CLASS-XI

ANNUAL EXAMINATION 2024-25

SUBJECT-CHEMISTRY

SET B2

Time:-3 hours **MM=70**

No. of printed pages=7

General Instructions:

a) There are **33** questions in this question paper with internal choice.

b) SECTION A consists of 16 multiple-choice 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.

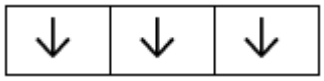
h) Use of log tables and calculators is not allowed.

SECTION A

1.In a container, there are 4 moles of nitrogen, 3 moles of oxygen and 7 moles of hydrogen; find out the mole fraction of oxygen in this reaction.

a) 0.2143
b) 0.2142
c) 0.1234
d) 0.2434

2.The below process of filling electrons in an orbital follows _____



a) Aufbau principle
b) Hund's rule of maximum multiplicity
c) Pauli's exclusive principle
d) Electronic configuration

3.As per Heisenberg's principle of uncertainty, the relation between relative momentum and relative position is _____

a) independent
b) equal
c) directly proportional
d) inversely proportional

4.What is the electronic configuration of hydrogen molecule?
a) $\sigma 1s^2$
b) $\sigma 1s^1$
c) $\sigma 1s$
d) $\sigma^* 1s$

5.Which of the following is not an acidic buffer?
a) Acetic Acid-Sodium acetate
b) Boric acid-borax
c) Ammonium hydroxide-ammonium chloride
d) All are acidic buffers

6.Acidity of BF_3 can be explained on the basis of which of the following concepts?
(a) Arrhenius concept
(b) Bronsted Lowry concept
(c) Lewis concept
(d) Bronsted Lowry as well as Lewis concept.

7.Which of the following is the correct IUPAC name?

(a) 3-Ethyl-4, 4-dimethylheptane

(b) 4,4-Dimethyl-3-ethylheptane

(c) 5-Ethyl-4, 4-dimethylheptane

(d) 4,4-Bis(methyl)-3-ethylheptane

8.Which type of isomerism is exhibited by the compounds whose structures are shown below?

$CH_3CH_2OCH_2CH_3$ and $CH_3OCH_2CH_2CH_3$

(a) Metamerism

(b) Geometric isomerism

(c) Tautomerism

(d) Position isomerism

9.What is the stock notation of cuprous oxide?
a) copper oxide
b) copper (I) oxide
c) copper (II) oxide
d) copper 2 oxide

10. Alkenes show _____ isomerism.
a) only structural
b) only geometrical
c) both geometrical and structural
d) neither geometrical nor structural

11. Which of the following is an example of meta directing group?
a) -CHO
b) $–NH_2$
c) $-OCH_3$
d) -NHR

12. Among halogens, the correct order of amount of energy released in electron gain (electron gain enthalpy) is
(a) F > Cl > Br > I
(b) F < Cl < Br < I
(c) F < Cl > Br > I
(d) F < Cl < Br > I

13. Assertion (A) : A liquid crystallises into a solid and is accompanied by decrease in entropy. Reason (R) : In crystals, molecules organise in an ordered manner

14. Assertion (A) : It is impossible to determine the exact position and exact momentum of an electron simultaneously.

Reason (R) : The path of an electron in an atom is clearly defined.

15. Assertion (A) : Combustion of 16 g of methane gives 18 g of water.

Reason (R) : In the combustion of methane, water is one of the products.

16. Assertion (A) : Among isomeric pentanes, 2, 2-dimethylpentane has highest boiling point.
Reason (R) : Branching does not affect the boiling point.

SECTION B

17.(a) Assign the position of the element having outer electronic configuration:- (1+1)

$ns^2\ np^4$ for n = 3

(b)Use the periodic table to identify an element that would tend to lose two electrons.

18. Explain the terms inductive and electromeric effects. Which electron displacement effect explain the following correct orders of acidity of the carboxylic acids? (1+1)

$Cl_3CCOOH > Cl_2CHCOOH > ClCH_2\ COOH$

19.In a reaction $A + B_2 \rightarrow AB_2$ (1+1)

Identify the limiting reagent, if any, in the following reaction mixtures.

(i) 300 atoms of A + 200 molecules of B

(ii) 2.5 mol A + 5 mol B

20. Draw Newman or Sawhorse projections for the eclipsed and staggered conformations of ethane. Which of these conformations is more stable and why? (1+1)

OR

Draw the cis and trans structures of hex-2-ene. Which isomer will have higher b.p. and why?

21.(i) Find energy of each of the photons which have wavelength of 0.50 Å.(Planck's constant = 6.626×10^{-34} Js) (1+1)

(ii) How many electrons in an atom may have the following quantum numbers?

(a) n = 4, $m_s = -½$ (b) n = 3, l = 0

SECTION C

22. Calculate the concentration of nitric acid in moles per litre in a sample which has a density, 1.41 g mL^{-1} and the mass percent of nitric acid in it being 69%. (Atomic mass of N=14, H=1, O=16 u) (3)

23. (a) Compare the relative stability and magnetic character of the following species on the basis of Molecular Orbital Theory: O_2^- (Superoxide), O_2^{2-} (peroxide) (2+1)

(b)Arrange the following, according to increasing covalent nature.

$NaCl, MgCl_2, AlCl_3$

OR

(a)Describe the hybridisation in case of PCl_5. Why are the axial bonds longer as compared to equatorial bonds? (Atomic number of P=15)

(b) Write the conditions which favour the formation of ionic bond.(Any two)

24.(a)Balance the following redox reaction:- (2+1)

$Cr_2O_7^{2-}(aq) + SO_2(g) \longrightarrow Cr^{3+}(aq) + SO_4^{2-}(aq)$ (in acidic solution)

(b)What is the role of a salt bridge in an electrochemical cell?

25. (a)Draw the resonance structures for C_6H_5OH. Show the electron shift using curved-arrow notation. (2+1)

(b) Why is nitric acid added to sodium extract before adding silver nitrate for testing halogens ?

26.(a) Which out of NH_3 and NF_3 has higher dipole moment and why? (2+1)

(b) Describe the change in hybridisation (if any) of the Al atom in the following reaction.

$$AlCl_3 + Cl^- \rightarrow AlCl_4^-$$

27.(a)Which of the following pairs of elements would have a more negative electron gain enthalpy? O or S. Give reason. (1.5+1.5)

(b)Would you expect the second electron gain enthalpy of O as positive, more negative or less negative than the first? Justify your answer.

28. When two moles of $C_2H_6(g)$ are burnt, 3129 kJ of heat is liberated. Calculate the heat of formation of $C_2H_6(g)$. ΔH_f^o for $CO_2(g)$ and $H_2O(l)$ are-393.5 and -286 kJ mol^{-1} respectively.

(3)

SECTION D

29.Read the following passage and answer the questions that follow: (2+2+1)

Bohr's model explained electrons can revolve only in certain permitted orbits whose angular momentum is integral multiple of h/2p, associated with fixed amount of energy. Bohr theory could successfully explain stability of atoms and spectrum of unielectron species. Hydrogen spectrum consist of Lyman, Balmer, Paschen, Brackett

and Pfund series. Bohr's theory could not explain spectrum of multi-electron species, Stark effect, Zeeman effect, dual nature of matter, de Broglie equation and Heisenberg uncertainty principle which lead to orbital concept. Electrons were filled in orbitals according to Aufbau's principle, Hund's Rule and Pauli's exclusion principle. Each electron is identified by four quantum numbers n, l, ml and ms out which n, l, ml were derived from Schrodinger's wave equation. Half filled and completely filled orbitals are more stable due to exchange energy and symmetrical distribution of electrons.

1.Calculate the wavelength of an electron moving with a velocity of 2.05×10^7 m s^{-1}. (Planck's constant = 6.626×10^{-34} Js)

2.Show that the circumference of the Bohr orbit for the hydrogen atom is an integral multiple of the de Broglie wavelength associated with the electron revolving around the orbit.

3. Write the electronic configuration of Cu^{2+} (Atomic no. of Cu=29)

30.Read the given passage and answer the questions that follow: (1 x4=4)

Organic compounds are formed by covalent bonding. The nature of covalent bonding can described with the help of hybridisation, sp, sp2 and sp3. The structure and reactivity depends upon type of bonds present in organic compounds. Organic compound can be represented by various structural formulae, Wedge and Dash formula is 3-D representation. Organic compounds can be classified on the basis of functional groups. Organic reactions mechanism are based on structure of substrate and the attacking reagent.

The intermediate formed can be free radical, carbocation, carbanion or carbene. The attacking reagent can be electrophile or nucleophile. The inductive, electromeric, resonance and hyperconjugative effect may help in polarisation of covalent bond. Organic reactions may be regarded as substitution, addition, elimination and rearrangement, oxidation and reduction reaction.

1.Write the hybridized state of C atoms in the following $CH_2 = CH - CN$

2.Explain why $(CH_3)_3C^+$ is more stable than $CH_3CH_2^+$

3.Which of the two:

$O_2NCH_2CH_2O^-$ or $CH_3CH_2O^-$ is expected to be more stable, and why?

4.Draw the possible resonance structures for CH_3-O-CH_2^+, and predict which of the structures is more stable.

SECTION E

31.(a)How will you convert benzene into:- (2+2+1)
(i) p-chloronitrobenzene (ii) Acetophenone

(b)Addition of HBr to propene yields 2-bromopropane as the major product. Write the reaction giving suitable mechanism.

(c)An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3-one. Write the structure and IUPAC name of 'A'.

OR

(a)Write the equations for the following reactions: (2+2+1)

(i) Dehydrohalogenation of 1-bromopropane

(ii) Decarboxylation of sodium benzoate

(b) Write the mechanism of halogenation of benzene.

(c) What happens when ethyne gas is passed through red hot iron tube? (eqn. only)

32.(a) The bond enthalpy of $H_2(g)$ is 436 kJ $mol^{-1}$and that of N_2 (g) is 941.3 kJ mol^{-1}. Calculate the average bond enthalpy of an N-H bond in ammonia. Given: $\Delta H_f{}^{o}$ (NH_3) = -46 kJ/mol. (2+2+1)

(b)Given the condition, $\Delta H = 0$ for the mixing of the two gases. Explain if the diffusion of these gases into each other in the closed container is a spontaneous process or not.

(c)Predict the change in the internal energy for the isolated system at the constant volume.

33.(a)pH of a solution of a strong acid is 5.0. What will be the pH of the solution obtained after diluting the given solution a 100 times? (log2=0.3010) (2+2+1)

(b)The solubility of AgCl in water at 298 K is 1.06 x 10^{-5} mole per litre. Calculate its solubility product at this temperature.

(c) Write the conjugate acids for the following Bronsted bases:

NH_3 and $HCOO^-$

OR

(a)State Le Chatelier's principle. (1+2+2)
(b)Following reactions occur in a Blast furnace.
$Fe_2O_3(s) + 3CO(g) \longrightarrow 2Fe(s) + 3CO_2(g)$

predict the direction of reaction when equilibrium mixture is disturbed by
(i) adding Fe_2O_3 (ii) removing CO_2 .
(c)A mixture of 1.57 mol of N_2, 1.92 mol of H_2 and 8.13 mol of NH_3 is introduced into a 20 L reaction vessel at 500 K. At this temperature, the equilibrium constant Kc for the reaction
$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ is 1.7×10^{-2}.
Is this reaction at equilibrium?