

O.P.JINDAL SCHOOL, SAVITRINAGAR
ANNUAL EXAMINATION-(2023-24)
SET- A

CLASS-XI
SUBJECT-CHEMISTRY

MM-70
Time:3hours

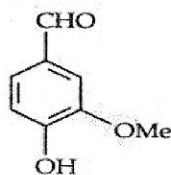
(Fifteen minutes extra will be given for reading the Question paper)

General Instruction:-

- (i) All questions are compulsory. There are 33 questions in all.
- (ii) SECTION -A: Question numbers 1 to 16 are MCQs carrying one mark each.
- (iii) SECTION -B: Question numbers 17 to 21 are short answer type-I questions and carrying 2 marks each.
- (iv) SECTION -C: Question numbers 22 to 28 are short answer type-II questions and carrying 3 marks each.
- (v) SECTION -D: Question numbers 29 and 30 are case-based questions carrying 4 marks each.
- (v) SECTION -E: Question numbers 31 to 33 are all long answer type questions and carrying 5 marks each.
- (vi) There is no overall choice. However, an internal choice has been provided in some questions.
- (vii) Use of calculator is not permitted. However, you may use log tables, if necessary.

SECTION-A

1. The functional groups in the given compound is:



- | | |
|------------------|--------------------|
| (a) Aldehyde | (b) Phenolic ether |
| (c) Methyloctane | (d) Aromatic amine |
2. According to Aufbau principle a new electron enters the orbitals when:

(a) $(n + 1)$ is minimum	(b) $(n + 1)$ is maximum
(c) $(n + m)$ is minimum	(d) $(n + m)$ is maximum
 3. The smallest ion among the following is

(a) Na^+	(b) Al^{3+}
(c) Mg^{2+}	(d) Si^{4+}
 4. In which of the following pairs, the two molecules have identical bond orders:

(a) N_2 , O_2^{2+}	(b) N_2 , O_2^-
(c) N_2^- , O_2	(d) O_2^{2-} , N_2
 5. The strong conjugate base is

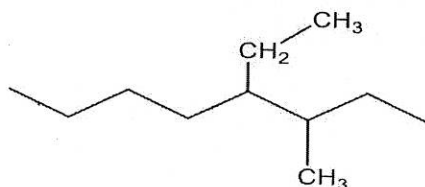
(a) NO_3^{2-}	(b) Cl^-
(c) SO_4^{2-}	(d) CH_3COO^-
 6. Oxidation number of P in PO_4^{3-} , of S in SO_4^{2-} and that of Cr in $\text{Cr}_2\text{O}_7^{2-}$ are respectively:

(a) +3, +6 and +5	(b) +5, +3 and +6
(c) +3, +6 and +6	(d) +5, +6 and +6
 7. The structure of 4-Methylpent-2-en-1-ol is:

(a) $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_2\text{OH}$	(b) $(\text{CH}_3)_2\text{C}=\text{CHCH}_2\text{CH}_2\text{OH}$
(c) $(\text{CH}_3)_2\text{CHCH}=\text{CHCH}_2\text{OH}$	(d) $\text{CH}_3\text{CH}(\text{OH})\text{CH}=\text{C}(\text{CH}_3)_2$

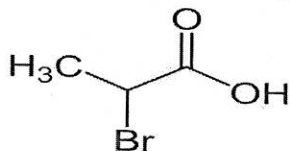
(XI-1)

8. The IUPAC name of given compound is



- (a) Isopropyl octane (b) 3-ethyl, 4-methyloctane
(c) 4-ethyl, 3-methyloctane (d) 3-methyl-2-benzene

9. The no. of π and σ bonds in the given compound are :



- (a) 3 π and 5 σ bonds (b) 7 π and 5 σ bonds
(c) 1 π and 9 σ bonds (d) 2 π and 8 σ bonds

10. An adiabatic expansion of an ideal gas always has..

- (a) Decrease in temperature (b) $q = 0$
(c) $W = 0$ (d) $\Delta H = 0$.

11. What is the oxidation number of Mn in KMnO_4

- (a) -3 (b) -5
(c) +5 (d) +7

12. Out of the following, intermolecular hydrogen bonding exists in:

- (a) water (b) H_2S
(c) 4-nitrophenol (d) 2-nitrophenol

Questions 13-16 are Assertion and Reason questions:

In these questions (13-16) 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 the correct explanation for assertion.
(b) Assertion and reason both are correct statements and reason is not the correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

13. **Assertion:** π bonds are weaker than σ bonds.

Reason: π bonds are formed by the overlapping of p-p orbitals along their axes.

14. **Assertion:** K_p can be less than, greater than or equal to K_c .

Reason: Relation between K_p and K_c depends on the change in number of moles of gaseous reactants and products (Δn).

15. **Assertion:** But-1-ene and 2-methylprop-1-ene are position isomers.

Reason: Position isomers have same molecular formula but differ in position of functional group or $\text{C}=\text{C}$.

16. **Assertion:** All the hydrogen atoms in $\text{CH}_2=\text{C}=\text{CH}_2$ are attached to sp^2 hybridized carbon atom.

Reason: All the carbon atoms in its are sp^2 hybridized.

SECTION-B

17. Account for the following:

- (i) Water is a liquid while H_2S is a gas
- (ii) NH_3 has higher boiling point than PH_3 .

18. Fifteen litre of ideal gas at 30 atm pressure expands until its volume is 60 litre. How much heat is absorbed and how much work is done.

OR

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?

19. Calculate the molarity of a solution of ethanol in water in which the mole fraction of ethanol is 0.040

20. What is the wavelength of the light emitted when the electron in a hydrogen atom undergoes transition from the energy level with $n = 4$ to energy level $n = 2$? What is the colour corresponding to this wavelength? (Given $R_H = 109678 \text{ cm}^{-1}$)

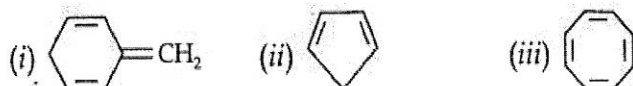
21. How would you explain the fact that the first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium?

OR

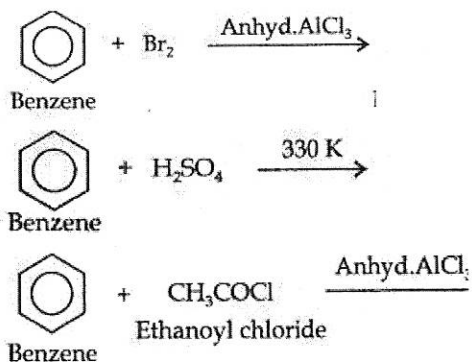
The first ionization enthalpy ($\Delta_i H$) values of the third period elements, Na, Mg and Si are respectively 496, 737 and 786 kJ mol^{-1} . Predict whether the first $\Delta_i H$ value for Al will be more close to 575 or 760 kJ mol^{-1} ? Justify your answer.

SECTION-C

22 Explain why the following systems are not aromatic?



23. What happens when benzene is treated with:



24 (i) Draw the Lewis structures for the molecule H_2SO_4 .

OR

Draw the Lewis structures for the molecule NO_2^- ion.

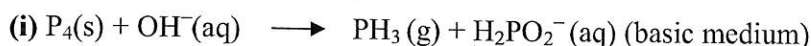
(ii) The equilibrium constant expression for a gas reaction is,

$$K_c = \frac{[\text{NH}_3]^4 [\text{O}_2]^5}{[\text{NO}]^4 [\text{H}_2\text{O}]^6}$$

Write the balanced chemical equation corresponding to this expression.

25. The species HCO_3^- , HSO_4^- and NH_3 can act both as Bronsted acid and base. For each case, give the corresponding conjugate acid and base.

26. Balance the following equation in basic medium by oxidation number method and identify the Oxidizing agent and the reducing agent.



OR

Consider the elements: Cs, Ne, I, F

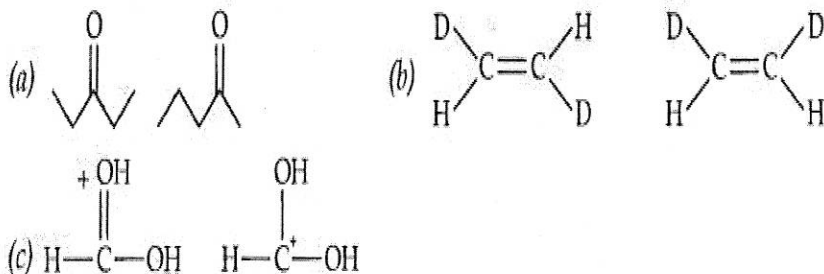
- (i) Identify the element that exhibits -ve oxidation state.
- (ii) Identify the element that exhibits +ve oxidation state.
- (iii) Identify the element that exhibits both +ve and -ve oxidation states.

27. (i) Propanal and pentan-3-ene are the ozonolysis products of an alkene. What is the structural formula of the alkenes?

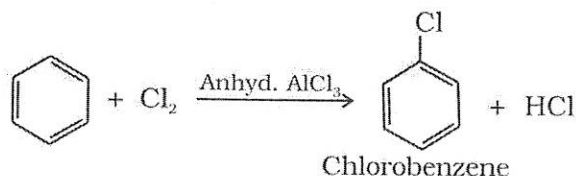
(ii) Write bond-line formulas for: 2,3-Dimethylpentanal and Heptan-3-one.

OR

What is the relationship between the members of following pairs of structures? Are they structural or geometrical isomers or resonance contributors?



28. Write Mechanism of electrophilic substitution of benzene to get Chlorobenzene



SECTION-D

Read the passage and answer the following questions

29. According to the German physicist, Max Born, the square of the wave function (i.e., ψ^2) at a point gives the probability density of the electron at that point. Boundary surface diagrams of constant probability density for different orbital's give a fairly good representation of the shapes of the orbital's. In this representation, a boundary surface or contour surface is drawn in space for an orbital on which the value of probability density $|\psi|^2$ is constant. In principle many such boundary surfaces may be possible. However, for a given orbital, only that boundary surface diagram of constant probability density* is taken to be good representation of the shape of the orbital which encloses a region or volume in which the probability of finding the electron is very high, say, 90%. In hydrogen atom, electron has the same energy when it is in the 2s orbital as when it is present in 2p orbital. The orbital's having the same energy are called degenerate. The 1s orbital in a hydrogen atom, as said earlier, corresponds to the most stable condition and is called the ground state and an electron residing in this orbital is most strongly held by the nucleus.

- (i) What gives the probability density of the electron at that point?
- (ii) How many electrons may exist in the same orbital?
- (iii) Explain the Degenerate orbital and Ground state.

(XI-4)

OR

Write electronic configuration of Cr^{+3} ion and Cu atom.

30. The Lattice Enthalpy of an ionic solid is defined as the energy required to completely separate one mole of a solid ionic compound into gaseous constituent ions.. Bond length is defined as the equilibrium distance between the nuclei of two bonded atoms in a molecule. Bond lengths are measured by spectroscopic, X-ray diffraction and electron-diffraction techniques. The covalent radius is measured approximately as the radius of an atom's core which is in contact with the core of an adjacent atom in a bonded situation. The Vander Waals radius represents the overall size of the atom which includes its valence shell in a no bonded situation. Bond Angle is defined as the angle between the orbital containing bonding electron pairs around the central atom in a molecule/complex ion. Bond angle is expressed in degree which can be experimentally determined by spectroscopic methods. It gives some idea regarding the distribution of orbital around the central atom in a molecule/complex ion and hence it helps us in determining its shape.

- (i) What is the technique use to measure bond length?
- (ii) What is the unit of bond enthalpy?
- (iii) Explain the Lattice Enthalpy of an ionic solid with suitable example.

OR

What is the correlation between bond order, bond enthalpy and bond length?

SECTION-E

31. (i) How will you convert ethanoic acid into benzene?

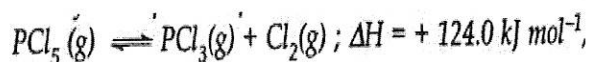
OR

(ii) Explain and write mechanism of the addition reactions of HBr to $\text{CH}_3\text{-CH}=\text{CH}_2$.

(a) In the absence of peroxide (b) In the presence of peroxide.

32. (i) Calculate the solubility of A_2X_3 in pure water, assuming that neither kind of ion reacts with water. The solubility product of A_2X_3 , $K_{sp} = 1.1 \times 10^{-23}$.

(ii) At 473 K, the equilibrium constant K_c for the decomposition of phosphorus pentachloride (PCl_5) is 8.3×10^{-3} . If decomposition proceeds as:



- (a) Write an expression for K_c for the reaction
- (b) What is the value of K_c for the reverse reaction at the same temperature.
- (iii) The pK_a of acetic acid and pK_b of ammonium hydroxide are 4.76 and 4.75 respectively. Calculate the pH of ammonium acetate

OR

(i) 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?

(ii) The solubility product of Cu_2S is 3×10^{-48} . What is the solubility of this salt?

(iii) For the following equilibrium, $K = 6.3 \times 10^{14}$ at 1000 K.



Both the forward and reverse reactions in the equilibrium are elementary bimolecular reactions.

What is K_c for the reverse reaction?

(XI-5)

33. (i) Describe the hybridization in case of PCl_5 . Why are the axial bonds longer as compared to equatorial bond.
- (ii) Using molecular orbital energy level diagram to show F_2 have a single bond, Ne_2 no bond and N_2 a triple bonds?

OR

- (i) Explain and draw the molecular structures of the following.

(a) XeF_4 (b) ClF_3

- (ii) Although geometries of NH_3 and H_2O molecules have distorted tetrahedral, the bond angle in water is less than that of Ammonia. Explain.
