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SUPPLEMENTARY EXAMINATION 2023-24

CLASS-XI **SUBJECT- CHEMISTRY**

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

General Instructions:

Read the following instructions carefully.

a) There are 33 questions in this question paper with internal choice.
b) SECTION A consists of 12 MCQ & 4 Assertion-Reasoning type questions carrying 1 mark each.
c) SECTION B consists of 5 very short answer questions carrying 2 marks each.
d) SECTION C consists of 7 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.

SECTION-A

1. Which of the following has the smallest number of molecules: 1
(a) 11.2 L of O_2 at NTP
(b) 8.0 g of O_2
(c) 0.1 mole of O_2
(d) 2.24×10^4 mL of O_2

2. Total number of orbitals associated with third shell will be…? 1
(a) 2
(b) 9
(c) 4
(d) 3

3. Two atoms are said to be isobars if…? 1
(a) they have same atomic number but different mass number.
(b) they have same number of electrons but different number of neutrons.
(c) they have same number of neutrons but different number of electrons.
(d) sum of number of protons & neutrons is same but the number of protons is different.

4. Which of the following has largest de Broglie wavelength given that all have equal velocity? 1
(a) CO_2 molecule
(b) NH_3 molecule
(c) Electron
(d) Proton

5. Among the elements B, Mg, Al and K, the correct order of increasing metallic character is ? 1
(a) B < Al < Mg < K
(b) B < Mg < Al < K
(c) Mg < B < Al < K
(d) Mg < Al < B < K

Or

Atomic number of the element with the symbol Unu is :
(a) 100
(b) 111

(c) 110
(d) 101

6. Valence electrons in the element A are 3 and that in element B are 6. Most probable compound formed from A and B is…..? 1

(a) A_2B
(b) AB_2
(c) A_2B_3
(d) A_6B_3

7. Which one of the following is not a Lewis acid? 1

(a) H_2O
(b) BF_3
(c) $AlCl_3$
(d) NH_4+

8. In the reaction, $SO_2 + 2H_2S$ □ $3S + 2H_2O$, the substance that is oxidised is…? 1

(a) SO_2
(b) H_2O
(c) H_2S
(d) S

9. In which of the following functional group isomerism is not possible? 1

(a) Alcohols
(b) Alkyl halides
(c) Aldehydes
(d) Alkyl cyanides

10. Which of the two: $O_2NCH_2CH_2O^-$ or $CH_3CH_2CH_2O^-$ is expected to be more stable and why? 1

(a) $O_2NCH_2CH_2O^-$, due to +I effect.
(b) $O_2NCH_2CH_2O^-$, due to -I effect.
(c) $CH_3CH_2CH_2O^-$, due to +I effect.
(d) $CH_3CH_2CH_2O^-$, due to -I effect.

11. In an electrophilic substitution reaction of nitrobenzene, which of the following effects can be seen due to the presence of nitro group? 1

(A) Nitro group deactivates the ring
(B) Nitro group activates the ring
(C) It decreases the charge density at ortho & para positions.
(D) It increases the charge density at meta position.

(a) B & D (b) A & D (c) B & C (d) A & C

12. Which of the following is the reagent of Friedel Craft's alkylation- 1

(a) CH_3Cl + anhyd. $AlCl_3$
(b) CH_3COCl + anhyd. $AlCl_3$
(c) Cl_2 + anhyd. $AlCl_3$
(d) $(CH_3CO)_2O$ + anhyd. $AlCl_3$

In the following questions, [from Q.13 to Q.16] 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.

13. Assertion: 2s orbitals of H, Li, Na and K have the energies in the order E_{2s} (H) > E_{2s} (Li) > E_{2s} (Na) > E_{2s} (K). 1

Reason: Greater the atomic number, greater is nuclear charge and so orbitals are pulled closer to the nucleus.

Or

Assertion: Chromium (Z=24) has the electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^4$.

Reason: 4s has lower energy than 3d and is filled earlier than 3d.

14. Assertion: The first ionisation enthalpy of Be is higher than that of B. 1

Reason: 2p orbital is lower in energy than 2s orbital.

15. Assertion**:** If volume is kept constant and an inert gas such as argon is added which does not take part in the reaction, the equilibrium remains undisturbed. 1

Reason**:** It is because the addition of an inert gas at constant volume does not change the partial pressure or the molar concentrations of the substance involved in the reaction.

16. Assertion: Tertiary carbocations are generally formed more easily than primary carbocations. 1

Reason: Hyperconjugation as well as inductive effect due to additional alkyl groups stabilize tertiary carbocations.

SECTION-B (VSQ)

17. Carbon and oxygen combine to form two oxides- CO and CO_2. Which law does it prove? Give the statement of this law. 1+1 = 2

18. Using s,p,d notations, describe the orbital with the following quantum numbers: ½ x 4 = 2
(a) n =1, l = 0 (b) n = 3, l = 1 (c) n = 4, l = 2 (d) n = 4, l = 3

19. **(i)** Which out of NH_3 and NF_3 has higher dipole moment and why? 1 x 2 = 2
(ii) O-nitrophenol is steam volatile whereas p-nitrophenol is not. Give reason.

20. State "Hess's Law of constant heat summation". Give any two application. 2

Or

Calculate the standard enthalpy of formation of CH_3OH. from the following data:
(i) $CH_3OH(l) + 3/2\ 0_2\ (g) \longrightarrow CO_2\ (g) + 2H_20\ (l)$; $\Delta_rH^- = -726 kj\ mol^{-1}$
(ii) $C(s) + 0_2\ (g) \longrightarrow C0_2\ (g)$; $\Delta_CH^- = -393\ kj\ mol^{-1}$
(iii) $H_2(g) + ½\ 0_2(g) \longrightarrow H_20\ (l)$; $\Delta_fH^- = -286\ kj\ mol^{-1}$

21. (i) Write IUPAC name of the following compound- CH_3-CO-CH_2-CH_2-COOH. 2

(ii) Draw the structure of 4-Ethyl-1-fluoro-2-nitrobenzene.

SECTION-C (SAQ)

22. (i) Give the statement of Heisenberg's uncertainty principle along with equation. 1 x 3 = 3

(ii) Which series of spectral lines of hydrogen spectrum get produced when electron jumps from higher energy level (n=3,4 or higher) to 2nd energy level ? In which region of EMR (i.e., electromagnetic radiation) these lines lie?
(ii) Define photoelectric effect.

23. Give reason: 1 x 3 = 3
(i) The size of Cl^- ion is bigger than that of Cl atom whereas size of Na^+ ion is smaller than that of Na.
(ii) Electron gain enthalpy of F is less negative than Cl although F is more electronegative than Cl.
(iii) Ionisation enthalpy of Mg is more than that of Na and Al.

24. What do you understand by C_p and C_v? Derive a relationship between them. 1 +2 = 3

OR

a) Define State Function with example.
b) Differentiate between extensive and intensive properties with suitable example.

25. Balance the following redox reaction (either ion electron method or oxidation number method)- 3
$MnO_4^- + I^- + H^+$ (aq.) □ Mn^{2+} (aq.) + I_2 + H_2O [In Acedic medium]

Or

P_4 + OH^- (aq.) □ PH_3 + HPO_2^- [In basic medium]

26. Distinguish between electrophiles and nucleophiles. Giving justification, categories the following molecules or ions as nucleophile or electrophile : HS^-, BF_3, $C_2H_5O^-$ & Cl^+. 3

27. 0.3780 g of an organic chloro compound gave 0.5740 g of silver chloride in Carius estimation. Calculate the percentage of chlorine present in the compound. 3

28. State "Huckel's rule of aromaticity". List out the characteristics to be possessed by an organic compound in order to be aromatic. 3

SECTION-D (CBQ)

29. Read the following passage and answer the questions given below the passage:
A chemical formula is a symbolic representation of one molecule of the substance which tells the number and kind of atoms of various elements present in its molecule. The determination of the formula of a substance involves first the determination of its "Empirical formula" and then the "Molecular formula". Empirical formula expresses the simplest whole number ratio of the atoms of constituent elements whereas molecular formula expresses the actual number of atoms of constituent elements present in one molecule of the compound. The chemical formula of different substances (i.e., reactants and products) are used to represent a chemical equation. Balanced chemical equation is very useful for theoretical calculation of amount of product from known amount of reactant or vice-versa. It also helps to calculate the percentage of different compounds present in a mixture or percentage purity of a compound or actual percent yield of a product etc. Knowing the concepts of molarity, normality etc., the calculations can be done for reactions in solution also. In many reactions, generally involving two reactants, one of the reactants is completely consumed while some amount of the second reactant is left behind. The former is called limiting reagent while the latter is called excess reagent.

(1) 3.0 g of H_2 react with 29.0 g of O_2 to form H_2O. Which is the limiting reagent? 1

(2) Define Molarity and how it vary with temperature? 1

(3) The empirical formula and molecular mass of a compound are CH_2O and 180 g respectively. What will be the molecular formula of the compound? 1

(i) $C_9H_{18}O_9$ (ii) CH_2O (iii) $C_6H_{12}O_6$ (iv) $C_2H_4O_2$

(4) Which of the following term(s) is/are unitless : (A) Molarity, (B) Molality, (C) Mol fraction & 1
(D) Mass percent ?

(i) A & B (ii) C & D (iii) B & C (iv) B & D

30. Read the following passage and answer the questions given below the passage:

The first law of thermodynamics has the limitation that it cannot predict the spontaneity of a process, i.e., a process can take place (by itself for on initiation) or cannot take place. The net driving force is the resultant of tendency for minimum energy and tendency for maximum randomness. Randomness is expressed in the terms of the thermodynamic quantity called entropy. Entropy change during a process depends upon physical state of reactants and products, volume change, temperature and number of gaseous molecules before and after the process. Entropy change also occurs during fusion, vaporisation and sublimation and can be calculated from heat of transition and transition temperature. Total entropy change is the sum of the entropy change of the system and entropy change of the surroundings. This helps to predict whether the process is spontaneous or non-spontaneous or in equilibrium. It is found that all the spontaneous processes are irreversible and accompanied by increase of entropy.

(i) For the reaction, $2Cl(g) \rightarrow Cl_2(g)$, what are the signs of ΔS & ΔH? 1
(a) ΔS = +ve & ΔH = +ve (b) ΔS = +ve & ΔH = -ve
(c) ΔS = -ve & ΔH = +ve (d) ΔS = -ve & ΔH = -ve

(ii) $A + B \rightarrow C + D$; $\Delta H = -1.0 \times 10^4$ $Jmol^{-1}$, $\Delta S = -33.3$ $Jmol^{-1}K^{-1}$. At what temperature the reaction will occur spontaneously from left to right? 1

Or

For the reaction, $2A(g) + B(g) \rightarrow 2D(g)$, $\Delta H° = -12.98$ kJ & $\Delta S° = -44.10$ JK^{-1}. 2
Calculate $\Delta G°$ for the reaction and predict whether the reaction may occur spontaneously at 298 K.

(iii) Comment on the spontaneity of a reaction at constant temperature and pressure in the following cases: (a) $\Delta H < 0$ and $\Delta S > 0$ (b) $\Delta H > 0$ and $\Delta S > 0$. 1

SECTION-E (LAQ)

31. Define Hybridisation. Describe hybridisation in the case of PCl_5 and SF_6. The axial bonds are longer than the equatorial bonds in PCl_5 whereas in SF_6 both axial bonds and equatorial bonds have the same bond length. Explain. 1+2+2

Or

(a) Draw the resonating structures of – (a) CO_3^{2-} (b) O_3 2+3
(b) Find the bond order and compare the relative stability and magnetic nature of O_2 & N_2 on the basis of MOT.

32. (a) A mixture of 2.0 mol of N_2 , 2.0 mol of H_2 and 8.0 mol of NH_3 is introduced into a 10 L reaction vessel at 500 K. At this temperature, the equilibrium constant, K_c for the reaction: $N_2(g) + 3\ H_2(g) \Leftrightarrow 2\ NH_3(g)$ is 1.7×10^2. Is the reaction mixture at equilibrium? If not, what is the direction of net reaction? 2
(b) Why NH_4Cl is used along with NH_4OH as group reagent during qualitative analysis of third group basic radicals? 2
(c) Find the conjugate acid/base for the species: NH_4^+ and CO_3^{2-}.

Or 1

(a) Find the value of K_c for the following equilibrium from the value of K_p:
$2NOCl\ (g) \Leftrightarrow 2NO\ (g) + Cl_2\ (g)$; $K_p = 1.8 \times 10^{-2}$ atm at 500 K. 2

(b) The solubility of A_2B_3 is 'y' mol dm^{-3}. Find its solubility product. 1

(c) What do you mean by buffer solution? Give it's types with suitable example of each. 2

33. (a) An alkene A on ozonolysis gives a mixture of propanal and pentan-3- one. Write the structural formula and IUPAC name of A. 2

(b) Complete the following reactions: 2

(i) $CH_3CH=CH_2 + HBr$ (in the presence of organic peroxide) □

(ii) $CH_3CH_2Br + Na$ (in dry Ether) □

(c)What happens when ethyne is passed through red hot iron tube at 873 K. Give chemical equation. 1

Or

(a) How will you convert

(i) Benzene to Toluene . (ii) Methane to Ethane 1 1

(b) State Markovnikov's rule with example. 1

(c) What happens when:-

(i) Sodium acetate is heated with soda lime. 1

(ii) Ethanol is heated with concentrated sulphuric acid at 443K . 1