TIME: 3 hours   **M.M.: 70**
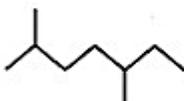
General Instructions:

Read the following instructions carefully.

a) There are 35 questions in this question paper with internal choice.

b) SECTION A consists of 14 MCQ & 4 Assertion-Reasoning type questions carrying 1 mark each.

c) SECTION B consists of 7 very short answer questions carrying 2 marks each.

d) SECTION C consists of 5 short answer questions carrying 3 marks each.

e) SECTION D consists of 2 case- based questions carrying 4 marks each.

f) SECTION E consists of 3 long answer questions carrying 5 marks each.

g) All questions are compulsory.

h) Use of log tables and calculators is not allowed.

Q. No.	SECTION-A	Marks
1.	Formation of CO and CO_2 illustrates the law of: (a) Law of conservation of mass (b) Law of Reciprocal proportion (c) Law of Constant Proportion (d) Law of Multiple Proportion	1
2.	Which of the following has the largest number of atoms? (a) 0.5 g-atoms of Cu (b) 0.635 g Cu (c) 0.25 moles of Cu atoms (d) 1g of Cu	1
3.	On the Pauling's electronegativity scale the element next to F is…? (a) N (b) O (c) Cl (d) Ne	1
4.	Which of the following is arranged in order of increasing radius? (a) K^+ (aq) < Na^+ (aq) < Li^+ (aq) (b) K^+ (aq) > Na^+ (aq) > Zn^{2+} (aq) (c) K^+ (aq) > Li^+ (aq) > Na^+ (aq) (d) Li^+ (aq) < Na^+ (aq) < K^+ (aq) Or Atomic number of the element with the symbol Uun is : (a) 100 (b) 111 (c) 110 (d) 101	1
5.	Out of the following, intramolecular hydrogen bonding exists in: (a) water (b) H_2S (c) 4-nitrophenol (d) 2-nitrophenol	1
6.	A co-ordinate/dative bond is formed by: (a) sharing of electrons contributed by both the atoms (b) complete transfer of electrons (c) sharing of electrons contributed by one atom only (d) none of these	1
7.	In a process, 701 J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy for the process? (a) -307 J (b) 307 J	1

	(c) -1095 J (d) 1095 J	
8.	An isochoric process takes place at constant : (a) volume (b) pressure (c) temperature (d) concentration	1
9.	If in a reaction mixture $Q_C > K_C$, then identify the correct statement- (a) the reaction shifts towards products (b) the reaction shifts towards reactants (c) nothing appears to happen, but forward and reverse are continuing at the same rate (d) nothing happens	1
10.	The oxidation number of Mn is maximum in…? (a) MnO_2 (b) K_2MnO_4 (c) Mn_3O_4 (d) $KMnO_4$	1
11.	The hybridization state of a carbocation is: (a) sp^3d (b) sp^3 (c) sp^2 (d) sp	1
12.	Which one of the following is the strongest acid ? (a) CH_2FCOOH (b) $CH_2ClCOOH$ (c) $CHCl_2COOH$ (d) CHF_2COOH	1
13.	Which among following is least reactive than benzene towards electrophilic substitution reactions? (a) Nitrobenzene (b) Aniline (c) Phenol (d) Chlorobenzene	1
14.	The lowest alkene that is capable of exhibiting geometrical isomerism is: (a) Ethene (b) But-1-ene (c) But-2-ene (d) Propene	1
	In the following questions, [from Q.15 to Q.18] a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices. a) Assertion and reason both are correct statements and reason is correct explanation for assertion. b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. c) Assertion is correct statement but reason is wrong statement. d) Assertion is wrong statement but reason is correct statement. e) Both assertion and reason are wrong statements.	
15.	Assertion: Black body is an ideal body that emits and absorbs radiations of all frequencies. Reason: The frequency of radiation emitted by a body goes from a lower frequency to higher frequency with an increase in temperature.	1
16.	Assertion: The correct order regarding the electronegativity of hybrid orbitals of carbon is- $sp < sp^2 < sp^3$. Reason: With increase in %s character, electronegativity increases.	1
17.	Assertion: Components of a mixture of red and blue inks can be separated by distributing the components between stationary and mobile phases in paper chromatography. Reason: The coloured components of inks migrate at different rates because paper selectively retains different components according to the difference in their partition between the two phases. Or Assertion: In differential extraction method, the same solvent is repeatedly used for extraction of the compound. Reason: Two compounds with different solubilities in the same solvent can be separated by this method.	1

18.	Assertion: Boiling point of alkanes increases with increase in molecular weight. Reason: van der Waal's forces increase with increase in molecular weight.	1
	SECTION-B (VSQ)	
19.	Find out the percentage composition of Ca,C and O in $CaCO_3$.(Ca-40,C-12,O-16)	2
20.	Distinguish between extensive and intensive properties with one suitable example of each.	2
21.	Calculate the standard enthalpy of formation of CH_3OH. from the following data: (i) $CH_3OH(l) + 3/2 O_2 (g) \longrightarrow CO_2 (g) + 2H_2O (l)$; $\Delta_r H^- = -726 kj\ mol^{-1}$ (ii) $C(s) + O_2 (g) \longrightarrow CO_2 (g)$; $\Delta_c H^- = -393\ kj\ mol^{-1}$ (iii) $H_2(g) + \frac{1}{2} O_2(g) \longrightarrow H_2O (l)$; $\Delta_f H^- = -286\ kj\ mol^{-1}$ Or State "Hess's Law of constant heat summation" and write its any two application.	2
22.	Find the value of K_c for the following equilibrium: $2NOCl (g) \Leftrightarrow 2NO (g) + Cl_2 (g)$ Provided that- $K_p = 1.8 \times 10^{-2}$ atm at 500 K & R = 0.0821 L atm K^{-1} mol^{-1}.	2
23.	(i) Write IUPAC names of the following compound- (ii) Draw the structure of 1-Ethyl-3-methylcyclohexene.	2
24.	In an estimation of sulphur by Carius method, 0.468 of an organic sulphur compound gave 0.668 g of barium sulphate. Find the percentage of sulphur in the compound.	2
25.	An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3- one. Write structure and IUPAC name of 'A'.	2
	SECTION-C (SAQ)	
26.	2 **kg of** Dinitrogen and 1 **kg of** dihydrogen react with each other to produce ammonia according to the following chemical equation: $N_2 (g) + 3H_2(g) \longrightarrow 2NH3 (g)$ (i) Find out the maximum mass of ammonia can be produced in above process. (ii) Will any of the two reactants remain unreacted? (iii) If yes, which one and what would be its mass?	3
27.	(i) State Hund's rule of maximum multiplicity. (ii) Write electronic configuration of element having atomic number 24. (iii) Draw the structure of dz^2 orbital.	3
28.	(a) Arrange the following elements as directed: (i) B, C, N, F and Si (decreasing order of their non-metallic character) (ii) F, Cl, Br and I (decreasing order of their electron gain enthalpy) (b) Assign the position of the element having outer electronic configuration, (i) $ns^2 np^4$ for n = 3 (ii) $(n – 1) d^2 ns^2$ for n = 4	3
29.	Enthalpy and entropy changes of a reaction are 40.0 kJ mol^{-1} and 120.0 JK^{-1} mol^{-1}, respectively. Predict the feasibility of the reaction at 27°C.	3
30.	Balance the following redox reaction - $Cr_2O_7^{2-}(aq.) + Fe^{2+} (aq.) \longrightarrow Cr^{3+}(aq.) + Fe^{3+} (aq.)$　　[In acidic medium] Or $MnO_4^- (aq.) + I^- (aq.) \square MnO_2 (s) + IO_3^-(aq.)$　 [In basic medium]	3

	SECTION-D (CBQ)	
31.	Read the following passage and answer the questions given below the passage: The electrolytes are compounds that produce ions when they are dissolved in water. The strong electrolytes almost get completely dissociated, whereas the weak electrolytes are only partially dissociated in their solutions. As per Le Chatelier's principle, in the presence of a strong electrolyte the dissociation of a weak electrolyte having common ion gets suppressed. This effect has significant role in qualitative analysis of inorganic salts. The equilibria involving acids and bases are very important for a wide variety of reactions wherein the measure of acidity or alkalinity of a solution is expressed in the terms of pH. The acids produce hydrogen ions i.e. are proton donor in the solution whereas bases furnish hydroxyl ions or are proton acceptors. In a situation where a sparingly soluble salt is dissolved in water, a dynamic equilibrium is established. (i) Write conjugate acids/bases or both of the following Bronsted acid/base- (a) NH_3 (b) HCO_3^- (ii) Find out the $[H^+]$ Concentration in water at 25^oC .$Kw=1X10^{-14}$ (iii) Calculate the pH Value of $2X10^{-6}$ M HCl solution if HCl ionise completely .(Given log2=0.301,log10=1)	 1 1 2
32.	Read the following passage and answer the questions given below the passage: The electron displacement in an organic molecule may take place either in the ground state under the influence of an atom or a substituent group or in the presence of an appropriate attacking reagent. The electron displacements due to the influence of an atom or a substituent group present in the molecule cause permanent polarisation of the bond. Inductive effect and resonance effects are examples of this type of electron displacements. There are two types of resonance or mesomeric effect designated as R or M effect. (a) Positive Resonance Effect (+R effect) In this effect, the transfer of electrons is away from an atom or substituent group attached to the conjugated system. (b) Negative Resonance Effect (- R effect) This effect is observed when the transfer of Electrons is towards the atom or substituent group attached to the conjugated system. Temporary electron displacement effects are seen in a molecule when a reagent approaches to attack it. This type of electron displacement is called electrometric effect or polarizability effect. (i) Which of the two: $O_2NCH_2CH_2O^-$ or $CH_3CH_2O^-$ is expected to be more stable and why? (ii) Draw the resonating structures of – (a) Phenol (b) Nitro Benzene (iii) Arrange the following carbocations in increasing order of their stability- $(CH_3)_3C+$, CH_3+ , $(CH_3)_2CH+$ and CH_3CH_2+	 1 2 1
	SECTION-E (LAQ)	
33.	(a) State Heisenberg's Uncertainty Principle. Give its mathematical expression. (b) The uncertainty in the position of a moving bullet of mass 10 g is 10^{-5} m. Calculate the uncertainty in its velocity? <center>Or</center> (a) Derive de-Broglie's equation. (b) Calculate the wavelength of an electron moving with a velocity of 2.05×10^7 s^{-1}. (Given h =6.626 x 10^{-34} kg m^2 s$^{-1,}$ mass of electron =9.1 x 10^{-31} kg).	2+3 2+3
34.	(a) Define Hybridisation. (b) Distinguish between sigma and pi bond (any two). (c) Determine the hybridization and geometry of PCl_5 and NH_3 using valence bond theory. <center>Or</center> (a) H_2O has greater boiling point than the boiling point of H_2S Why? (b)Draw the Lewis dot structure of $SF_6.$ (c) Compare the relative stability and magnetic nature of O_2, O_2^- & O_2^{2-} on the basis of MOT.	1 2 2 1 1 3
35.	(a) What are the necessary conditions for any system to be aromatic? (b) Write the following named reactions (Reaction Equation is compulsory) (i) Wurtz reaction (ii) Friedel Craft alkylation (iii) Soda lime decarboxylation. <center>Or</center> (a) Convert following to (i) Ethyne to benzene (ii) Benzene to Chlorobenzene. (b) Predict the major product in the following reactions: (i) $CH_3-CH=CH_2$ + HBr □ ?	2 3 2

| | (ii) $CH_3-CH=CH_2$ + HBr (in the presence of peroxide) $\square$?
 (iii) $CH_3CH_2-\underset{\underset{Br}{\vert}}{CH}-CH_3$+KOH(Alco) $\square$? | 3 |