

**O.P.JINDAL SCHOOL, SAVITRINAGAR**  
**ANNUAL EXAMINATION-(2022-23)**

SET- B

**CLASS-XI**

**MM-70**

**Subject-Chemistry**

**Time:3hours**

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

**General Instruction:-**

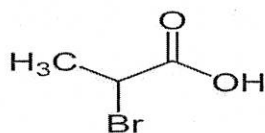
- (i) All questions are compulsory. There are 33 questions in all.  
(ii) SECTION -A: Question numbers 1 to 16 are MCQs carrying one mark each.  
(iii) SECTION -B: Question numbers 17 to 21 are short answer type-I questions and carrying 2 marks each.  
(iv) SECTION -C: Question numbers 22 to 28 are short 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**

- The peroxide effect in anti-Markovnikov addition involves ...
  - The heterolytic fission of the double bond
  - The hemolytic fission of the double bond
  - a free radical mechanism
  - an ionic mechanism
- The catalyst required for the given reaction is..
$$\text{HC} \equiv \text{CH} + \text{dil H}_2\text{SO}_4 \xrightarrow{\text{Catalyst}} \text{CH}_3\text{CHO}$$
  - HgSO<sub>4</sub>
  - Pt
  - AlCl<sub>3</sub>
  - Pd
- Which of the following pairs of gases contains the same number of molecules?
  - 16 g of O<sub>2</sub> and 14 g of N<sub>2</sub>
  - 6 g of O<sub>2</sub> and 22 g of CO<sub>2</sub>
  - 28 g of N<sub>2</sub> and 22 g of CO<sub>2</sub>
  - 32 g of CO<sub>2</sub> and 32 g of N<sub>2</sub>
- Which of the following are correct?
  - CH<sub>3</sub> – O – CH<sub>2</sub><sup>+</sup> is more stable than CH<sub>3</sub> – CH<sub>2</sub><sup>+</sup>
  - (CH<sub>3</sub>)<sub>2</sub>CH<sup>+</sup> is less stable than CH<sub>3</sub> – CH<sub>2</sub> – CH<sub>2</sub><sup>+</sup>
  - CH<sub>2</sub> = CH – CH<sub>2</sub><sup>+</sup> is more stable than CH<sub>3</sub> – CH<sub>2</sub> – CH<sub>2</sub><sup>+</sup>
  - CH<sub>2</sub> = CH<sup>+</sup> is more stable than CH<sub>3</sub> – CH<sub>2</sub><sup>+</sup>
- An adiabatic 'expansion of an ideal gas always has...
  - Decrease in temperature
  - q = 0
  - W = 0
  - ΔH = 0.

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6. The oxidation number of Cr in  $K_2Cr_2O_7$  is..
- (a)-3 (b)-5  
(c) +6 (d) +7
7. Out of the following, intermolecular hydrogen bonding exists in..
- (a) ortho-nitrophenol (b)  $H_2S$   
(c) para-nitrophenol (d) water
8. The conjugate acids for the  $HCOO^-$  is...
- (a)  $NH_2^-$  (b)  $Cl^-$   
(c)  $HBr$  (d)  $HCOOH$
9. The no. of  $\pi$  and  $\sigma$  bonds in the given compound are :



- (a) 3  $\pi$  and 5  $\sigma$  bonds (b) 7  $\pi$  and 5  $\sigma$  bonds  
(c) 1  $\pi$  and 9  $\sigma$  bonds (d) 2  $\pi$  and 8  $\sigma$  bonds
10. 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)  $O_2^{2-}$ ,  $N_2$
11. According to Aufbau principle a new electron enters the orbital when:
- (a)  $(n + l)$  is minimum (b)  $(n + l)$  is maximum  
(c)  $(n + m)$  is minimum (d)  $(n + m)$  is maximum
12. The smallest ion among the following is
- (a)  $Na^+$  (b)  $Al^{3+}$   
(c)  $Mg^{2+}$  (d)  $Si^{4+}$

**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:** 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 C = C.

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

**Reason:** All the carbon atoms in its are  $\text{sp}^2$  hybridized.

**15. 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 ( $\Delta n$ ).

**16. Assertion:**  $\pi$  bonds are weaker than  $\sigma$  bonds.

**Reason:**  $\pi$  bonds are formed by the overlapping of p-p orbitals along their axes.

### SECTION-B

**17.** Fifteen litre of ideal gas at 30 atm pressure expands until its volume is 60 litres. 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?

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

**19.** How would you justify the presence of 18 elements in the 5th period of the Periodic Table?

**OR**

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

**20.** Account for the following: —

(i) Water is a liquid while  $\text{H}_2\text{S}$  is a gas

(ii)  $\text{NH}_3$  has higher boiling point than  $\text{PH}_3$ .

**21.** What are the frequency and wavelength of a photon emitted during a transition from  $n = 5$  state to the  $n = 2$  state in the hydrogen atom?

### SECTION-C

**22. (i)** Draw the Lewis structures for the molecule  $\text{H}_2\text{S}$

**OR**

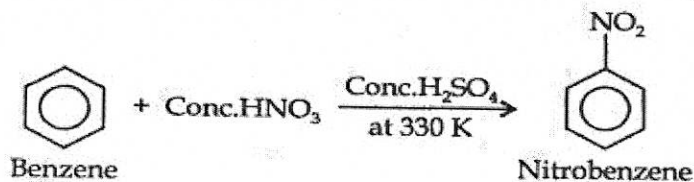
Draw the Lewis structures for the  $\text{CO}_3^{2-}$  ion.

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

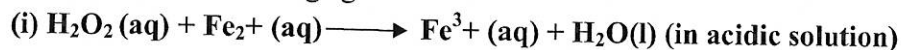
$$K_c = \frac{[\text{NH}_3]^4 [\text{O}_2]^5}{[\text{NO}]^4 [\text{H}_2\text{O}]^6}$$

Write the balanced chemical equation corresponding to this expression.

23. Write Mechanism of electrophilic substitution of benzene to get Nitrobenzene.



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



OR

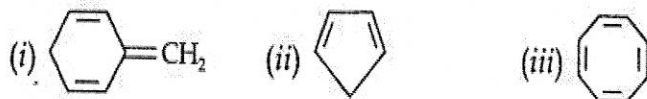
Consider the elements: Cs, Ne, I, F

(i) Identify the element that exhibits -ve oxidation state.

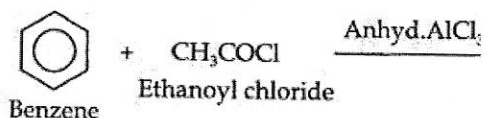
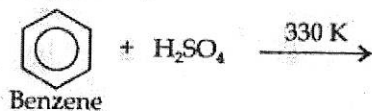
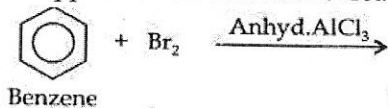
(ii) Identify the element that exhibits +ve oxidation state.

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

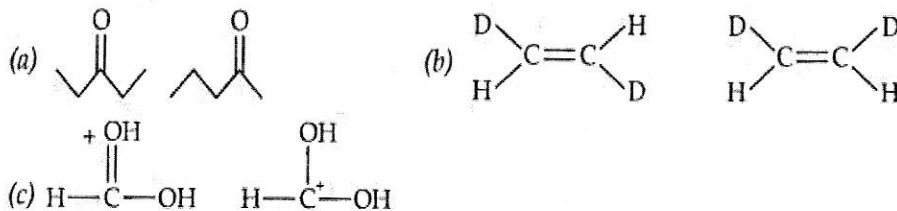
25. Explain why the following systems are not aromatic?



26. What happens when benzene is treated with?

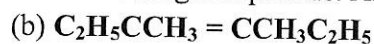
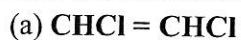


27. What is the relationship between the members of following pairs of structures? Are they structural or geometrical isomers or resonance contributors?



OR

(i) Draw cis and trans isomers of the following compounds. Also write their IUPAC names:



(ii) Write bond-line formulas for:

(a) 2,3-Dimethylbutanal

(b) Heptan-4-one.

28. The species  $\text{HCO}_3^-$ ,  $\text{HSO}_4^-$  and  $\text{NH}_3$  can act both as Bronsted acid and base. For each case, give the corresponding conjugate acid and base.

#### SECTION-D

29. Read the passage and answer the following questions

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?

30. According to the German physicist, MaxBorn, the square of the wave function(i.e., $\psi^2$ ) 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.

**OR**

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

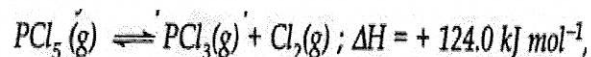
(XI-5)

**SECTION-E**

31. (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  $8.3 \times 10^{-3}$ . 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  $3 \times 10^{-48}$ . 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?

32. (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  $O_2$  have a double bond,  $He_2$  no bond and  $N_2$  a triple bonds?

**OR**

(i) Explain and draw the molecular structures of the following on the basis of VSEPR Theory.

(a)  $XeF_2$             (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

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

**OR**

(ii) Explain and write mechanism of the addition reactions of  $HBr$  to  $CH_3-CH=CH_2$ .

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

(XI-6)

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