# +1 Public Chemistry Em Answerkey - March-2025

27.3.25

பா.கவியரசு M.Sc.,B.Ed., முதுகலை வேதியியல் ஆசிரியர்

## 1 marks — Part-I — 15×1 = 15

| | A-Type | | B-Type | |
|---|---|---|---|---|
| 1. | c | $NH_4Cl$ | 1. b | Both are true and Reason is correct explanation. |
| 2. | b | acetaldehyde | 2. b | Propene |
| 3. | a | P | 3. d | $-3227\ KJ\ mol^{-1}$ |
| 4. | a | Staggered > Skew > Eclipsed | 4. a | Bio-magnification |
| 5. | c | 3 | 5. a | Staggered > Skew > Eclipsed |
| 6. | d | $-3227\ KJ\ mol^{-1}$ | 6. d | 17 |
| 7. | b | Kerosene | 7. c | $NH_4Cl$ |
| 8. | c | Glucose | 8. a | P |
| 9. | a | Argon | 9. c | $(RT)^2$ |
| 10. | d | 17 | 10. a | Argon |
| 11. | c | $C_6H_5\overset{+}{N}H_3$ | 11. b | acetaldehyde |
| 12. | b | Propene | 12. b | Kerosene |
| 13. | a | Bio-magnification | 13. c | 3 |
| 14. | c | $(RT)^2$ | 14. c | Glucose |
| 15. | b | Both are true and Reason is correct explanation. | 15. c | $C_6H_5\overset{+}{N}H_3$ |

## 2 Marks: — Part-II — 6×2 = 12

16. **Relative atomic mass:**

It is defined as "the ratio of the average atomic mass factor to the unified atomic mass unit".

$$\text{Relative atomic mass } (A_r) = \frac{\text{Average mass of the atom}}{\text{Unified atomic mass}}$$

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17. **Heisenberg's Uncertainty principle:**

"It is impossible to accurately determine both the position as well as the momentum of a microscopic particle simultaneously"

$$\Delta x . \Delta p \geq \frac{h}{4\pi}$$

$\Delta p$ = uncertainties in determining the momentum

$\Delta x$ = uncertainties in determining the position.

18. **Three types of Covalent Hydrides:-**

1. Electron precise Hydrides eg: $CH_4$, $C_2H_6$
2. Electron deficient Hydrides eg: $B_2H_6$
3. Electron rich hydrides. eg: $NH_3$, $H_2O$

19. Avogadro hypothesis states that "Equal volumes of all gases under the same conditions of temperature and pressure contain equal numbers of molecules."

$$V \propto n, \quad \frac{V_1}{n_1} = \frac{V_2}{n_2} = \text{Constant}$$

$V_1$ & $n_1$ → Volume and number of moles of a gas

$V_2$ & $n_2$ → Different set of values of volume and number of moles of the same gas at same temperature and pressure

20. **Third law of Thermodynamics:**

The entropy of Pure crystalline substance at a absolute zero is zero.

$\lim_{T \to 0} S = 0$ for a perfectly ordered crystalline state.

21. **Sublimation:-**

When heated pass directly from solid to vapour without melting (i.e. liquid). On cooling the vapours will give back solids. eg: benzoic acid, naphthalene and Camphor.

22. **Inductive effect:**

"The change in the polarisation of a covalent bond due to the presence of adjacent bonds, atoms (or) groups in the molecule". This is a permanent effect.

eg: Ethyl Chloride

$\overset{\delta\delta+}{CH_3} \rightarrow \overset{\delta+}{CH_2} \rightarrow\!\!\rightarrow \overset{\delta-}{Cl}$

2 1

23. **Smog:**

1. Smog is a combination of smoke and fog which forms droplets that remain suspended in the air.
2. It mainly consists of ground level ozone, oxides of nitrogen, Volatile organic compounds, $SO_2$, acidic aerosols and gases and particulate matter.

24. **[Compulsory] :-**

**Given:**

$[NH_3] = 1.8 \times 10^{-2} M$, $[N_2] = 1.2 \times 10^{-2} M$

$[H_2] = 3 \times 10^{-2} M$, $K_c = ?$

**Solution:**

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$$

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3} = \frac{1.8 \times 10^{-2} \times 1.8 \times 10^{-2}}{1.2 \times 10^{-2} \times 3 \times 10^{-2} \times 3 \times 10^{-2} \times 3 \times 10^{-2}}$$

$$K_c = 1 \times 10^3 \, L^2 \, mol^{-2}$$

**3 Marks:** **Part-III** **6x3=18**

25. **Relative molecular mass:**

(i) **Ethanol:- ($C_2H_5OH$)**

C → 2 x 12 = 24
H → 6 x 1 = 06
O → 1 x 16 = 16
46 g

25. (ii) Glucose : $(C_6H_{12}O_6)$ :-

$C \rightarrow 6 \times 12 = 72$
$H \rightarrow 12 \times 1 = 12$
$O \rightarrow 6 \times 16 = 96$
$180\ g$



26. Pauling's scale of electronegativity :-

1. Pauling, assigned arbitrary value of electronegativities for hydrogen and fluorine as 2.1 and 4.0 respectively.
2. Based on this the electronegativity values for other elements can be calculated using the following expression

$$(\chi_A - \chi_B) = 0.182 \sqrt{E_{AB} - (E_{AA} \times E_{BB})^{1/2}}$$

Where $E_{AB}$, $E_{AA}$ and $E_{BB}$ are the bond dissociation energies of AB, $A_2$ and $B_2$ molecules respectively.

$\chi_A$ & $\chi_B$ = electro negativity of A and B.

27. Para Hydrogen ⟶ Ortho hydrogen :-

1. By treatment with catalysts Pt (or) Fe.
2. By Passing an electric discharge.
3. By Heating to 800°c (or) more.
4. By mixing with Paramagnetic molecules like $O_2$, NO, $NO_2$

28. If the Vander Wall's constant (a) = 0, for a gas, then, it behaves ideally. (ie), there are no intermolecular forces of attraction. So it cannot be liquified.

$$P_c = \frac{a}{27b^2}$$

If a=0, then P and 27b=0, which means that either P=0 (or) b=0 which is not possible. Therefore the gas cannot be liquified.

29. Limitations of Henry's law:

* Henry's law is applicable at moderate temperature and pressure only.
* Only the less soluble gases obeys Henry's law.
* The gases reacting with the solvent do not obey Henry's law. For example. $NH_3$ (or) HCl reacts with Water and hence does not obey this law

$$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$$

* The gases obeying Henry's law should not associate (or) dissociate while dissolving in the solvent.



30. Covalent Character in ionic bond:-

* The positively charged cation attracts the valence electrons of anion while repelling the nucleus.
* This causes a distortion in the electron cloud of the anion and its electron density drifts towards the cation, which results in some sharing of the valence electrons between these ions.
* Thus, a partial covalent character is developed between them. This phenomenon is called Polarisation eg: LiCl shows covalent character and is soluble in ethanol.

31. Isomerism :- The existence of 2 (or) more compounds With the same molecular formula but different

Structure and Properties (physical, chemical, or both) are called isomerism.

Isomerism

- Constitutional Isomers
  - Chain
  - Position
  - Functional
  - Metamers
  - Tautomers
  - Ring Chain
- Stereo isomers
  - Conformational
  - Configurational
    - Geometrical
    - optical

32. Uses of Chlorobenzene:

1. In the manufacture of pesticides like DDT.
2. High boiling solvent in organic synthesis.
3. Fibre-swelling agent in textile processing.

33. [Compulsory]:-

Chain reactions between Methane and Chlorine:-

(in the presence of light)

$$CH_4 + Cl_2 \xrightarrow{light} CH_3Cl + HCl$$

$$CH_3Cl + Cl_2 \xrightarrow{light} CH_2Cl_2 + HCl$$

$$CH_2Cl_2 + Cl_2 \xrightarrow{light} CHCl_3 + HCl$$

$$CHCl_3 + Cl_2 \xrightarrow{light} CCl_4 + HCl$$



5 Marks: Part-IV 5×5=25

34. a) (i) Molar Volume:

The Volume occupied by one mole of any substance in the gaseous state at a given temperature and pressure.

34. a) (ii) Limitations of Bohr's atom model:-

1. This model is applicable only to species having one electron such as $H_2$, $Li^{2+}$ and not applicable to multi electron atoms.

2. It was unable to explain the splitting of spectral lines in the presence of magnetic field (Zeeman effect) or an electric field (stark effect).

3. Bohr's theory was unable to explain why the electron is restricted to revolve around the nucleus in a fixed orbit in which the angular momentum (mvr) of the electron is equal to $\frac{nh}{2\pi}$.

(OR)

34. b) (i) 1. Halogens are highly electronegative and with high negative electron gain enthalpies.

2. Therefore, they have high tendency to gain an electron. Hence they act as strong oxidising agents.

34. b) (ii) 1. The electronegativity increases as we move from Left to right in a period due to the increase of nuclear charge.

2. The electronegativity decreases as we move from top to bottom along a group due to decrease of nuclear charge.

35. a) *Biological importance of Mg:-



1. Magnesium plays an important role in many biochemical reactions catalysed by enzymes.

2. It is the co-factor of all enzymes that utilize ATP in phosphate transfer and energy release.

3. It also essential for DNA synthesis and is responsible for the Stability and proper functioning of DNA. It is also used for balancing electrolytes in our body.

4. Deficiency of Magnesium results into convulsion and neuromuscular irritation.

## Biological importance of Ca:

1. Calcium is a major component of bones and teeth.
2. It is also present in blood and its concentration is maintained by hormones (Calcitonin and Parathyroid hormone)
3. Deficiency of Calcium in blood causes it to take longer time to clot.
4. It is also important for muscle contraction.

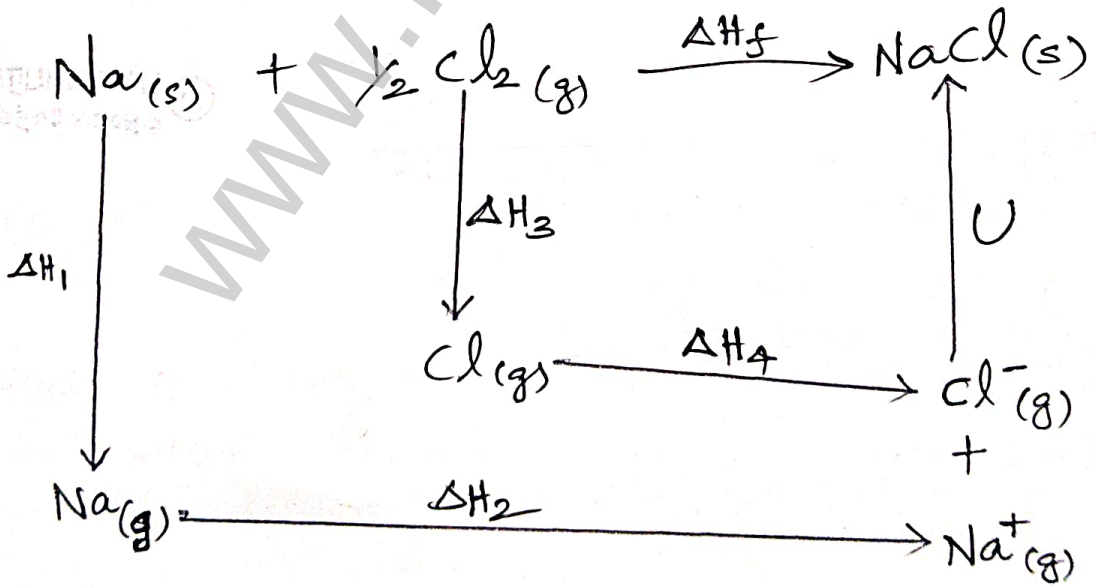


(OR)

35. b) **Indirect method to calculate lattice enthalpy of NaCl crystal:-**

The formation of NaCl can be considered in 5 steps. The sum of the enthalpy changes of these steps is equal to the enthalpy change for the overall reaction from which the lattice enthalpy of NaCl is calculated.

Let us calculate the lattice energy of sodium chloride using Born-Haber cycle.




Heat of formation of NaCl $\Delta H_f = -411.3\ KJ\ mol^{-1}$

Heat of sublimation of $Na_{(s)}$ $\Delta H_1 = 108.7\ KJ\ mol^{-1}$

Ionisation energy of $Na_{(g)}$ $\Delta H_2 = 495.0\ KJ\ mol^{-1}$

Dissociation Energy of $Cl_{2(g)}$ $\Delta H_3 = 244.0\ KJ\ mol^{-1}$

Electron affinity of $Cl_{(g)}$ $\Delta H_4 = -349.0\ KJ\ mol^{-1}$

U = Lattice energy of NaCl

$$\Delta H_f = \Delta H_1 + \Delta H_2 + \tfrac{1}{2}\Delta H_3 + \Delta H_4 + U$$

$$U = \Delta H_f - (\Delta H_1 + \Delta H_2 + \tfrac{1}{2}\Delta H_3 + \Delta H_4)$$

$$U = (-411.3) - (108.7 + 495 + 122 - 349)$$

$$U = (-411.3) - (376.7)$$

$$U = -788\ KJ\ mol^{-1}$$



This negative sign in lattice energy indicates that the energy is released when sodium is formed from its constituent gaseous ions $Na^+$ and $Cl^-$.

36. a) (i) Effect of Concentration on equilibrium:

1. At equilibrium, the Cocentration of the reactants and the products does not Change. The addition of more reactants or products at equilibrium causes an increase in their respective concentrations.
2. According to Le Chateliers principle, the effect of increase in concentration is to shift the equilibrium in a direction that consumes the added substance.

(ii) Effect of pressure on equilibrium:-

1. When the pressure is increased, the volume decrease proportionately and the system responds by shifting the equilibrium in a direction that has fewer moles of gaseous molecules. When $\Delta n_g = 0$ pressure has no effect on equilibrium. When $\Delta n_g \neq 0$ pressure has effect.

(iii) Effect of temperature on equilibrium:

1. If the forward reaction is exothermic then the backward reaction is endothermic.

2. When temperature of the system increases it favours endothermic reaction.

3. When temperature of the system decreases it favours exothermic reaction.



(iv) Effect of Catalyst on equilibrium:

1. Addition of a catalyst does not affect the state of the equilibrium.

2. The catalyst increases the rate of both the forward and the reverse reactions to the same extent. Hence, it does not change the equilibrium composition of the reaction mixture.

(V) Effect of a added inert gas on reaction at equilibrium:

1. The total number of moles of gases present in the container increases, that is, the total pressure of gases increases.

2. The partial pressure of the reactants and the products are unchanged. Hence at constant volume, addition of inert gas has no effect on equilibrium.

(OR)

36. b) Expression for vapour pressure of binary solution of Liquid in liquids using Raoult's law:-

Now, let us consider a binary liquid solution formed by dissolving a liquid solute 'A' in a pure solvent 'B' in a closed vessel. Both the components A & B present in the solution would evaporate and an equilibrium will be established between the liquid and vapour phases of the components A & B.

The french chemist Raoult, Proposed a quantitative

relationship between the partial pressures and the molefractions of two components A & B, which is known as Raoult's law. This law states that, "in the case of solution of volatile liquids, the partial vapour pressure of each component (A & B) of the solution is directly proportional to its molefraction".

According to Raoult's law,

$p_A \propto x_A$ ——— (1) $\quad p_A = k x_A$ When $x_A = 1$, $k = p_A^\circ$

Where $p_A^\circ$ is the vapour pressure of pure component 'A' at the same temperature.

Therefore, $p_A = p_A^\circ x_A$ ——— (2)



Similarly, for component 'B'

$p_B = p_B^\circ x_B$ ——— (3)

$x_A$ and $x_B$ are the molefraction of the components A and B respectively.

According to Dalton's law of partial pressure the total pressure in a closed vessel will be equal to the sum of the partial pressures of the invidual components

Hence, $p_{total} = p_A + p_B$ ——— (4)

Substituting the values of $p_A$ and $p_B$ from equation (2) and (3) in the above equation,

$$p_{total} = x_A p_A^\circ + x_B p_B^\circ \quad \text{——— (5)}$$

We know that $x_A + x_B = 1$ (or) $x_A = 1 - x_B$

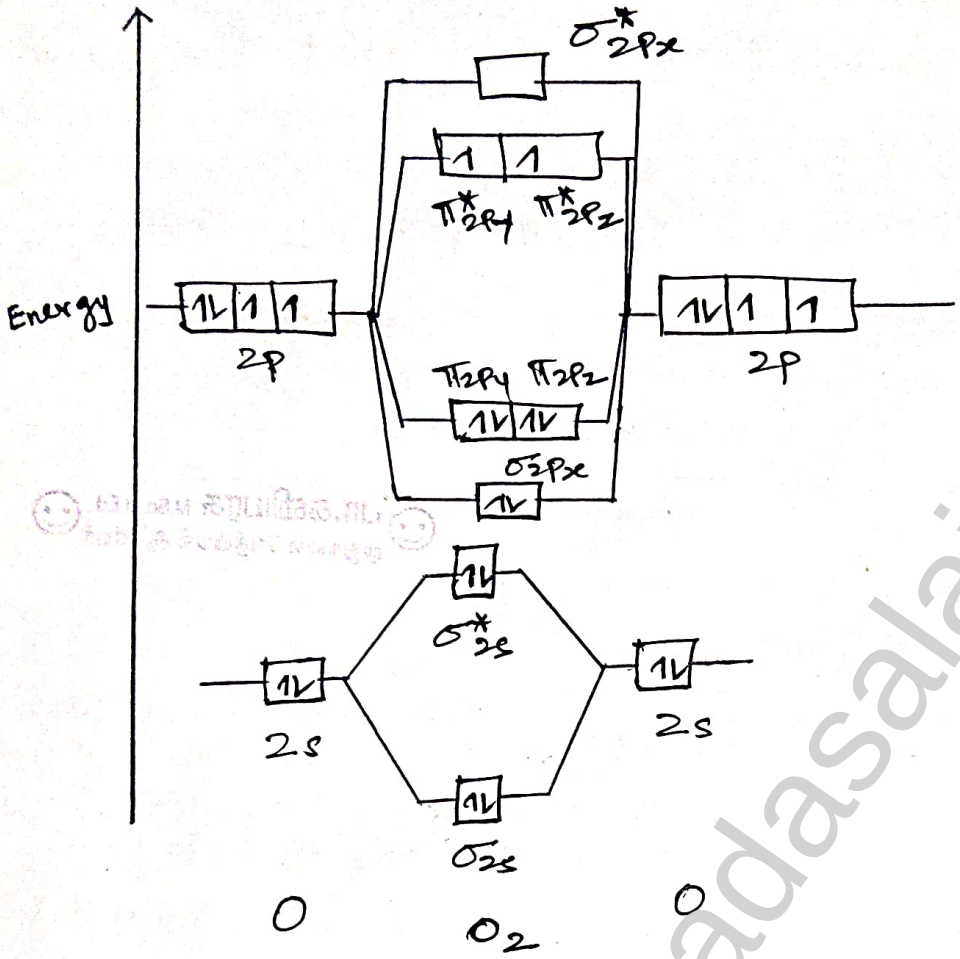
Therefore, $p_{total} = (1 - x_B) p_A^\circ + x_B p_B^\circ$ ——— (6)

$$p_{total} = p_A^\circ + x_B (p_B^\circ - p_A^\circ) \quad \text{——— (7)}$$

The above equation is of the straight-line equation form $y = mx + c$. The plot of $p_{total}$ versus $x_B$ will give a straight line with $(p_B^\circ - p_A^\circ)$ as slope and $p_A^\circ$ as the Y intercept.

37. a) **M.O. Diagram of $O_2$ :-**

$_8O \longrightarrow 1s^2\ 2s^2\ 2p^4$






$O_2$ : $(\sigma_{1s})^2 (\sigma^*_{1s})^2 (\sigma_{2s})^2 (\sigma^*_{2s})^2 (\sigma_{2p_x})^2 (\pi_{2p_y})^2 (\pi_{2p_z})^2 (\pi^*_{2p_y})^1 (\pi^*_{2p_z})^1$

Bond order $= \frac{N_b - N_a}{2} = \frac{10-6}{2} = 2$ , $O=O$

Magnetic Property : Paramagnetic. (Molecule has two unpaired electrons)

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37. b) (i) (I) $CH_3 - CH_2 - \underset{OH}{CH} - CHO$ (OR) $\longrightarrow$ 2-hydroxy butanal

(II) $CH_3 - C \equiv C - \underset{Cl}{CH} - CH_3$ $\longrightarrow$ 4-chloro pent-2-yne

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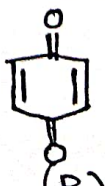
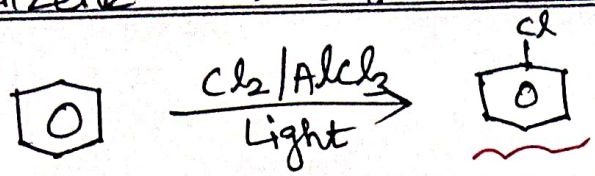
(ii) (I)  $\xrightarrow{Pt/H_2}$ 

Cyclohexane (A)

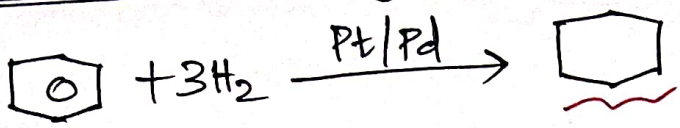
(II)  $\xrightarrow[H_2SO_4]{K_2Cr_2O_7}$ 

p-benzo quinone (B)

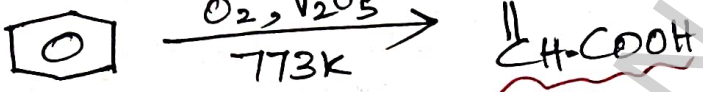
38. a) (i) Benzene ⟶ Chlorobenzene:




(ii) Benzene ⟶ Cyclohexane:

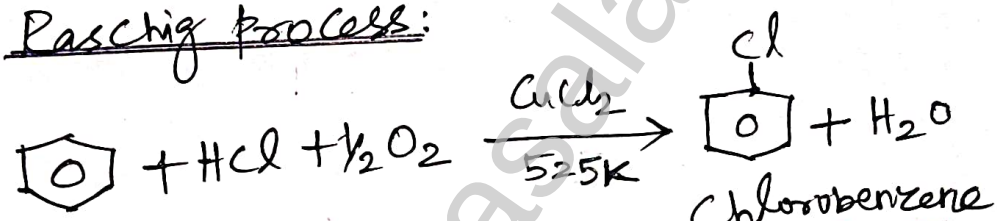



(iii) Benzene ⟶ Maleic acid:




(OR)

38. b) (i) Raschig process:




Chlorobenzene

(ii) Dow's process:

$C_6H_5Cl + NaOH \xrightarrow[300\,atm]{350^\circ C} C_6H_5OH + NaCl$

Chlorobenzene — phenol

(iii) Williamson's Ether Synthesis:

$CH_3CH_2Br + CH_3CH_2ONa \xrightarrow{\Delta} CH_3CH_2OCH_2CH_3 + NaBr$

diethylether.

Prepared By

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# 2024-25 - March +1 Chemistry Question Paper Analysis:

27.3.25 +1 வேதியியல் மதிப்பெண் By பா.கவியரசு

| S.No | UNITS | 1mark | 2mark | 3Mark | 5Mark | Total Questns | Total Marks |
|---|---|---|---|---|---|---|---|
| 1. | Basic Concepts of Chemistry and Chemical Calculations | 1 (BB) | 1 (BB) | 1 (Int) | 1 (2-Int) | 4 | 8 |
| 2. | Quantum Mechanical Model of atom | 1 (BB) | 1 (Int) | — | 1 (3-Int) | 3 | 6 |
| 3. | Periodic Classification of Elements | 1 (BB) | — | 1 (BB) | 1 (5-BB) | 4 | 9 |
| 4. | Hydrogen | 1 (BB) | 1 (BB) | 1 (BB) | — | 3 | 6 |
| 5. | Alkaline and Alkaline Earth Metals | 1 (BB) | — | — | 1 (5-BB) | 2 | 6 |
| 6. | Gaseous State | 1 (BB) | 1 (BB) | 1 (BB) | — | 3 | 6 |
| 7. | Thermodynamics | 1 (Int) | 1 (BB) | — | 1 (5-BB) | 3 | 8 |
| 8. | Physical and chemical Equilibrium | 1 (BB) | 1* (Int) | — | 1 (5-Int) | 3 | 8 |
| 9. | Solutions | 1 (BB) | — | 1 (Int) | 1 (5-Int) | 3 | 9 |
| 10. | Chemical bonding | 1 (BB) | — | 1 (BB) | 1 (5-BB) | 3 | 9 |
| 11. | Fundamentals of organic Chemistry | 1 (BB) | 1 (Int) | 1 (Int) | 1 (2-BB) | 4 | 8 |
| 12. | Basic concept of organic Reactions | 1 (BB) | 1 (BB) | — | 1 (3-Int) | 3 | 6 |
| 13. | Hydro Carbons | 1 (Int) | — | 1* (Int) | 1 (5-Int) | 3 | 9 |
| 14. | Haloalkanes and Haloarenes | 1 (BB) | — | 1 (Int) | 1 (3-BB, 2-Int) | 3 | 9 |
| 15. | Environmental chemistry | 1 (BB) | 1 (BB) | — | — | 2 | 3 |
| | | 1 Marks: BB-13, Int-2 = 15 | 2 Marks: BB-12, Int-6 = 18 | 3 Marks: BB-12, Int-15 = 27 | 5 Marks: BB-25, Int-25 = 50 | 46 | 110 |

* → Compulsory

→ 110

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| S.No | Chemistry | 1 mark | 2 Mark | 3 Mark | 5 Mark | Total |
|---|---|---|---|---|---|---|
| 1. | Inorganic Chemistry | 5 | 6 | 9 | 15 | 35 |
| 2. | Physical Chemistry | 5 | 6 | 9 | 20 | 40 |
| 3. | Organic Chemistry | 5 | 6 | 9 | 15 | 35 |
| | Total Marks | 15 | 18 | 27 | 50 | 110 |

| | Questions | Marks |
|---|---|---|
| Book Back | 30 | 62 |
| Interior | 16 | 48 |
| Total | 46 | 110 |

Analysis By பா.கவியரசு முதுகலை வேதியியல் ஆசிரியர்

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