# PT4/ANNUAL EXAMINATION, 2022-23
## CHEMISTRY

**Time - 3 hrs.**          Class – XI (SET-A)          **M.M. – 70**

*Name of the student* _____ *Section* _____ *Date - 17.02.2023 (Friday)*

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**GENERAL INSTRUCTIONS :**
- There are 35 questions in this question paper.
- Section A consists of 18 multiple -choice questions carrying 1 mark each.
- Section B consists of 7 very short answer questions carrying 2 marks each.
- Section C consists of 5 short answer questions carrying 3 marks each.
- Section D consists of 2 case-based questions carrying 4 marks each.
- Section E consists of 3 long answers questions carrying 5 marks each.
- All questions are compulsory.
- Use of log tables and calculators is not allowed.

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## SECTION-A  (18x1=18 )

Q1.   The number of molecule in 4.25 g of $NH_3$ is –

(a) $1.505 \times 10^{23}$          (b) $3.01 \times 10^{23}$          (c) $6.02 \times 10^{23}$          (d) None of these

Q2.   10 mL of gaseous hydrocarbon on combustion give 40 mL of $CO_2$ (g) and 50 mL of $H_2O$ (g). The hydrocarbon is

(a) $C_4H_5$          (b) $C_8H_{10}$          (c) $C_4H_8$          (d) $C_4H_{10}$

Q3.   Which of the following is not permissible set of quantum numbers in an atom?

(a) n = 3, l = 2, m = –2, s = –1/2          (b) n = 4, l = 0, m = 0, s = –1/2

(c) n = 5, l = 3, m = 0, s = +1/2          (d) n = 3, l = 2, m = –3, s = –1/2

Q4.   The orbital with maximum energy is

(a) 3d          (b) 5p          (c) 4s          (d) 6d

Q5.   How many electrons can fit in the orbital for which n = 3 and l = 1 ?

(a) 10          (b) 14          (c) 2          (d) 6

Q6.   $S^{-2}$ is not isoelectronic with :-

(a) Ar          (b) $Cl^-$          (c) $HS^-$          (d) $Ti^{+3}$

Q7.   Out of $Na^+$, $Mg^{+2}$, $O^{-2}$ and $N^{-3}$, the pair of species showing minimum and maximum Ionization energy would be.

(a) $Na^+$ , $Mg^{+2}$          (b) $Mg^{+2}$, $N^{-3}$          (c) $N^{-3}$, $Mg^{+2}$          (d) $O^{-2}$, $N^{-3}$
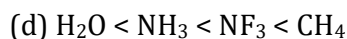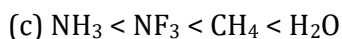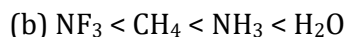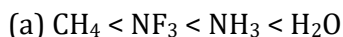
Q8.   Select the correct matching.

| List I | List II |
|---|---|
| A) $XeF_4$ | i) Pyramidal |
| B) $XeF_6$ | ii) T-shape |
| C) $XeO_3$ | iii) Distorted Octahedral |
| D) $XeOF_2$ | iv) Square planar |

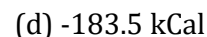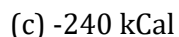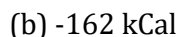(a) A-iv, B-iii, C-i, D-ii          (b) A-i, B-ii, C-iii, D-iv          (c) A-ii, B-i, C-iii, D-iv          (d) A-iv, B-i, C-iii, D-ii
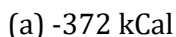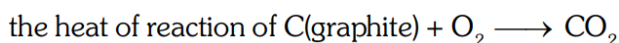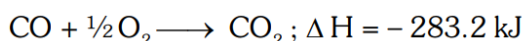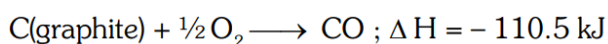
**Q9.** The correct order of dipole moment is :

(a) $CH_4 < NF_3 < NH_3 < H_2O$

(b) $NF_3 < CH_4 < NH_3 < H_2O$

(c) $NH_3 < NF_3 < CH_4 < H_2O$

(d) $H_2O < NH_3 < NF_3 < CH_4$

**Q10.** For which reaction from the following $\Delta S$ will be maximum ?

(a) $Ca_{(s)} + \frac{1}{2} O_{2(g)} \rightarrow CaO_{(s)}$

(b) $CaCO_{3\ (s)} \rightarrow CaO_{(s)} + CO_{2\ (g)}$

(c) $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$
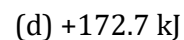
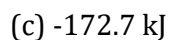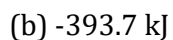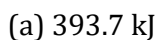(d) $N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}$
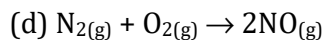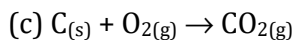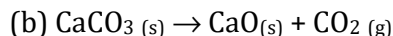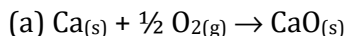
**Q11.** The standard molar heat of formation of ethane, $CO_2$ and water($\ell$) are respectively –21.1, –94.1 and – 68.3 kCal. The standard molar heat of combustion of ethane will be

(a) -372 kCal    (b) -162 kCal    (c) -240 kCal    (d) -183.5 kCal

**Q12.** From the thermochemical reactions,

$C(graphite) + \frac{1}{2}O_2 \longrightarrow CO\ ;\ \Delta H = -110.5\ kJ$

$CO + \frac{1}{2}O_2 \longrightarrow CO_2\ ;\ \Delta H = -283.2\ kJ$

the heat of reaction of $C(graphite) + O_2 \longrightarrow CO_2$

is :

(a) 393.7 kJ    (b) -393.7 kJ    (c) -172.7 kJ    (d) +172.7 kJ

**Q13.** If the solubility of $PbBr_2$ is 'S' g molecules per litre, considering 100% ionisation its solubility product is -

1) $2S^3$    2) $4S^2$    3) $4S^3$    4) $2S^4$

**Q.14** For a reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, the value of $K_C$ does not depends upon :-
(a) Initial concentration of the reactants
(b) Pressure
(c) Temperature
(d) Catalyst

(a) Only c    (b) a, b, c    (c) a, b, d    (d) a, b, c, d
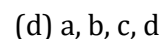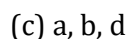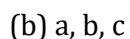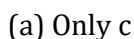
**Q.15** The IUPAC name of given compound is

$CH_3CH=C-CH_2CH_3$
$\quad\quad\quad\quad |$
$\quad\quad\quad COOH$
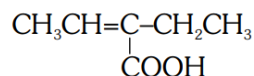
(a) 3-Carboxy-2-pentene    (b) 2-Ethylidene butanoic acid

(c) 2-Ethyl-but-2-Enoic acid    (d) 3-Ethyl-2-buten-4-oic acid

**Q.16** Which can show 'Geometrical isomerism' -



(a)    (b)    (c)    (d)

**Q.17**

For $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-ONa \xrightarrow{\text{Electrolysis}}$ (A) alkane
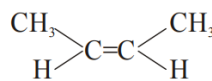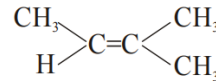
Which is incorrect ?

(a) A is ethane            (b) (A) is formed at anode

(c) $CO_2$ evolves at cathode     (d) pH near cathode increases during the process

Q.18   For the reaction

$$\bigcirc \xrightarrow[\text{AlCl}_3]{\text{CH}_3\text{CH}_2\text{--CH}_2\text{--Cl}} \text{(A)}$$

Correct statement is –

(a) A is n-propyl benzene       (b) It is a friedel craft alkylation

(c) A is iso propyl benzene      (d) both 2 and 3

# Section-B (7x2=14 marks )

Q19. What is limiting reagent ?

Q20. Write the IUPAC name and symbol of element having atomic number 113 ?

**OR**

Why do elements in the same group have similar physical and chemical properties?

Q21. Explain why ionisation enthalpies decrease down a group of the periodic table ?

**OR**

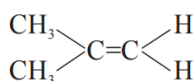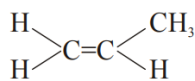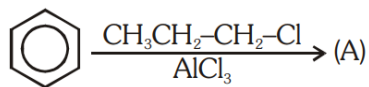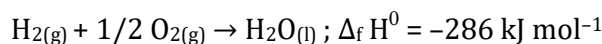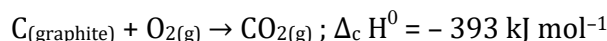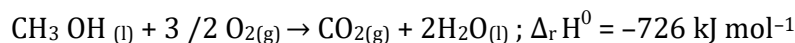What is the basic difference between the terms electron gain enthalpy and electronegativity?

Q22. Calculate the standard enthalpy of formation of $CH_3OH(l)$ from the following data:

$CH_3OH_{(l)} + 3/2\ O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$ ; $\Delta_r H^0 = -726$ kJ mol$^{-1}$

$C_{(graphite)} + O_{2(g)} \rightarrow CO_{2(g)}$ ; $\Delta_c H^0 = -393$ kJ mol$^{-1}$

$H_{2(g)} + 1/2\ O_{2(g)} \rightarrow H_2O_{(l)}$ ; $\Delta_f H^0 = -286$ kJ mol$^{-1}$

Q23. What are electrophiles and nucleophiles ? Explain with examples.

Q24. Write the reactions involved in kjeldahl method and detection of sulphur.

Q25. 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. (At. wt. of Ag=108u. Cl=35.5u)

# Section – C (5x3=15 marks)

Q26. i) Define mole fraction

ii) Calculate the molarity of a solution of ethanol in water, in which the mole fraction of ethanol is 0.040 (assume the density of water to be one )

Q27. i) Which of the following carbocation is most stable

$(CH_3)_3C.\overset{+}{C}H_2$    (b) $(CH_3)_3\overset{+}{C}$    (c) $CH_3CH_2\overset{+}{C}H_2$    (d) $CH_3\overset{+}{C}H\ CH_2CH_3$
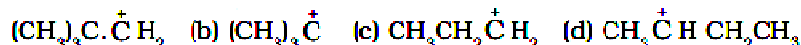
ii) Explain, the process of distillation under reduced pressure.

iii) Draw the resonating structures of phenol

Q28. An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3- one. Write structure and IUPAC name of 'A'.

Q29. Answer the following questions.

a) Calculate the wave number for the longest wavelength transition in the balmer series of atomic hydrogen.

b) Calculate the energy associated with the first orbit of He$^+$.

c) What is nodal plane ?

Q30. State and explain the following:

i) Aufbau Principle  ii) Pauli exclusion principle  iii) Hund's rule of maximum multiplicity

**OR**

The qunatum numbers of six electrons are given below. Arrange them in order of increasing energies. Identify the orbitals which are having same energy.

i) $n=4, l=2, m_l = -2, m_s = -1/2$

ii) $n=3, l=2, m_l = 1, m_s = +1/2$

iii) $n=4, l=1, m_l = 0, m_s = +1/2$

iv) $n=3, l=1, m_l = -2, m_s = -1/2$

v) $n=3, l=1, m_l = -1, m_s = +1/2$

vi) $n=4, l=1, m_l = 0, m_s = +1/2$

# Section -D (2x4=8 marks)

Q31. The idea of oxidation number has been invariably applied to define oxidation, reduction, oxidising agent (oxidant), reducing agent (reductant) and the redox reaction. To summarise, we may say that:

Oxidation: An increase in the oxidation number of the element in the given substance

Reduction: A decrease in the oxidation number of the element in the given substance.

Oxidising agent: A reagent which can increase the oxidation number of an element in a given substance. These reagents are called as oxidants also.

Reducing agent: A reagent which lowers the oxidation number of an element in a given substance. These reagents are also called as reductants.

Redox reactions: Reactions which involve change in oxidation number of the interacting species.

i)  Oxidation number of Mn in K<u>Mn</u>O$_4$ is _____.  (1)

ii)  Justify that the following reactions are redox reactions :  (1)

$CuO_{(s)} + H_{2\ (g)} \rightarrow Cu_{(s)} + H_2O_{\ (g)}$
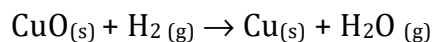
iii)  Identify the substance oxidised, reduced, oxidising agent and reducing agent for each of the below reaction  (2)
$Fe_2O_{3\ (s)} + 3\ CO_{(g)} \rightarrow 2Fe_{(s)} + 3CO_{2\ (g)}$
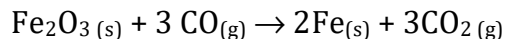
**OR**

Calculate oxidation number of chromium in $CrO_5$ and $K_2Cr_2O_7$.

Q32. The enthalpy of a system is defined as the sum of the internal energy of the system and the energy that arises due to its pressure and volume. Mathematically, the enthalpy is defined by the equation,

$H = U + PV$

Enthalpy change ($\Delta H$) of a system is the heat absorbed or evolved by the system at constant pressure.
$\Delta H = q_p, \Delta H = \Delta U + P\Delta V$

i)  Which of the following is not correct about enthalpy?

(a) It is an extensive property.

(b) It is not a state function.

(c) Its absolute value cannot be determined.

(d) Enthalpy of a compound is equal to the enthalpy of formation of that compound.

ii)   Lattice enthalpies are determined by

    (a) Born-Haber cycle                                   (b) Hess's law

    (c) lattice cycle                                        (d) none of these

iii)   In which of the following thermochemical changes $\Delta H$ is always negative?

    (a) Enthalpy of solution                        (b) Enthalpy of hydrogenation

    (c) Enthalpy of reaction                         (d) Enthalpy of transition

iv)   For the reaction $2\,A(g) + B(g) \rightarrow 2D(g)$ $\Delta U^0 = -10.5$ kJ and $\Delta S^0 = -44.1$ JK$^{-1}$. Calculate $\Delta G^0$ for the reaction, and predict whether the reaction may occur spontaneously

**OR**

Given $N_2(g) + 3H_{2(g)} \rightarrow 2NH_{3(g)}$ ; $\Delta r\, H^0 = -92.4$ kJ mol$^{-1}$ What is the standard enthalpy of formation of $NH_3$ gas?

# Section -E (3x5=15 marks)

Q33.  a) Nitrogen is less reactive in comparison to oxygen. Give reason.             (1+1+1+2)

    b) Write two differences between sigma and pi bond

    c) Show the hybridisation in methane, ethene molecules.

    d) Explain intermolecular hydrogen bond with an example.

**OR**

    a) What is meant by the term bond order? Calculate the bond order of : $N_2$, $O^{2+}$     (3+1+1)

    b) Explain with the help of suitable example polar covalent bond

    c) Explain why $BeH_2$ molecule has a zero dipole moment although the Be–H bonds are polar

Q34.  Calculate the pH of the following solution.                              (2+1+2)

    a)  0.3 g of $Ca(OH)_2$dissolved in water to give 500 mL of solution. Calculate the pH of the following solution  ( MW of $Ca(OH)_2$ is 74 )

    b)  What is the effect of pressure on preparation of ammonia in the following process

       $N_2 + 3H_2 \Leftrightarrow 2NH_3$

    c)  The solubility product constant of $Ag_2CrO_4$ and AgBr are $1.1\times10^{-12}$ and $5.0\times10^{-13}$ respectively. Calculate the ratio of the molarities of their saturated solutions

**(OR)**

    a)  What is buffer solution ?give an example?                              (2+3)

    b)  The ionization constant of propanoic acid is $1.32 \times 10^{-5}$. Calculate the degree of ionization of the acid in its 0.05M solution and also its pH. What will be its degree of ionization if the solution is now in 0.01M HCl?

Q35.  a) Write IUPAC names of the products obtained by addition reactions of HBr to Hex-1-ene  (i) in the absence of peroxide and (ii) in the presence of peroxide.            (2+1+2)

    b) How will you convert ethanoic acid into benzene?

    c) how will you prepare propyne  from a vicinal di halide.

**OR**

How will you prepare the following compounds from **benzene.**                       (1x5)

a) 1,2 – Dichloro benzene   b) Para Niro toluene     c) Meta nitro bromobenzene

d) Benzene sulphonic acid. e) Aceto phenone .