 kJ/mole | 3380 kJ/mole |

Which of the above elements is
(I) a reactive non-metal
(II) a noble gas
(III) a metal that forms a stable binary halide of the formula $AX_2$ (X = halogen)

# ANSWER KEY

## PART - A

### ORGANIC CHEMISTRY

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q.1 | A,B | Q.2 | B,D | Q.3 | A | Q.4 | A | Q.5 | B | Q.6 | A | Q.7 | B |
| Q.8 | A,C | Q.9 | C | Q.10 | D | Q.11 | D | Q.12 | D | Q.13 | D | Q.14 | B |

### PHYSICAL CHEMISTRY

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q.15 | A,B,D | Q.16 | A,B | Q.17 | A | Q.18 | A | Q.19 | C | Q.20 | B | Q.21 | C,D |
| Q.22 | A | Q.23 | C | Q.24 | C | Q.25 | A | Q.26 | B | Q.27 | A | Q.28 | B |
| Q.29 | B | Q.30 | B | Q.31 | B | Q.32 | B | Q.33 | A | Q.34 | A | Q.35 | C |
| Q.36 | C | Q.37 | A | Q.38 | C | Q.39 | B | Q.40 | (A) Q, (B) R, (C) P, (D) S | | | | |

### INORGANIC CHEMISTRY

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q.41 | A,D | Q.42 | A | Q.43 | D | Q.44 | D | Q.45 | B | Q.46 | A | Q.47 | B |
| Q.48 | B | Q.49 | B | Q.50 | C | | | | | | | | |

## PART - B

### ORGANIC CHEMISTRY

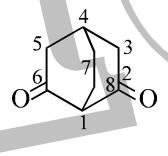
Q.1 7 (four for alcohols and three for ethers) Q.3 3

Q.4 (i) E, (ii) Z, (iii) E, (iv) E, (v) E, (vi) E, (vii) E, (viii) E

Q.5 $CH_3C(Br) = CHBr$ and 1, 2 - Dibromocyclopropane

Q.6 (a) Geometrical, (b) Functional, (c) Same

Q.9 (i) Ethyl-2-chloro-3-methoxy propanoate

(ii) 

Bicyclo [2,2,2]-2,6-octandione

### PHYSICAL CHEMISTRY

Q.10 $E_{B-H-B} = 455$ kJ/mole Q.11 1 kg Q.12 5 m

Q.13 (i) F, (ii) F, (iii) T

Q.15 Mole fraction = 0.25 and mass fraction = 0.4 Q.16 4

Q.17 16.4 Q.18 5T/6 K Q.19 –325 kJ/mol Q.20 74.10

Q.21 (i) 38.13% , (ii) 6

Q.22 3.57 mass% $As_2O_5$ and 11.52 mass% $Na_2HAsO_3$ Q.23 $R_{Cu} = 269$

### INORGANIC CHEMISTRY

Q.24

(a) For the formation of $FCl_3$, F atom must expand its valence shell, which is not possible as in second shell d-subshell does not exist.

(b) $Li^+$ being smallest alkali metal cation gets extensively hydrated, hence its ionic radius in aqueous medium becomes largest among all hydrated alkali metal cations. Therefore, its ionic mobility decreases

Q.25 (I) V, (II) S, (III) U

