

**O.P.JINDAL SCHOOL,SAVITRINAGAR**

**ANNUAL EXAMINATION-(2022-23)**

**CLASS-XI**

**MAX.MARKS-70**

**SUBJECT-CHEMISTRY**

**MAX.TIME-3HOURS**

**General Instruction:-**

- (i) All questions are compulsory .There are 35 questions in all.
- (ii) SECTION –A: Question numbers 1 to 18 are MCQs carrying one mark each.
- (iii) SECTION –B: Question numbers 19 to 25 are short answer type-I questions and carrying 2 marks each.
- (iv) SECTION –C: Question numbers 26 to 30 are short answer type-II questions and carrying 3 marks each.
- (v) SECTION –D: Question numbers 31 and 32 are case-based questions carrying 4 marks each.
- (v) SECTION –E: Question numbers 33 to 35 are al 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. How many chain isomers are given by the compound  $C_5H_{12}$  ?
  - (a) one
  - (b) Two
  - (c) Three
  - (d) Four
2. The position of an element having e.c.e.  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$  is
  - (a) Period 4 and group 6
  - (b) Period 6 and group 4
  - (c) Period 3 and group 1
  - (d) Period 4 and group 5
3. Consider two elements P and Q.If P has 2 and Q has 6 electrons in their outermost shell, then the formula of the compound is
  - (a)  $P_2Q$
  - (b) PQ
  - (c)  $P_2Q_3$
  - (d)  $PQ_2$
4. The IUPAC name of  $CH_3COCH(CH_3)_2$  is
  - (a) iso-propylmethyl ketone
  - (b) 2-methyl-3-butanone
  - (c) 4-methyl iso-propyl ketone
  - (d) 3-methyl-2-butanone
5. What is the molarity of the solution which contains 5.85 g of NaCl per 500 mL?
  - (a) 0.4M
  - (b) 4M
  - (c) 0.2M
  - (d) 2M

**(XI-CHE-1)**

(XI-CHE-2)

In these questions (15-18) 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 the correct explanation for assertion.  
(b) Assertion and reason both are correct statements and reason is not the correct explanation for assertion.

Questions 15-18 are Assertion and Reason questions:

14. Which amongst the following will be most stable?  
(a)  $\dot{C}H_3$   
(b)  $\dot{C}H_2CH_3$   
(c)  $\dot{C}H(CH_3)_2$   
(d)  $\dot{C}(CH_3)_3$
13. The IUPAC name of neopentane is  
(a) 2-methylbutane  
(b) 2,2-dimethylpropane  
(c) 2-methylpropane  
(d) 2,2-dimethylbutane
12. The C - C - C bond angle in propane is expected to be about :  
(a)  $109^\circ$   
(b)  $120^\circ$   
(c)  $150^\circ$   
(d)  $180^\circ$
11. Among the following, the weakest Bronsted base is :  
(a)  $F^-$   
(b)  $Cl^-$   
(c)  $Br^-$   
(d)  $I^-$
10. The maximum number of hydrogen bonds in which water molecule can participate is :  
(a) 1  
(b) 2  
(c) 3  
(d) 4
9. The correct order regarding the electronegativity of hybrid orbitals of carbon is :  
(a)  $sp < sp^2 < sp^3$   
(b)  $sp > sp^2 > sp^3$   
(c)  $sp > sp^2 > sp^3$   
(d)  $sp < sp^2 < sp^3$
8. Which of the following orders of ionic radii is correctly represented?  
(a)  $H^- > H^+ > H$   
(b)  $Na^+ > F^- > O^{2-}$   
(c)  $F^- > O^{2-} > Na^+$   
(d)  $Al^{3+} > Mg^{2+} > N^{3-}$
7. The total number of atomic orbitals in fourth energy level of an atom is  
(a) 32  
(b) 16  
(c) 8  
(d) 4
6. Number of atoms of oxygen present in 10.6 g  $Na_2CO_3$  will be :  
(a)  $6.02 \times 10^{22}$   
(b)  $12.04 \times 10^{22}$   
(c)  $1.806 \times 10^{23}$   
(d)  $31.8 \times 10^{28}$

- (c) Assertion is correct statement but reason is wrong statement .  
(d) Assertion is wrong statement but reason is correct statement .

**15. Assertion:** Pent-1-ene and pent-2-ene are position isomers.

**Reason:** Position isomers differ in the position of functional group or a substituent.

**16. Assertion:** Addition of bromine to butane gives 1,4-dibromobutane.

**Reason:** Alkanes do not undergo addition reactions.

**17. Assertion:** The value of  $K_w$  increases with the increase in temperature.

**Reason:** The pH of water increases with the increase in temperature.

**18. Assertion:**  $\text{ClF}_3$  is almost T-shaped.

**Reason:** Cl atom is surrounded by 2 lone pairs and 3 bond pairs.

### SECTION-B

**19.** Why are unsaturated hydrocarbons more reactive than saturated hydrocarbons?

OR

Draw the cis and trans isomers of  $\text{C}_2\text{H}_5\text{CH}=\text{CHC}_2\text{H}_5$  and also write their IUPAC names.

**20.** Calculate the oxidation number of:

(i) iron in  $\text{Fe}_3\text{O}_4$

(ii) carbon in  $\text{HCO}_3^-$

(iii) Mn in  $\text{KMnO}_4$

(iv) sulphur in  $\text{H}_2\text{S}_2\text{O}_7$

**21.** An alkene 'X' on ozonolysis gives a mixture of ethanal and methanal. Write the structure and IUPAC name of 'X'. Explain the formation of products from with chemical equation.

OR

The stability order of following carbocations is as follows:

$(\text{CH}_3)_3\text{C}^+ > \text{CH}_3\text{CH}_2^+ > \text{CH}_3^+$  . Explain why?

**22.** Calculate the molality of the solution containing 20.7 g of potassium carbonate dissolved in 500 mL solution. (density of the solution =  $1 \text{ g mL}^{-1}$ ) .

**23.** Out of o-nitrophenol and p-nitrophenol which has higher boiling point and why?

OR

Explain the Lewis structure of nitrite ion.

**24.** Explain giving reasons, which of the following sets of quantum numbers are not possible.

(i)  $n=3, l=3, m_l = +3, m_s = +\frac{1}{2}$

(ii)  $n=4, l=3, m_l = -2, m_s = -\frac{1}{2}$

(iii)  $n=5, l=4, m_l = +3, m_s = +1$

(iv)  $n=3, l=0, m_l = +1, m_s = -\frac{1}{2}$

(XI-CHE-3)

(XI-CHE-4)

31. First law of thermodynamics was proposed by Helmholtz and Robert-Mayer who stated that

SECTION-D

Balance the following redox reaction by oxidation-number method:  
 $\text{MnO}_4^- (\text{aq}) + \text{Br}^- (\text{aq}) \rightarrow \text{MnO}_2 (\text{s}) + \text{BrO}_3^- (\text{aq})$  (in basic medium)

OR

30. Balance the following redox reaction by ion-electron method:  
 $\text{Cr}_2\text{O}_7^{2-} + \text{Fe}^{2+} + \text{Cr}^{3+} + \text{Fe}^{3+} + \text{H}_2\text{O}$  (in acidic medium)

An organic compound on analysis gave the following data: C = 80% and H = 20%. If the molecular mass is 30, then calculate its molecular formula.

OR

29. 5.64 g of glucose (molar mass = 180) are dissolved in 30 g of water. Calculate the mole fraction of glucose and water.

- How will you convert  
(i) ethane into ethene  
(ii) ethyne into ethanal  
(iii) phenol into benzene

OR

- (i) Decarboxylation reaction  
(ii) Wurtz reaction  
(iii) Friedel-Crafts acylation reaction

28. Write the chemical equations for the following reactions.

27. Explain the structure of ethene on the basis of hybridization.

26. Draw the resonance structures for the following compounds:  
(i)  $\text{C}_6\text{H}_5 - \text{NH}_2$   
(ii)  $\text{C}_6\text{H}_5 - \text{NO}_2$   
(iii)  $\text{C}_6\text{H}_5 - \text{O}^-$

SECTION-C

For a gaseous reaction,  
 $2\text{A}_2(\text{g}) + 5\text{B}_2(\text{g}) \rightarrow 2\text{A}_2\text{B}_5(\text{g})$  at  $27^\circ\text{C}$  the heat change at constant pressure is found to be  $-50160\text{J}$ . Calculate the value of internal energy change. ( $R = 8.314\text{ J K}^{-1}\text{ mol}^{-1}$ )

OR

25. For a water gas reaction,  
 $\text{C}(\text{s}) + \text{H}_2\text{O}(\text{g}) \rightarrow \text{CO}(\text{g}) + \text{H}_2(\text{g})$   
at  $1000\text{K}$  the standard Gibbs free energy change is  $-8.1\text{ kJ mol}^{-1}$ . Calculate the value of equilibrium constant. ( $\text{antilog } 0.3323 = 2.149$ )

the energy of an isolated system is constant ,i.e. energy can neither be created nor be destroyed but can be converted from one form to another. That's why it is also called law of conservation of energy.

- (i) In a process , 701J 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 ?
- (ii) Two litre of ideal gas at 10 atm pressure expands until its volume is 10 litre. How much heat is absorbed and how much work is done when the gas expands in a reversible manner ?

32. In an atom a large number of electron orbitals are permissible .These orbitals are designated by a set of numbers known as quantum numbers. In order to specify energy, size, shape and orientation of the electron orbital, three quantum numbers are required. These are, principal quantum number, azimuthal quantum number and magnetic quantum number. These quantum numbers arise as a natural consequence during the solution of the Schrodinger wave equation. In order to designate the electron, an additional quantum number called spin quantum number is needed to specify the spin of the electron.

- (i) Using s,p,d,f notations describe the orbitals with following quantum numbers:  $n=2, l=0$ .
- (ii) How many subshells are there in N shell?
- (iii) How many orbitals (of all kinds) are possible in  $n=3$  energy level.

#### SECTION-E

33. (i) Addition of HBr to propene in presence of benzoyl peroxide yields 1-bromopropane . Explain and give the mechanism.

(ii) How would you convert benzene into:

- (a) toluene                      (b) m-nitrobromobenzene

OR

(i) Explain the nitration of benzene with mechanism.

(ii) Complete and balance the following reaction.

- (a)  $\text{CH}_4 \rightarrow \text{C}_2\text{H}_4$                       (b)  $\text{C}_2\text{H}_2 \rightarrow \text{C}_6\text{H}_6$

34. (i) Compare the relative stability of the following species and indicate their magnetic properties;  $\text{O}_2$  ,  $\text{O}_2^+$  ,  $\text{O}_2^-$  ,  $\text{O}_2^{2-}$

(ii)  $\text{XeF}_2$  molecule is a linear molecule but it is a  $\text{sp}^3\text{d}$  hybridized . Why?

OR

(i) Using VSEPR theory draw the molecular structures of the following.

- (a)  $\text{H}_2\text{O}$       (b)  $\text{XeF}_4$       (c)  $\text{BF}_3$

(ii) Calculate the formal charges on the various atoms in ozone molecule.

(XI-CHE-5)

(XI-CHE-6)

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The value of equilibrium constant,  $K_c$  is  $3.17 \times 10^{-6}$  at 1000K. Calculate the  $K_p$  for the reaction at this temperature.

$$2\text{NOCl (g)} \rightleftharpoons 2\text{NO (g)} + \text{Cl}_2 \text{ (g)}$$

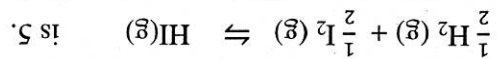
(ii) For the equilibrium, temperature, ( $\log 1.643 = 0.2156$ )  
(i) Ionic product of water at 310 K is  $2.17 \times 10^{-14}$ . What is the pH of neutral water at this temperature.

OR

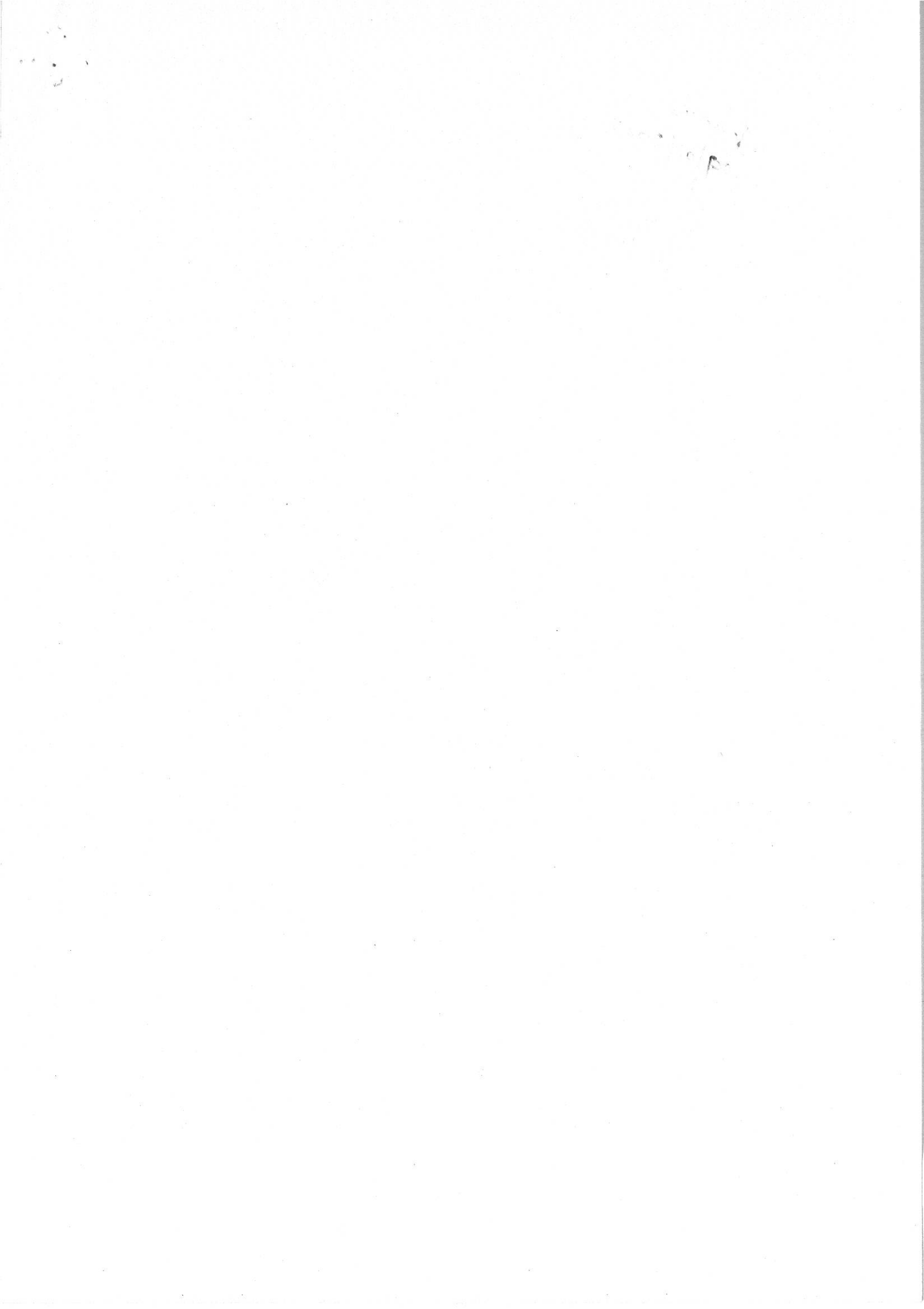
(ii) The solubility product of  $\text{Ag}_2\text{CrO}_4$  at 298 K is  $4 \times 10^{-12}$ . Find out its solubility at this temperature.



What would be the equilibrium constant,  $K_c$  for the reaction given below:



35. (i) At 500K, equilibrium constant,  $K_c$  for the following reaction:



11/21/2023  
Sundberg

09/02/2023  
Jensen