

12 ශ්‍රේණිය අවසාන වාර පරීක්ෂණය - 2024 (2025)

தரம் 12 ஆண்டிறுதிப் பரீட்சை - 2024 (2025) Grade 12 Final Term Test - 2024 (2025)

රසායන විද්‍යාව I
 இரசாயனவியல் I
 Chemistry I

02 E I

කාලය } පැය දෙකයි
 நேரம் } இரண்டு மணித்தியாலம்
 Time } Two hours

Instructions

- This paper consists of 8 pages.
- A periodic table is provided.
- **Answer all questions.**
- **Calculators are not allowed to use.**
- Write your name or index number in the relevant space on the answer script.
- Select most appropriate answer from 1, 2, 3, 4 & 5 given answers and mark (X) on it.

Universal gas constant $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$
 Avogadro's constant $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$

Planck's constant $h = 6.626 \times 10^{-34} \text{ J s}$
 Velocity of light $c = 3 \times 10^8 \text{ m s}^{-1}$

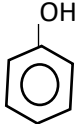
1. A radio wave with a energy value 26.56 J has a wave length of 30 cm. Calculate the number of photons available in it .
 (1) 2.5×10^{-21} (2) 2.5×10^{-24} (3) 4.0×10^{18} (4) 4.0×10^{25} (5) 6.0×10^{25}
2. Which of the following consists of a pair of polar species ?
 (1) CCl_4 , CH_2Cl_2 (2) SO_3 , NH_3 (3) HCHO , COS (4) SCl_4 , CH_4 (5) XeF_4 , XeF_2
3. Which of the following is **incorrect** relevant to shapes of molecules or ions ?
 (1) BrF_3 molecule is T shaped.
 (2) Repulsion units around central atoms of NH_4^+ and ClO_4^- ions are equal to each other.
 (3) NCl_3 and BCl_3 are two different species with different shapes.
 (4) Electron pair geometry around the central atom of $\text{S}_2\text{O}_3^{2-}$ is planer triangular.
 (5) The approximate bond angle around N in NO_2 molecule is 118° .
4. The number of Cl^- ions available in 2.22 g of CaCl_2 is . (Ca – 40, Cl – 35.5)
 (1) 2.0×10^{-2} (2) 4.0×10^{-2} (3) 1.2044×10^{22}
 (4) 1.8066×10^{22} (5) 2.4088×10^{22}
5. IUPAC name of the following compound is

$$\text{HO}-\text{CH}_2-\text{CH}_2-\text{C}\equiv\text{C}-\underset{\text{CH}_3}{\text{CH}}-\overset{\text{O}}{\text{C}}-\text{H}$$

 (1) 6-hydroxy-2-methyl-3-hexenal (2) 5- methyl-6-oxo-3-hexynol
 (3) 6-hydroxy-2-methyl-3-hexynal (4) 2-methyl-6-hydroxy-3-hexynal
 (5) 6-formyl-5-methyl-3-hexynal

6. The true statement relevant to elements O, F, Na and Mg is
 (1) Atomic radius increases as $F < O < Na < Mg$
 (2) Ionic radii of species of O^{2-} , F^- , Na^+ and Mg^{2+} increases as $Mg^{2+} < Na^+ < F^- < O^{2-}$
 (3) Electron affinity of F is a negative value .
 (4) First ionization energy increases as $Na < Mg < F < O$
 (5) Electronegativity of Mg decreases than Na
7. A closed rigid container with a gas mixture named A consists of $CH_4(g)$ and $C_3H_8(g)$ at $27^\circ C$ creates 0.60 atm pressure value. When this gas mixture underwent complete combustion , resulting CO_2 gas inserted to the same container A. Container A was vaccumed by a sucking pump at same $27^\circ C$ temperature. The pressure exerted by CO_2 gas is 0.75 atm. The molar ratio of $CH_4(g)$ and $C_3H_8(g)$ in the gas mixture was
 (1) 2 : 7 (2) 7 : 2 (3) 7 : 1 (4) 4 : 1 (5) 3 : 1
8. Consider the following reaction occurs at $27^\circ C$ temperature

$$2 H_2(g) + O_2(g) \longrightarrow 2 H_2O(l)$$

 ΔG and ΔS values of above reaction at $27^\circ C$ respectively are , $- 228.4 \text{ kJ mol}^{-1}$ and $44 \text{ J mol}^{-1} K^{-1}$ What is the combustion enthalpy of $H_2(g)$ in kJ mol^{-1} at 300K ?
 (1) $- 107.6$ (2) $+ 107.6$ (3) $- 228.4$ (4) $+ 228.4$ (5) $- 53.8$
9. The **false** statement relevant to benzene is
 (1) All C – C bond length are equal
 (2) All C atoms undergo sp^2 hybridization
 (3) Shows electrophilic substitution reactions
 (4) True structure of benzene is with permanent three double bonds
 (5) Does not discolour bromine liquid under general conditions
10. The correct ascending order given for the acidity of compounds accurately is
 (a) $CH_3C \equiv CH$ (b) CH_3CH_2COOH (c) 
 (1) $a < c < b$ (2) $a < b < c$ (3) $c < a < b$ (4) $b < c < a$ (5) $b < a < c$
11. A, B and C are three colourless aqueous solutions. Solutions A, B and C gives white precipitates with aqueous NaOH and in the presence of excess NaOH, precipitate B and C dissolves. Solution A, B and C give precipitates with dilute NH_3 and only the precipitate C dissolves in excess NH_3 . The three cations available in solutions A, B and C respectively are
 (1) Ba^{2+} , Al^{3+} , Zn^{2+} (2) Mg^{2+} , Al^{3+} , Zn^{2+} (3) Mg^{2+} , Al^{3+} , Cu^{2+}
 (4) Mg^{2+} , Zn^{2+} , Al^{3+} , (5) Mg^{2+} , Ca^{2+} , Zn^{2+}
12. Charge and mass ratio of a positive ray particle which travels in $5 \times 10^5 \text{ ms}^{-1}$ velocity is . $1.5 \times 10^5 \text{ C g}^{-1}$. The De broglie wave length of the wave if charge of the particle is $1.6 \times 10^{-19} \text{ C}$ is

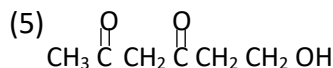
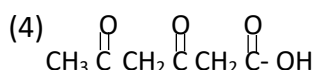
- (1) 1.03×10^{-12} m (2) 1.03×10^{-15} m (3) 1.24×10^{-12} m
 (4) 1.24×10^{-15} m (5) 8.28×10^{-16} m

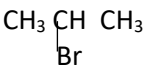
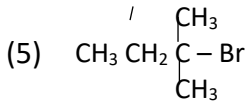
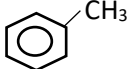
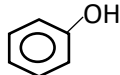
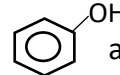
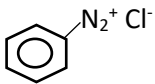
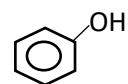
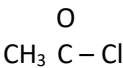
13. The identity of an electron of an atom can be described by a quantum number group (n, l, m_l, m_s). Which of the description of following quantum numbers are correct ?
 (1) An unpaired electron of Mn at ground state can be indicated by quantum numbers (4, 0, 0, $+\frac{1}{2}$)
 (2) Maximum number of orbitals which can be available for main quantum number, $n=3$ is ten.
 (3) Quantum number $m_l=3$ cannot be existed for main quantum number, $n=4$.
 (4) Total number of electrons which can be existed for $n=2$ and $m_l=1$ is six .
 (5) Group of quantum numbers (3, 2, 2, $-\frac{1}{2}$) states the unpaired electrons in Cu^{2+} ion.
14. 8 g of an ideal gas exists in a container with volume v at T_1 °C and exerts pressure 4×10^5 Pa. When the temperature of this system increases to 27 °C, the pressure of the gas increases in 20 %. Calculate the temperature T_1 , if molar mass of an ideal gas is 80 g mol^{-1} and volume of the gas is constant .
 (1) – 23 °C (2) – 23 K (3) 250 °C (4) 250 K (5) 77 °C
15. Metal M, converts to $\text{M}_2(\text{SO}_4)_3$ when an aqueous solution of above sulphate treated with $\text{Pb}(\text{NO}_3)_2$ solution, $\text{PbSO}_4(\text{s})$ was given. Calculate r.a.m of M, if 2.08 g of M gave 18.18 g (dry mass) of PbSO_4 . (Pb – 207, S – 32, O – 16)
 (1) 27 (2) 52 (3) 56 (4) 60 (5) 70
16. $\text{CH}_3\text{CH}_2\text{Br} \xrightarrow{\text{Mg / dry ether}} \text{A} \xrightarrow[\text{(ii) } \text{H}^+ / \text{H}_2\text{O}]{\text{(i) } \text{CH}_3\text{C}(=\text{O})-\text{H}} \text{B}$
False statement relevant to above reaction sequence is
 (1) $\text{A} \rightarrow \text{B}$ conversion is a nucleophilic addition reaction.
 (2) Product **B** shows optical activity.
 (3) **A** shows strong alkaline characteristics.
 (4) When **B** reacts with PCC, the resulting product gives a coloured precipitate with 2,4-DNP.
 (5) **B**, answers for silver mirror test.
17. Organic compound X
 • Evolves H_2 with Na
 • Turns Br_2 liquid to colourless
 • Turns acidic $\text{K}_2\text{Cr}_2\text{O}_7$ from orange colour to green colour. The X can be
 (1) $\text{CH}_3\underset{\text{OH}}{\text{CH}}\text{CH}_2\text{C}\equiv\text{CH}$ (2) $\text{CH}_3\underset{\text{OH}}{\text{CH}}\text{CH}_2\text{COOH}$ (3) $\text{CH}_2=\text{CHCH}_2\text{CHO}$
 (4) $\text{CH}_3\underset{\text{OH}}{\text{CH}}\text{CH}_2\text{CH}_2\text{OH}$ (5) $\text{CH}_3\text{CH}=\text{CHCOOH}$

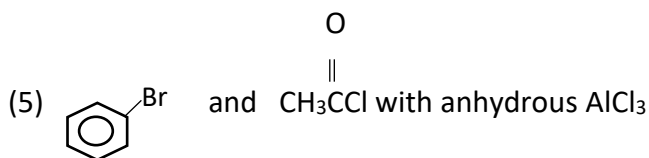
18. **False** statement relevant to alkaline metals of group 1
 (1) All elements react with water giving hydrogen gas.
 (2) When going down the group, metals become soft and melting point decreases.
 (3) Under thermal decomposition, only LiNO_3 gives NO_2 gas.
 (4) Aqueous solutions of alkaline metal salts are colourless if anion does not have a colour.
 (5) Water solubility of NaI is lower than NaF .
19. When 20 cm^3 of $0.005 \text{ mol dm}^{-3} \text{ K}_2\text{S}_2\text{O}_8$ solution was added to KI aqueous solution, iodine is produced according to following equation.

$$\text{S}_2\text{O}_8^{2-} + 2 \text{I}^- \longrightarrow 2 \text{SO}_4^{2-} + \text{I}_2$$

 Calculate the volume of $0.005 \text{ mol dm}^{-3} \text{ Na}_2\text{S}_2\text{O}_3$ required to react with resulting iodine in cm^3 is
 (1) 10 (2) 20 (3) 30 (4) 40 (5) 50
20. Type of mechanism of reaction between $\text{CH}_3\text{CH}=\text{CH}_2$ and conc. H_2SO_4 is
 (1) Nucleophilic addition (2) Nucleophilic substitution
 (3) electrophilic addition (4) electrophilic substitution
 (5) Acid - Base
21. The correct statement relevant to secondary interactions is
 (1) Dipole – induced dipole interactions are available between HCl molecule and Ar atom.
 (2) Ion – dipole interactions occur when solid iodine dissolve in water.
 (3) London forces available in 2,2-dimethylpropane which are stronger than n-pentane.
 (4) Only hydrogen bonds available in aqueous NH_3 solution
 (5) In para-nitro phenol ($\text{HO}-\text{C}_6\text{H}_4-\text{NO}_2$) intra molecular hydrogen bonds are available.
22. Which of the following reactions does not give NH_3 as a product ?
 (1) Reaction of Mg_3N_2 with water
 (2) Heating NH_4NO_3 salt with NaOH
 (3) Reactions of NaNO_3 and FeSO_4 in the presence of conc. H_2SO_4 .
 (4) Thermal decomposition of $(\text{NH}_4)_2\text{CO}_3$
 (5) Reaction of NaNO_3 and Al in alkaline medium
23. $\text{C(s)} + \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g})$; $\Delta H_1^\ominus = -393.5 \text{ kJ mol}^{-1}$
 $\text{CO}_2(\text{g}) \longrightarrow \text{CO(g)} + \frac{1}{2} \text{O}_2(\text{g})$; $\Delta H_2^\ominus = +283.0 \text{ kJ mol}^{-1}$
 $2 \text{CO(g)} \longrightarrow 2 \text{C(s)} + \text{O}_2(\text{g})$; $\Delta H_3^\ominus = , ?$
 The correct answer which indicates $\Delta H_3^\ominus$ value in kJ mol^{-1} is "
 (1) -110.5 (2) +110.5 (3) -221.0 (4) +221.0 (5) 676.5
24.
$$\begin{array}{c} \text{O} \quad \quad \text{O} \\ \parallel \quad \parallel \\ \text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CCH}_2\text{C}\text{OH} \end{array}$$
 When $\text{NaBH}_4/\text{methanol}$ is added to this compound, the product will be
 (1)
$$\begin{array}{c} \text{OH} \quad \quad \text{OH} \quad \quad \text{O} \\ | \quad \quad | \quad \quad \parallel \\ \text{CH}_3\text{CHCH}_2\text{CHCH}_2\text{C}\text{OH} \end{array}$$
 (2)
$$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3\text{CHCH}_2\text{CCH}_2\text{CH}_2\text{OH} \end{array}$$
 (3)
$$\begin{array}{c} \text{OH} \\ | \\ \text{CH}_3\text{CHCH}_2\text{CHCH}_2\text{CH}_2\text{OH} \\ | \\ \text{OH} \end{array}$$



25. The cation which forms octahedral complex ion when NH_3 is only available as ligands is
 (1) Cu^{2+} (2) Zn^{2+} (3) Mn^{2+} (4) Ni^{2+} (5) Fe^{3+}
26. What is the incorrect statement among the followings ?
 (1) IUPAC name of FeC_2O_4 is, iron(II) oxalate.
 (2) When one electron is removed from radioactive $^{14}_6\text{C}$, isotope $^{14}_7\text{N}$ forms.
 (3) Mass composition of H_2O_2 in 20 % H_2O_2 aqueous solution in ppm is 2.5×10^5 by mass
 (4) Empirical formular of $\text{C}_6\text{H}_{12}\text{O}_6$ is CH_2O
 (5) Maximum yield of NH_3 which can be obtained from 0.6 moles of N_2 and 1.2 moles of H_2 is ,0.8 moles
27. True statement relevent to hydrides formed by s and p elements of 3rd period of periodic table is
 (1) All hydrides are covalent.
 (2) Hydrogen exists at +1 oxidation state in all hydrides
 (3) Aqueous solutions of H_2S shows strong acidic properties.
 (4) PH_3 weakly dissolves in water to form very weakly acidic solutions.
 (5) AlH_3 exists as a covalent lattice structure.
28. Which of the following compound does not show nucleophilic substitution reaction with $\text{CH}_3\text{O}^-\text{Na}^+$?
 (1)  CH_2Cl (2) $\text{CH}_3\text{CH}=\text{CHCl}$ (3) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$
 (4)  $\text{CH}_3\text{CH}(\text{Br})\text{CH}_3$ (5)  $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_2\text{Br}$
29. Which of the following reaction gives a gaseous product that does not occur a colour change with acidic KMnO_4 solution ?
 (1) Reaction of Na_2S with dil. HCl (2) Reaction of Mg with dil. H_2SO_4
 (3) Reaction of $\text{Na}_2\text{S}_2\text{O}_3$ with dil. HNO_3 (4) Reaction of S with conc. H_2SO_4
 (5) Reaction of Cu with hot conc. H_2SO_4
29. Which reaction does not indicate an electrophilic substitution reaction ?
 (1)  and conc. HNO_3 / conc. H_2SO_4
 (2)  and Br_2 liquid
 (3)  and  in alkaline medium
 (4)  and 

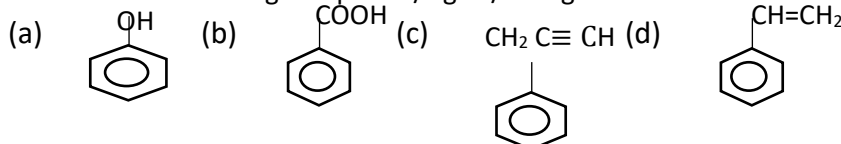


- For each of the questions from 31 to 40 one or more responses out of four (a), (b), (c) & (d) given is / are correct. Select the correct response/ responses and mark a cross (X) on the correct number corresponding to your choice in the answer script according to the instructions given below. If

Summary of instructions

(1)	(2)	(3)	(4)	(5)
(a) & (b) Only correct	(b) & (c) Only correct	(c) & (d) Only correct	(d) & (a) Only correct	Any other no of combination of response/s is /are correct

31 Which of the following compound/s give/s H_2 gas when reacted with Na?



32 Which of the following statement/s is/are true relevant to species NO_2 , ClO_2 , CO_2 & CO ?

- (a) CO is a non polar molecule
 (b) NO_2 Lewis dot dash structure of NO_2 is $\ddot{\text{O}} = \text{N} = \ddot{\text{O}}$
 (c) One unpaired electron available on Cl atom in the dot-dash structure of ClO_2
 (d) C – O bond length in CO_2 is higher than C – O bond length in CO

33 True statement/s is /are

- (a) Anhydrous Sodium Carbonate is a primary standard substance
 (b) 0.1 mol dm^{-3} NaOH solution is a standardized solution.
 (c) 0.1 mol dm^{-3} $\text{Na}_2\text{S}_2\text{O}_3$ Solution cannot be used as secondary standard solution
 (d) KMnO_4 cannot be used as a primary standard substance

34 True statement/s relevant to an ideal gas is /are

- (a) Agrees with Vanderwaal's equation at any temperature and pressure
 (b) Mean velocity of a gas molecule depends on temperature
 (c) Mass and volume of gas particles can be neglected
 (d) All gas molecules have a definite velocity at a given temperature

35 $\text{CH}_3\text{CH}_2\overset{\text{O}}{\underset{\text{||}}{\text{C}}}\text{CH}_2\text{CH}_2\text{OH}$ True statement relevant to given molecule is / are

- (a) When reacted with LiAlH_4 and $\text{H}^+ / \text{H}_2\text{O}$ is applied an optically active compound is given
 (b) When reacted with conc H_2SO_4 and heated resulting product shows isomerism
 (c) When reacted with Zn/Hg , conc HCl resulting product shows isomerism
 (d) When reacted with $\text{H}^+ / \text{KMnO}_4$ resulting product doesnot consist with Chiral C atom

36 Select correct statement/s

- (a) Lighter positive ray particle is given when Hydrogen gas is filled into cathode ray tube
 (b) Neutrons do not deflect in a magnetic fields

(c) Electrons ,protons and neutrons commonly named as Nucleons

(d) $^{16}_8\text{O}^{17}_8\text{O}$ molecule has 16 neutrons

- 37 HNO_2 , disproportionates at room temperature while NaOCl disproportionates at higher temperatures. Which of the following answer/s correctly indicate /s relevant product given by each compound?

- (a) $\text{HNO}_2 \longrightarrow \text{NO}_2$, $\text{NaOCl} \longrightarrow \text{NaCl}$
 (b) $\text{HNO}_2 \longrightarrow \text{HNO}_3$, $\text{NaOCl} \longrightarrow \text{NaCl}$
 (c) $\text{HNO}_2 \longrightarrow \text{NO}$, $\text{NaOCl} \longrightarrow \text{NaClO}_3$
 (d) $\text{HNO}_2 \longrightarrow \text{HNO}_3$, $\text{NaOCl} \longrightarrow \text{Cl}_2$

- 38 The product /s which can be resulted by the reaction of NaOH & $\text{CH}_3\text{C}(=\text{O})\text{CH}_2\text{CH}_3$ is /are

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

- 39 6g of solid B was added to 1 mol dm^{-3} 100 cm^3 solution A in a heat insulating container which is kept under 1 atm pressure. Then temperature of the solution increased in 7°C . Following reaction occurs here



Density of solution = 1 g cm^{-3} , Specific heat capacity of solution = $4 \text{ J g}^{-1} \text{ K}^{-1}$

The correct statement /s relevant to above process and thermochemical reaction is /are

- (a) 28 kJ thermal energy is absorbed for 1 mole of reactant
 (b) 16.8 kJ thermal energy evolves for 1 mole of reactant
 (c) Enthalpy change of the reaction is -28 kJ mol^{-1}
 (d) 2.8 kJ thermal energy evolves during the reaction

- 40 Which of the following answers match with given gas and identification reaction of it with each other. ?

- (a) H_2S - When bubbled through $\text{Pb}(\text{CH}_3\text{COO})_2$ aqueous solution white precipitate occurs
 (b) SO_2 when bubbled through acidic KMnO_4 solution clear colourless solution given
 (c) NH_3 - when passed through a NaOH aqueous solution in excess first it turns milky and then turns to colourless solution.

- In Question no 41 to 50 two statements are given with respect to each question from the table given below select the response out of the responses (1), (2), (3), (4) iy (5) that best fits the two statements and mark appropriately in your answer script.

12 ශ්‍රේණිය අවසාන වාර පරීක්ෂණය - 2024 (2025)

தரம் 12 ஆண்டிறுதிப் பரீட்சை - 2024 (2025) Grade 12 Final Term Test - 2024 (2025)

රසායන විද්‍යාව II
இரசாயனவியல் II
Chemistry II

02 E II

කාලය III
நேரம் III
Time III
மூன்று மணித்தியாலம்
Three hours

නම
பெயர்
Name

විභාග අංකය
சட்டிசைக்கம்
Index No.

Use extra reading time to choose questions after reading and reorganize your answers by prioritizing the questions

Instructions

- A periodic table is provided
- Use of Calculators is not allowed.
- Write your name or index number in the space provided.

Part A – Structured Essay (Page 2 -9)

- Answer all questions on this paper itself.
- Write your answer in the space provided for each question . Please note that the space provided is sufficient for the answer and that extensive answers are not expected.

Part B & C- Essay (Pages 10 -16)

- Answer two questions from part B and two questions from part C
- At the end of the time allotted for this paper, tie the answers to the three parts A,B and C together so the part A is on top and hand them over to the examiner.
- You are permitted to remove only parts B and C of the question paper from the examination hall.

Universal gas Constant $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$

Planck's Constant $h = 6.626 \times 10^{-34} \text{ J s}$

Avagadro's Constant $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$

Velocity of light $c = 3 \times 10^8 \text{ m s}^{-1}$

For Examiners use only

Part	Question No.	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
C	8	
	9	
	10	
Total		
Percentage		

Final

In letters	
In numbers	

Signatures

Examiner	
Invigilator	

Part A - Structured Essay

- Answer all four questions on this paper itself.
(Allocated marks for each question is 100)

1. (a) Write answers for following questions on the space given below.

- Which of the following gaseous elementary atoms Mg, F, Cl releases large amount of energy when an electron is inserted to it? -----
- Which of the anions among Cl^- , Br^- and I^- has highest polarizability? -----
- Which of the compounds has least thermal stability among $\text{Mg}(\text{NO}_3)_2$, $\text{Ca}(\text{NO}_3)_2$ and $\text{Sr}(\text{NO}_3)_2$? -----
- Which of the compound has highest electronegative C atom among the CH_4 , CHF_3 and CHCl_3 ? -----
- Which of the Hydride has least bond angle around central atom among H_2S , H_2Se and H_2Te ? -----
- Which of the compounds has strongest intermolecular forces among HCl , HCHO and H_2O_2 ? -----

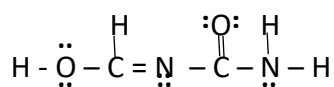
24 marks

(b) (i) Draw most acceptable Lewis structure for SOCl_2 molecule?

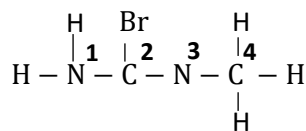
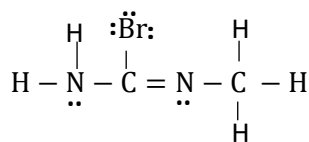
- Write
 - Shape around central atom and
 - Oxidation state of central atom of drawn structure in (i) above.

I. ----- II. -----

- Following is the most stable Lewis dot dash structure of $\text{C}_2\text{N}_2\text{O}_2\text{H}_4$ molecule. Draw more 4 Lewis dot - dash (resonance) structures and indicate their stability below as stable & unstable.



(iv) Complete the following table using given Lewis dot - dash structure and labelled sketch below.



		N ¹	C ²	N ³	C ⁴
I.	VSEPR pairs around central atom				
II.	Electron pair geometry around central atom				
III.	Shape around atom				
IV.	Type of hybridization				

- Following question no (v) to (vii) are based on the Lewis dot - dash structure in above (iv). Labeling of the atoms are same as in (iv) above.

(v) Identify the atomic/ hybridized orbitals which participate to form sigma bonds.

(I)	N ¹ - H	N ¹	_____	H	_____
(II)	N ¹ - C ²	N ¹	_____	C ²	_____
(III)	C ² - Br	C ²	_____	Br	_____
(IV)	C ² - N ³	C ²	_____	N ³	_____
(V)	N ³ - C ⁴	N ³	_____	C ⁴	_____
(VI)	C ⁴ - H	C ⁴	_____	H	_____

(vi) Mention approximate bond angles around atoms N¹, C², N³ and C⁴.

N¹ _____ C² _____ N³ _____ C⁴ _____

(vii) Arrange the atoms N¹, C², N³ and C⁴ according to the ascending order of their electronegativities.

_____ < _____ < _____ < _____

(56 marks)

(c) Indicate whether the following statements are true or false. Give reasons for your selections.

- (i) Boiling point of NO is higher than O₂ although molecular masses of NO and O₂ are approximately equal.

- (ii) Net nuclear charge of elements Na, Mg, Al and Si increases $\text{Si} < \text{Al} < \text{Mg} < \text{Na}$.

20marks

100

2. (a) X is a s block element. R and Q are P block elements in same group. X is in use to produce an important metal organic reagent in organic chemistry. R and Q combined to form 2 gaseous products RQ_2 and RQ_3 while metal X reacts with RQ_2 to form R.

- (i) Identify elements X, Q and R.

X : ----- Q : ----- R : -----

- (ii) Write correct chemical formulae of RQ_2 and RQ_3 .

RQ_2 : ----- RQ_3 : -----

- (iii) Write electronic configuration of R.

- (iv) Write 2 most stable oxidation states of R.

- (v) Write balanced chemical equation for the formation of R by X and RQ_2 using correct symbols of elements.

- (vi) Write balanced chemical equations for reactions of RQ_2 and RQ_3 with water.

- (vii) The product given from the reactions of RQ_3 with water again reacts with X under certain condition to give RQ_2 . Write relevant balanced equation indicating reaction conditions.

- (viii) Nonmetal Q reacts with element Y to form 2 covalent compounds named A & B. A and B compounds exists as liquids at room temperature.

A is with high viscosity and it's boiling point is higher than B.

- I. Identify A and B.

A : ----- B : -----

- II. Draw structured of A.

III. Write balanced chemical equation for the reaction of A with acidic KMnO_4

IV. B behaves as an acid and a base. Write balanced chemical equations for each to explain this.

As an acid : -----

As a base : -----

68 marks

(b) (i) Write balanced chemical equations of the followings with water.

I. Na_2O -----

II. PCl_3 -----

III. SCl_2 -----

IV. Cl_2O_7 -----

(ii) Write balanced chemical equations for decomposition of following compounds.

I. $(\text{NH}_4)_2\text{SO}_4$ -----

II. $\text{Sr}(\text{NO}_3)_2$ -----

III. Li_2CO_3 -----

IV. $\text{Ca}(\text{HCO}_3)_2$ -----

32 marks

3. (a) (i) Use ideal gas equation to derive a relationship among pressure of a gas (P) molar mass (M) Density (d) and absolute temperature (T) of an ideal gas.

(ii) Molar mass of the ideal gas X is 50 g mol^{-1} . Density of the gas at 300 K is 0.02 kg m^{-3} . Calculate pressure at 300 K temperature.

100

- (iii) Write 3 reasons for unavailability of accurate values when pressure of a real gas is calculated using above equation.

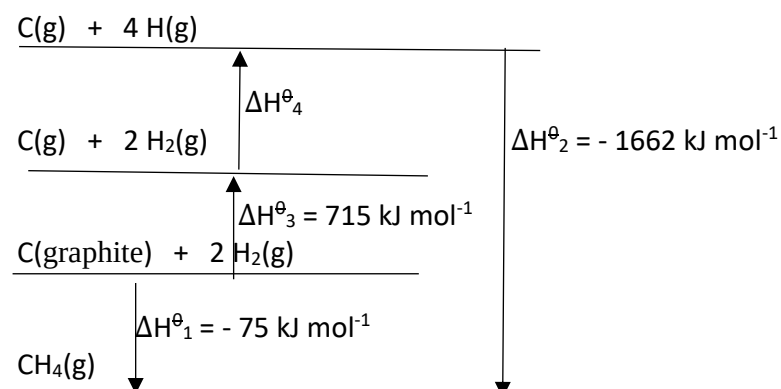
- (iv) Vanderwaal equation can be used to do calculations for real gases.

I. Write vanderwaal equation.

II. Vandewal equation consists of unique constants for real gases. Introduce them.

40 marks

- (b) (i) Calculate standard bond dissociation enthalpies of Hydrogen gas using energy diagram below. Given thermo dynamic data is relevant to 25 °C .

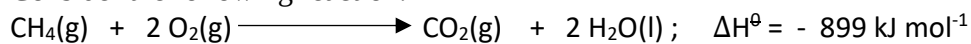


- (ii) Calculate standanrd entropy change of the reaction given using following data
 $\text{C(gr)} + 2 \text{H}_2(\text{g}) \longrightarrow \text{CH}_4(\text{g})$

Chemical Species	C(graphile)	H ₂ (g)	CH ₄ (g)
Staudard entropy J K ⁻¹ mol ⁻¹ (25 °C)	85	130	186

- (iii) Calculate standard gibb's ensy change of the reaction at 25 °C.
Indicate the spontaneity of reaction at 25 °C

- (iv) Consider the following reaction.



- I. Define the enthalpy change relevant to above reaction.

- II. What is the inconvenience which can be caused if gaseous CH₄ is used as an optional domestic fuel to LP gas?

60 marks

100

4. (a) A, B and C are 3 structural isomers of molecular formula C₅H₈.
All 3 compounds reacts with Hg²⁺ / dil H₂SO₄ and resulting products gave coloured precipitates with 2, 4 – DNP . B and C only reacts with ammonical silver nitrate to give D and E respectively. When A, B and C undergo catalytic hydrogenations A and B both gave same product F and C gave the product G.

- (i) Draw structures of A, B, C, D, E, F and G in the given cages below.

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A B C D

--	--	--

E F G

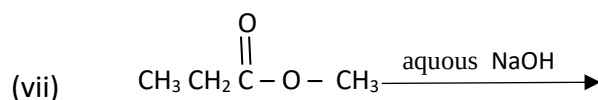
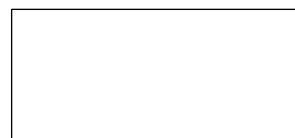
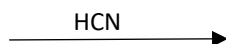
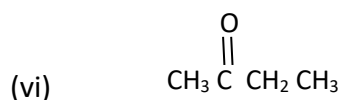
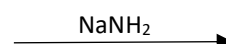
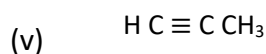
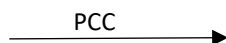
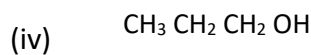
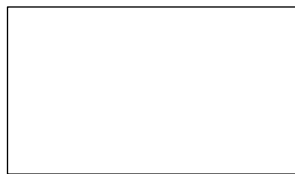
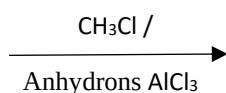
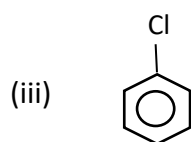
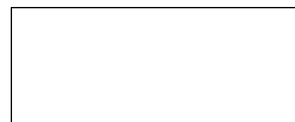
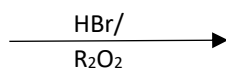
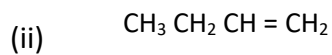
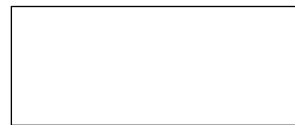
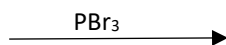
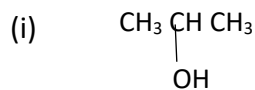
- (ii) Draw the product, when C reacts with dil H₂SO₄/ Hg²⁺ in the cage below

--

- (iii) Write an experiment which can be used to identify and separate A and B which is not mentioned on this paper.

45marks

(b) Draw the products of the following reactions in the given cages.

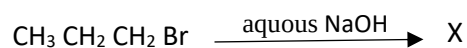


+



40 marks

(c) Consider following reaction.



(i) Write the structure of compound X. ixfhda.fha jHQyh fokak'

(ii) Write the reaction mechanism relevant to receive above product.

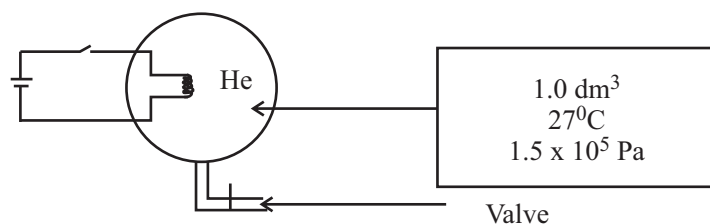
(iii) What is the type of reaction mechanism given in above (ii)? -----

15 marks

Part B - Essay

- * Answer two questions only
(Each questions carries 150 marks)

05 (a)

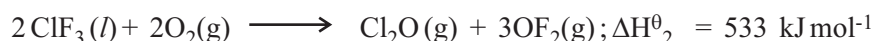


Gaseous He is available in the above rigid container under the given above conditions. Then gaseous O_2 was inserted to it until the pressure of the container become 4×10^5 Pa. Then electrical circuit was linked and gaseous oxygen was partially converted to gaseous ozone with electrical sparks. When the temperature inside the container decreased upto $27^\circ C$ the total pressure was 3.65×10^5 Pa (RAM of He = 4, O = 16)

- Calculate the partial pressure value of gaseous oxygen before applying electrical sparks.
- Calculate the mass of gas mixture before applying electrical sparks.
- Write balanced chemical equation for the reaction occurs when passing electrical sparks.
- Calculate the mass of gaseous ozone which formed by passing of electrical sparks.
- Calculate the mass percentage of gaseous ozone which formed in the gas mixture by passing electrical sparks. (80 marks)

(b) A heteroatomic gaseous compound named $X(g)$, reacts with gas Fluorine $F_2(g)$ and forms compound $Y(l)$ as the only compound. The $Y(l)$ consists of Fluorine and chlorine. The mass percentages of Fluorine and chlorine in $Y(l)$ respectively are 61.7% and 38.3%. The molecular Formula and empirical Formula of $Y(l)$ equals to each other (RAM of F = 19, Cl = 35.5)

- Deduce molecular Formula of Y
- Write molecular Formula of X
- Write balanced chemical equation of the reaction using real symbols of compounds / elements
- According to Hess's Law calculate the enthalpy change of the reaction between $F_2(g)$ and $X(g)$ using Thermo dynamic data given below and the Hess's Law. (No need to draw thermochemical cycles)



Standard Formation enthalpy of $\text{OF}_2(g) = 25 \text{ kJ mol}^{-1}$

- (v) 10.9g of X(g) reacts with excess F₂(g) under above conditions 18% thermal loss occurred. Calculate available amount of thermal energy in the above reaction.
- (vi) Mention the name of a suitable container which minimize the heat loss during reaction.
- (vii) Does the amount of thermal energy calculated (v) sufficient to boil 100cm³ of water?

Show it using a suitable calculation.

Initial temperature of water = 25°C

Density of water = 1 g cm³

Specific heat capacity of water = 4.2 J g⁻¹ K⁻¹

(70 marks)

- 06.(a) (i) Explain the relationship between standard Enthalpy of atomization of chlorine (ΔH_1^θ) and standard Enthalpy of Bond Dissociation of chlorine (ΔH_2^θ)

Explain, with relevant thermodynamic equations

- (ii) $\text{CH}_4(\text{g}) + 3\text{Cl}_2(\text{g}) \longrightarrow \text{CHCl}_3(\text{g}) + 3\text{HCl}(\text{g})$

Calculate the standard enthalpy change of the above reaction using following thermodynamic data given in the table below. (Use thermo chemical cycle)

Bond	C-H	Cl - Cl	C - Cl	H - Cl
Standard enthalpy Bond Dissociation of (ΔH_D^θ) / kJ mol ⁻¹	410	243	330	432

- (iii) Enthalpy change of a reaction can be calculated by standard formation enthalpies of reactants and products. The calculations done using bond dissociation enthalpies are incorrect. What is the reason for it?
- (iv) Draw distribution of velocities of CH₄(g) and Cl₂(g) at 27°C in between same axes. (50 marks)

- (b) Iodimetric titrations are done for standardization of Sodium Thiosulphate easily, by adding excess KI to known volume of standard Potassium Iodate solution.

- (i) What are the essential characteristics of a certain compound for to consider as a primary standard substance.
- (ii) Give a reasons For sodium thiosulphate to not to consider as a primary standard.
- (iii) What is the task of dil H₂SO₄ in this experiment.
- (iv) What is the indicator used in above titration and when it can be added to the titration Flask.
- (v) What is the colour change at the endpoint?
- (vi) 25.00 cm³ of 0.02 mol dm⁻³ KIO₃ solution was obtained and 20cm³ of dil H₂SO₄ and then 10 cm³ of excess KI was added to it.
- (i) Write balanced chemical equation for reaction occurring
- (ii) Calculate the no of moles of releasing Iodine.
- (iii) When a solution of Na₂S₂O₃ is reacted with released I₂ the burette reading was 6.00 cm³
Calculate the concentration of Na₂S₂O₃ solution.

- (iv) What is the error which can be occurred, when excess dil H_2SO_4 is added to the above titration process. Write the relevant balanced chemical equation for the change/error.
- (v) Why that hydrated sodium thiosulphate cannot be used for this experiment. (50 marks)

(c) Followings are 1st consequents ionization energy values of element X which is a non transition element.

	IE ₁	IE ₂	IE ₃	IE ₄	IE ₅	IE ₆	IE ₇	IE ₈
Ionization energy kJ mol ⁻¹	578	1817	2745	11578	14831	18378	23295	27459

- (i) Deduce the group which X belongs to.
- (ii) Identify X if atomic number of X is below than 20.
- (iii) Write the electronic configuration of the cation which formed by X
- (iv) Draw rough sketch of variation of ionization energy values of element of the period which X belongs to
- (v) Y and Z are 2 consequent elements to X which are positioned on the same period the variation of atomic radil of them are $Z > X > Y$
- (i) Identify element Y and Z
- (ii) What is the element which has the highest electro negativity among X, Y, Z
- (iii) Experimented dipole moment of HCl molecule is 1.03D and bond length of HCl is $1.275 \times 10^{-10} \text{ m}$
- Calculate the amount of charge on H in HCl molecule ($e = 1.6 \times 10^{-19} \text{ C}$) (50 marks)

07 (a) Following data based on the energy of first four energy levels of Hydrogen atom on which it own electron can be positioned (Energy of infinite level is considered as zero) n = Main quantum number

$$n=1 \longrightarrow -1312 \text{ kJ mol}^{-1}$$

$$n=2 \longrightarrow -328 \text{ kJ mol}^{-1}$$

$$n=3 \longrightarrow -146 \text{ kJ mol}^{-1}$$

$$n=4 \longrightarrow -82 \text{ kJ mol}^{-1}$$

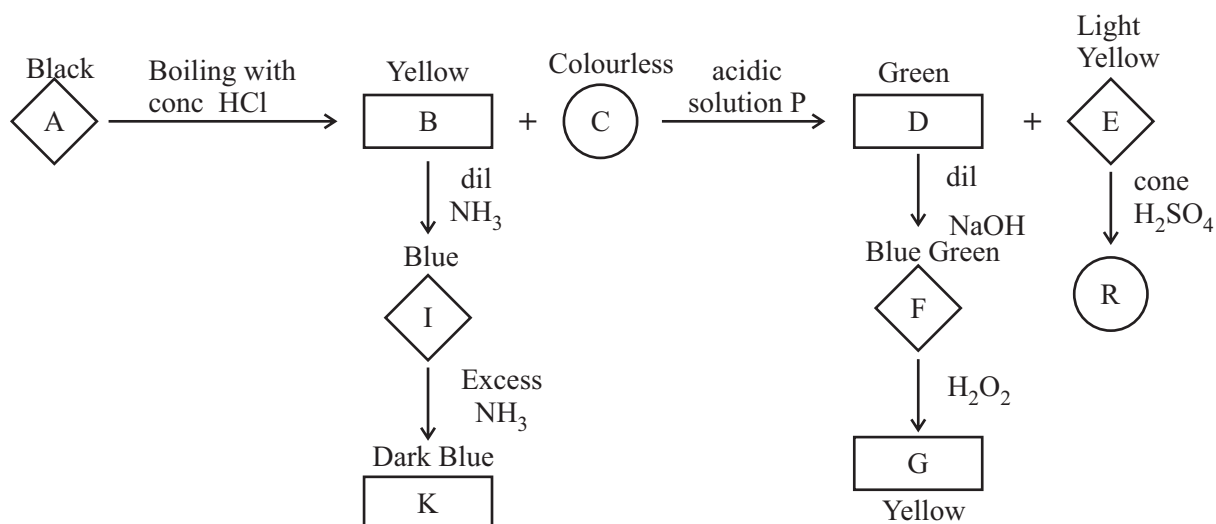
- (i) Calculate first ionization energy of Hydrogen atom using above data
- (ii) Calculate I energy of one mole of photon
- II frequency
- III Wave Length of green Spectral line of Balmex series
- (iii) Consider the electron transitions relevant to energy value 64 kJ
- (i) What is the name given for the series of spectral lines in which this spectral line belongs to?
- (ii) What is the electromagnetic spectrum which this series of spectral lines belongs to?

- (ii) Draw arrow diagram to indicate relevant electron transitions which occurs in above I
 (iii) Mention two series of spectral lines which has lower energy than this series of spectral lines.
 (iv) Indicate the occurring of above spectral series on the diagram in III (70 marks)

(b) Consider following reaction series

It symbolises

-  as Presipitates / solids
 as solutions
 as Gases



- (i) Identify species A, B, C, D, E, F, G, J, K and R
 (ii) Write balanced chemical equations to indicate the reaction which forms D by G and E, using real symbols of them.
 (iii) Write names of B and according to IUPAC nomenclature
 (iv) Indicate
- I the colour
 - II the formula of complex ion
 - III the coordination number of central metal ion and shape around cation A in it's aqueous solution
- (80 marks)