தேசிய வெளிக்கள நிலையம் தொண்டைமானாறு
மூன்றாம் தவணைப் பரீட்சை - 2025
National Field Work Centre, Thondaimanaru.
3rd Term Examination - 2025

| இரசாயனவியல | I | One Hours | 02 | E | I |
| Chemistry | I | Gr -12 (2025) | | | |

1. The minimum temperature is the temperature at which all particles of matter are rest

   (1) 273.15K   (2)-273.15K   (3)0 K   (4)$0^o C$ (5)300K

2. Which of the following statements is **incorrect** regarding ideal gases at given temperature

   (1) Boyl temperature of a gas is temperature at which the inter molecular force can be neglected

   (2) The compressibility factor of a gas depends on pressure.

   (3) The pressure exerted by a gas is the result of collisions of the molecules on the walls of the container.

   (4) Any ideal gases have the same average kinetic energies at the same temperature

   (5) At a given temperature, the average speed of gas molecules adjusts according to their masses

3. Which of the following thermochemical reaction step is correct regarding standard enthalpy of atomization of Na

   (1) $Na_{(aq)} \rightarrow Na_{(g)}$ (2) $Na^+_{(aq)} \rightarrow Na_{(g)}$ (3) $Na_{(s)} \rightarrow Na_{(g)}$

   (4) $Na_{(s)} \rightarrow Na_{(l)}$ (5) $Na_{(l)} \rightarrow Na_{(vap)}$

4. What is IUPAC name of the following compound.

$$O=CH-CH_2-CH=CH-\overset{\overset{\displaystyle O}{\|}}{C}-O-CH_3$$
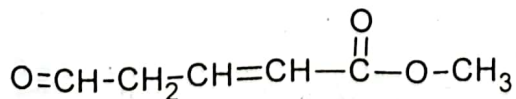
   (1) methyl 5-oxo-2-pentenoate   (2) methoxy 5-oxo-2-pentenoate

   (3) 1- methoxy 5-oxo-2-pentenal   (4) methyl 5-fomyl-2-buttenoate

   (5) methane 5-oxo-2-pentenoate

5. Which of the following statements is **incorrect** regarding hydrogen peroxide and dihydrogen monoxide

   (1) hydrogen peroxide is a viscous liquid compared to dihydrogen monoxide at room temperature

   (2) The molecular shape of dihydrogen monoxide is an almost symmetrical tetrahedron regarding center atom in solid state at $-30^{\circ}C$

   (3) Boiling point of hydrogen peroxide is higher than the dihydrogen monoxide

   (4) hydrogen peroxide act as reducing agent as well as oxidizing agents

   (5) dihydrogen monoxide do not act as reducing agent as well as oxidizing agents

6. The number of paired electrons of manganese atom that are associated with principal quantum number n= 3 is

   (1) 2   (2)3   (3)4   (4)5   (5) 7

7. The compound which cannot be used to determine the molar volume of oxygen is

   (1) Ag_2O (2) $KMnO_4$ (3) $NaNO_3$ (4) Na_2CO_3 (5) $KClO_3$

8. X, Y, Z, P, Q are five successive non-d- block elements in the third period of the periodic table. Q form a solid acidic oxide while P forms a gaseous acidic oxide, the electron configuration of X is in the outermost energy level of X

   (1) ns^2 (2) ns^2np^1 (3) ns^2np^2 (4) ns^2np^5 (5) ns^2np^4

9. The relative atomic mass of an atom (A) is 108 and its density is 10.80 g cm^{-3}. estimate the approximate volume of an atom A (L= 6.022×10^{23})

   (1) $1.66\ 1X\ 0^{-23}\ cm^3$ (2) $1.66\ 1X\ 0^{-22}cm^3$ (3) $1.99X\ 0^{-22}\ cm^3$

   (4) $0.1\ cm^3$.   (5) $6.022\times 10^{23}cm^3$

10. Which of the following statements is **correct** with regard to Boran and Aluminum of group 13 elements

    (1) Boron reacts with both HCl and NaOH solution

    (2) Al reacts with both NaOH and HCl solution to form hydrogen gas

    (3) Al is inert to steam water vapour

    (4) Al exists dimer in gaseous state

    (5) Al is dissolved in concentrated HNO_3

11. Consider the following d- block elements

Sc, V, Cr, Mn, Fe. Zn

which is show the correct order of the melting point of given element

(1) Zn<Mn< Sc= Fe < Cr<V

(2) V< Cr<V̂ <Mn< Sc<Fe

(3) Zn<Mn= Cr<V < Sc<Fe

(4) V<Fe <V̂ <Mn< Sc< Cr

(5) V< Cr<V̂ < Sc=Fe<Mn

12. In the following compounds, / ions' **correct** descending order of the electronegative of carbon is

(1) HCN >CO>C_2H_2>C_2Cl_4

(2) CO>HCN>C_2H_2 > C_2Cl_4

(3) CO>HCN>C_2H_2>C_2Cl_4

(4) CO>HCN>C_2Cl_4 > C_2H_2

(5) HCN >C_2H_2 > CO > C_2Cl_4

13. The solid sample was found to contain NH_4NO_3 and non-reactive substances. A 0.2g of the solid sample was dissolved in water and diluted to $50.00 cm^3$ in a volumetric flask. Aluminium powder was added to this obtained solution then excess of NaOH was added. The resultant mixture of this solution was heated liberated gas was passed in to $25.00 cm^3$ of 0.5mol dm^{-3}HCl solution. The volume of 0.5mol dm^{-3}NaOH required to neutralize the remaining HCl was $20.00 cm^3$. calculate the mass percentage of NH_4NO_3 in solid sample. (H=1, N=14, O=16)

(1) 50%   (2)55%   (3) 60%   (4) 60%   (5) 60%

14. 5.8g of gaseous butane completely burned with 1.5 mol of oxygen gas at 150^0C give 1.65mol gaseous mixture which contain CO, CO_2 , and H_2O.what is the mole of $CO_{(g)}$ in this combustion reaction. (H=1, C=12, O=16)

(1) 0.2   (2) 0.4   (3) 2   (4) 2.5   (5) 4

15. A sample of graphite is burned with excess oxygen in a 4.157 dm^3 rigid container under $3x10^4$ pa pressure at 500 K. The obtained gaseous mixture contain by mass **27%**, CO **42%**CO_2 **31%**O_2 . Enthalpy of formation of CO =-111 KJmol^{-3} enthalpy of formation of CO_2 -394KJmol^{-3} at this temperature and pressure. calculate the liberated heat in this reaction process.

(1) 5.05KJ   (2) 10.11KJ   (3) 505KJ   (4) 6.16kJ   (5) 616KJ

❖ **16 – 20 -> instruction**

(1)	(2)	(3)	(4)	(5)
Only (a) and (b) are correct	Only (b) and (c) are correct	Only (c) and (d) are correct	Only (a) and (d) are correct	Any other combination.

16. which of the following relationship is **incorrect** about following reaction process

$$CO_{2(g)} + H_2O_{(g)} \rightarrow CO_{(g)} + H_{2(g)} \qquad \Delta H \quad -41 \text{ kJ mol}^{-1}$$
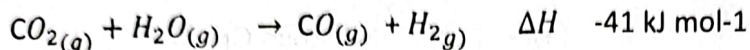
   a. Reaction is spontaneous even at high temperature

   b. This reaction process can be used for obtaining thermal energy in usual life process

   c. Reaction is spontaneous even at low temperature

   d. Effect of $T\Delta S$ on ΔG of this reaction is almost nil

17. Which of the following statement / statements is/ are **correct** regarding sub particles of an atom /atoms

   a. $\frac{e}{m}$ ratio of proton is same in different type of atom in different matter

   b. A neutron may be considered as by the combination of a proton and electron

   c. Different atoms contain different neutrons consider as isotopes

   d. Moving all type of sub particles of atom do not obey the De Broglie equation
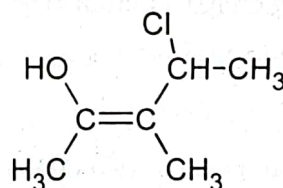
18. The correct statement/s regarding the following structures A, B, C is / are

   A   B   C
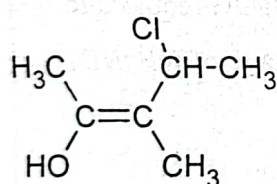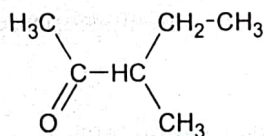
   a. A and B are resonance structures   b. A and C are geometrical isomers

   c. stability B.> A, C   d. B does not show optical activity

19. All the atons which forms the following compound satisfy octet rule

   (a) CO_2 (b) H_2O (c)NaH   (d)NaCl

20. When excess NH_4Cl solution was added to a solution of X a white-colored precipitate (P) and filtrate (Q) were obtained. Obtained product P is soluble in hot water. when a small amount of NaOH solution was added to the filtrate Q, the color of the solution of Q was changed. The possible cation/s present in a solution of X is

   a. Pb^{2+}, Cu^{2+},   b. Al^{3+}, Fe^{2+},

   c. Zn^{2+}, Cu^{2+},   d. Ag^+, Ni^{2+}

❖ **Instructions for questions 21 – 25.**

Response	1st statement	2nd statement
1	True	True, and correctly explains the 1st statement
2	True	True, but doesn't explain the 1st statement
3	True	False
4	False	True
5	False	False

	First statement	Second statement
21	Alkane do not react with polar reagents under normal conditions.	Alkanes do not have atoms which have positive and negative charges.
22	N does not form NCl_5	Electron configuration of N can't expanded beyond octet rule because N does not have d orbital
23	Boyl temperature of $NH_3 > CH_4$	The Boyl temperature of a gas which has high intermolecular force is less than a gas which has low intermolecular force
24	A perfect Lattice crystal at zero Kelvin has zero entropy	When the temperature decreases the randomness of the system increases
25	The bond angle of H_2S is greater than H_2O	When the electro-negativity of the center atom increases, the repulsion between bond pairs of electrons decreases.

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FWC

இரசாயனவியல்	II (A)	Gr -12 (2025)	02	E	II (B)
Chemistry	II (A)				

5). A)

(i) Derive the relationship for an ideal gas using its pressure (P) temperature (T) density (d), Molar mass (M) and universal gas constant (R)

(ii) An ideal gas exists at 27^oC and $2.00\times 10^5 Nm^{-2}$ in $4.157\ dm^3$ of rigid container. (molar mass of gas is $72g mol^{-1}$ and universal gas constant is 8.314 Nm $mol^{-1}K^{-1}$) Calculate the mass of the gas which occupies in this container.

B)

(i) Determine the lattice enthalpy of NaCl solid using the Born- Haber cycle followings are the enthalpy changes of some species at 25 °C and 1 atm

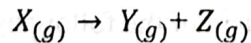Sublimation energy of Na $\qquad = 108.4$ KJ mol^{-1}

first ionization energy of Na $\qquad = 496$ KJ mol^{-1}

bond dissociation energy of $Cl_2 \qquad =242$ KJ mol^{-1}

electron gain energy of chlorine $\quad =-348.6$ KJ mol^{-1}

formation of $NaCl_{(s)} \qquad\qquad =-411.2$ KJ mol^{-1}

(ii) Consider following reaction at 300K

$$X_{(g)} \rightarrow Y_{(g)} + Z_{(g)}$$

following data for ΔH_f^θ and ΔS^θ

	$X_{(g)}$	$Y_{(g)}$	$Z_{(g)}$
$\Delta H^\theta (kJ\ mol^{-1})$	-300	-130	-100
$\Delta S^\theta (Jmol^{-1}K^{-1})$	100	500	200

a) Does the above reaction is spontaneous at 300K explain your answer?

b) Calculate possible minimum temperature in which reaction is spontaneo

c) State the assumption used part b in this question?

us?

6) (A) Preparation of the compound V has been caried out using $HC \equiv CH$ according to the reaction scheme given below

$$HC \equiv CH \xrightarrow{R_1} P \xrightarrow{NaOH_{(aq)}} T \xrightarrow{PCC/heat} U$$

P $\xrightarrow{R_2}$ Q $\xrightarrow{R_3}$ R $\xrightarrow{R_4}$ S

U $\xrightarrow[2)H^+/H_2O]{1)S}$ V

$$H_3C-CH_2-\overset{\overset{\displaystyle HO}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-CH_2-\overset{\overset{\displaystyle HO}{|}}{CH}-CH_2CH_3$$

V
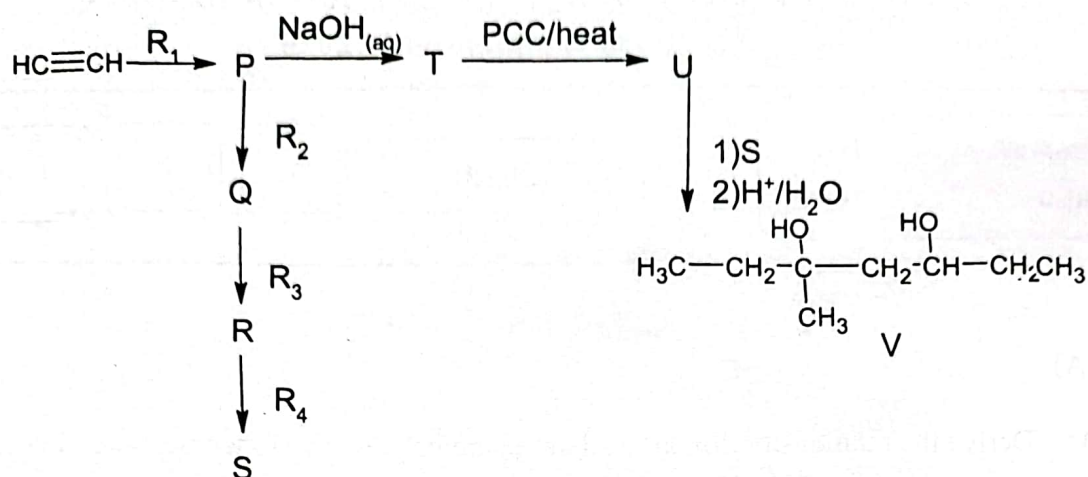
i) Give the structure of the compound P, Q, R, S, T, and U, and the reagents R_1, $R_2, R_3, and R_4$ only the chemical substances given below should be used either singly or as combinations as reagents

Chemical substances: $NaBH_4$, dry Ether, HBr, $HgSO_4$, H_2SO_4, methanol, Mg,

ii) Draw the structure of the product formed when compound P react with 2,4-dinitrophenylhydraxene (2,4-DNP)

B) show how the transformation given below can be carried out using not more than six steps
   i)
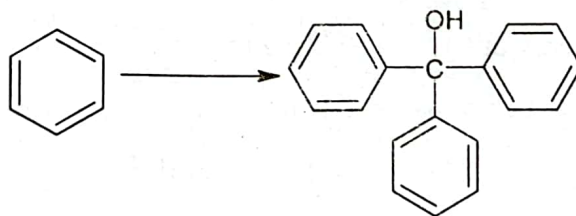
ii) Give the structure of the product P and the mechanism of the following reaction

$$\text{benzene} \xrightarrow[\triangle]{ConHNO_3 +Con\ H_2SO_4} P$$
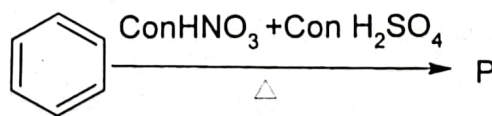
iii) Explain why vinyl chloride is difficult to undergo nucleophilic substitution reaction

9). (A) The following question is based on the qualitative analysis of cations in aqueous solution (A) contains four cations of metal. The symbols given are used to represent precipitates (solid), and solution
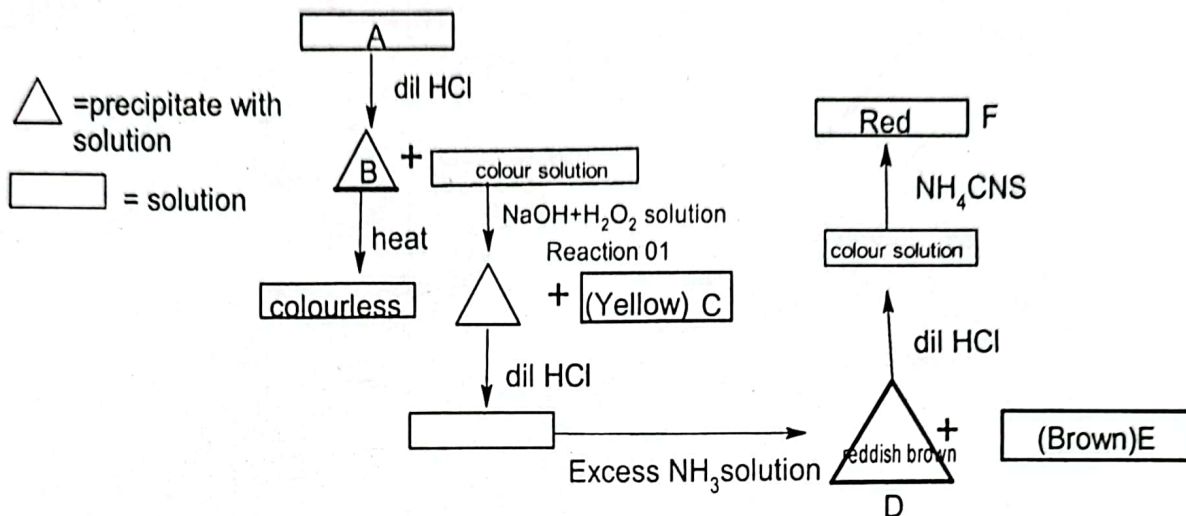
a. Identify the cations in a given solution

b. **A, C, D, E** and **F** are compounds / species of the four cations. Identify A, C, D, E and F

c. Write the balanced chemical reaction for reaction 1

B) A solid sample of mineral Y contain MnS, ZnS and inert impurity. following procedure was used to determine percentage of each constituents.

2. 0g of sample Y was completely dissolved in **diluted** H_2SO_4 solution and titrated with 1.0moldm^{-3} $KMnO_4$ solution required volume of $KMnO_4$ for complete reaction was 48.00 cm^3. During this reaction, SO_4^{2-}-,Zn^{2+}, and Mn^{2+} were formed. Under this condition SO_2 **does not form**. Resultant solution was treated with NaOH until solution become basic medium and keep the solution approximately half an hour. While Zn $(OH)_2$, MnO_2 precipitated would be formed. Resultant mixture was treated with excess solid **KI** in acidic medium. liberated iodine was titrated with 1.0 mol dm^{-3} $Na_2S_2O_3$ solution. Required volume of $Na_2S_2O_3$ for complete reaction was 20.00 cm^3.(molar mass of MnS = 87g mol⁻¹ ZnS =97g mol⁻¹)

i. Write balance chemical equation for reaction in both titrations

ii. Find out mass percentages of MnS, ZnS in the mineral Y