XI[TH] QUARTERLY EXAMINATION CHEMISTRY ANSWER KEY - 2024
DINDIGUL DISTRICT

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PART -A

I. CHOOSE THE CORRECT ANSWER: (15 x 1 =15)

1. Oxidation number of oxygen in oxygen difluoride (OF_2) is _____ d) +2

2. The maximum number of electrons in a subshell is given by the expression __ c) 2(2l + 1)

3. Which one of the following is the least electro negative element? d) Hydrogen

4. Water is a _____ (c) amphoteric oxide

5. Which one of the following is used to restore the white colour of the old paintings?
c) Hydrogen peroxide

6. If temperature and volume of an ideal gas is increased to twice its values, the initial pressure P becomes _____ c) P

7. Change in internal energy, when 4 kJ of work is done on the system and 1 kJ of heat is given out by the system is _____ c) +3 KJ

8. Which of the following pairs of elements exhibit diagonal relationship? d) Be and Al

9. In adiabatic process which one of the following magnetic material is used to produce cooling by removing magnetic property_____ c) Gadolinium sulfate

10. K_c /K_p for the reaction, $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ is _____ d) $(RT)^2$

11. If Q < Kc, the reaction will proceed in the _____a) forward direction

12. Nitrogen detection in an organic compound is carried out by Lassaigne's test. The blue colour formed is due to the formation of _____ b) $Fe_4[Fe(CN)_6]_3$

13. Which one of the following shows functional isomerism? c) Ethanol

14. What is the hybridisation state of benzyl carbonium ion? a) sp^2

15. Homolytic fission of covalent bond leads to the formation of _____ d) free radical

PART -B

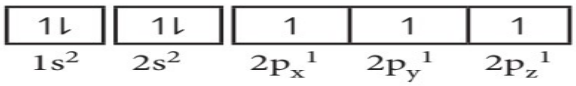
II. ANSWER ANY SIX QUESTIONS: QUESTION 24 IS COMPULSORY : (6 X 2 =12)

16. Define the term Mole.

- Mole is the amount of substance of a system, which contains as many elementary particles as there are atoms in 12 g of carbon-12 isotope.
- 1 mole = 6.022×10^{23} entities

17. State Hund's rule of maximum multiplicity.

Electron pairing in the degenerate orbitals does not take place until all the available orbitals contains one electron each. N (Z=7) - $1s^2\ 2s^2\ 2p^3$



18. What are isoelectronic ions? Give example.

- ✓ Isoelectronic refers to two atoms,ions or molecules that have the same electronic structure and same number of valence electrons.
- ✓ ex: Ne, F^- and Na^+ and Mg^{2+}.all have same no. of electrons -$1s^2\ 2s^2\ 2p^6$

19. What is water-gas shift reaction?

When carbon mono oxide of Water gas can be converted into carbon di oxide by mixing the gas mixture with more steam.

$$CO + H_2O \xrightarrow{Cu\ /\ Fe\ /\ 400^0C} CO_2 + H_2$$

20. Define Dalton's law of partial pressure.

The total pressure of a mixture of non-reacting gases is the sum of partial pressures of the gases present in the mixture. $P_{total} = p_1 + p_2 + p_3 + ...$

21. Write the Kp and Kc for the following reaction. $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

$$K_C = \frac{[SO_3]^2}{[SO_2]^2\,[O_2]},\quad K_P = \frac{p_{SO_3}^2}{p_{SO_2}^2 \cdot p_{O_2}}$$

22. What is sublimation?

Sublimation is a process when a solid changes directly into its vapour state without changing into liquid state.

23. What is Hyperconjucation?

- ✓ The delocalisation of electrons of **σ** bond is called as hyper conjugation. It is a permanent effect.
- ✓ It requires an **α**-CH group or a lone pair on atom like N, O adjacent to a **π** bond.

24. If an automobile engine burns petrol at a temperature of 816°C and if the surrounding temperature is 21°C, calculate its maximum possible efficiency.

$$\%\ \text{Efficiency} = \left[\frac{T_h - T_c}{T_h}\right] \times 100$$

Here Th = 816+273= 1089 K; Tc = 21+273= 294K

$$\%\ \text{Efficiency} = \left(\frac{1089 - 294}{1089}\right) \times 100$$

% Efficiency=73%

PART - C

III. ANSWER ANY SIX QUESTIONS: QUESTION 24 IS COMPULSORY (6 X 3 =18)

25. Calculate the molar mass of the following compounds.

a) urea $[CO(NH_2)_2]$ b) boric acid $[H_3BO_3]$ c) sulphuric acid $[H_2SO_4]$

1. urea $[CO(NH_2)_2]$	Boric acid $[H_3BO_3]$	Sulphuric acid $_2[H_2SO_4]$
Atomic mass of C =12	Atomic mass of B = 10	Atomic mass of 2(H) = 2
Atomic mass of O =16	Atomic mass of 3(H) = 3	Atomic mass of 1(S) = 32
Atomic mass of 2(N) = 28	Atomic mass of 3(O) = 48	Atomic mass of 4(O) = 64

Atomic mass of 4(H) = 4 ∴ Molar mass of Urea = 60	∴ Molar mass of Boric acid = 61	∴ Molar mass of Sulphuric acid = 98

26. What is exchange energy?

- If two or more electrons with the same spin are present in degenerate orbitals, there is a possibility for exchanging their positions.
- During exchange process the energy is released and the released energy is called exchange energy.
- If more number of exchanges are possible, more exchange energy is released.
- More number of exchanges are possible only in the case of half filled and fully filled configurations.

27. Explain diagonal relationship.

- On moving diagonally across the periodic table, the second and third period elements show certain similarities.

- The similarity in properties existing between the diagonally placed elements is called 'diagonal relationship'.

28. What are ortho and para hydrogen?

	Ortho hydrogen	Para hydrogen
1	In hydrogen molecule, if the two nuclei rotates in the same direction	In a hydrogen molecule, if the two nuclei rotates in the opposite direction
2	It is more stable	It is less stable
3	75% at room temperature	25% at room temperature
4	It has a net magnetic moment	It has Zero magnetic moment
5	Its melting point is 13.95K	Its melting point is 13.83K

29. What is entropy? Give its unit.

1. Entropy is a thermodynamic state function that is a measure of the randomness or disorderliness of the system.
2. the change in entropy of the system is equal to heat energy absorbed or evolved (q) by the system divided by the constant temperature (T).

$$\Delta S_{sys} = \frac{q_{rev}}{T}$$

3. SI unit of entropy is J K^{-1}

30. Distinguish Diffusion and Effusion.

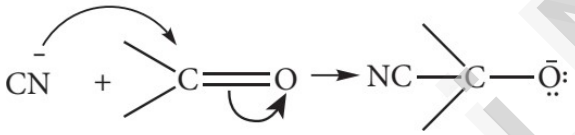
- Diffusion: When two non -reactive gases are allowed to mix, the gas molecules migrate from region of higher concentration to a region of lower concentration
- Ex: perfume or room freshener
- Effusion: Gas escapes from a container through a small opening into a vacuum
- Ex: poking a hole in a balloon

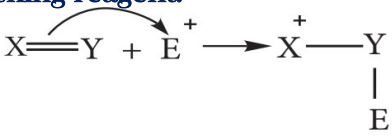
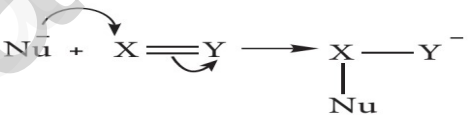
31. State Le- Chatelier Principle.

"If a system at equilibrium is disturbed, then the system shifts itself in a direction that nullifies the effect of that disturbance."

32. Explain Electromeric effect.

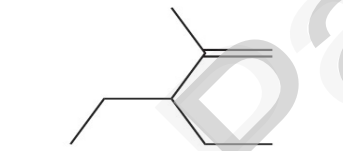
Electromeric is a temporary effect which operates in unsaturated compounds in the presence of an attacking reagent.



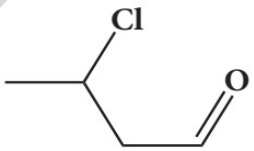
+E effect	-E effect
When the π electron is transferred towards the attacking reagent. 	When the π electron is transfered away from the attacking reagent 

33. Give the structure for the following compound.

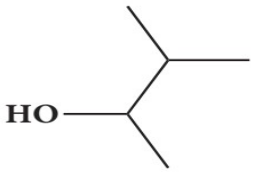
i) 3 -ethyl -2- methyl -1-pentane ii) 3- chlorobutanal iii) 3- methylbutan-2-ol



3-ethyl-2-methyl-1-pentene



3-Chlorobutanal



3-methylbutan-2-ol

PART – D

IV. ANSWER ALL QUESTIONS: (5 X 5 = 25)

34. A) i) Define equivalent mass. (2)

Gram equivalent mass is defined as the mass of an element that combines or displaces 1.008 g hydrogen or 8 g oxygen or 35.5 g chlorine.

ii) Balance the following equation by oxidation number method. (3)

$K_2Cr_2O_7 + KI + H_2SO_2 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + I_2 + H_2O$

$$\overset{+6}{K_2Cr_2}O_7 + K\overset{-1}{I} + H_2SO_4 \rightarrow K_2SO_4 + \overset{+3}{Cr_2}(SO_4)_3 + \overset{0}{I_2} + H_2O$$

$2 \times 3e^-$ $1e^-$

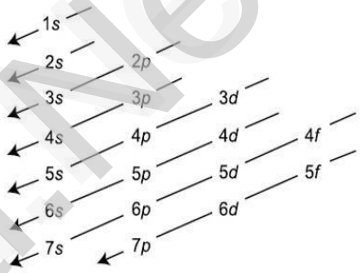
$$K_2Cr_2O_7 + 6KI + H_2SO_4 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + I_2 + H_2O$$

$$K_2Cr_2O_7 + 6KI + H_2SO_4 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + 3I_2 + H_2O$$

$$K_2Cr_2O_7 + 6KI + 7H_2SO_4 \rightarrow 4K_2SO_4 + Cr_2(SO_4)_3 + 3I_2 + 7H_2O$$

[OR]

34. B) i) Write a note an Aufbau Principle. (2)



In the ground state of the atoms, the orbitals are filled in the order of their increasing energies.

Once the lower energy orbitals are completely filled, then the electrons enter the next higher energy orbitals.

ii) Write the assumptions of Bohr atom model. (3)

1. The energies of electrons are quarantined

2. The electron is revolving around the nucleus in a certain fixed circular path called the stationary orbit.

3. Electron can revolve only in those orbits in which the angular momentum (mvr) of the electron must be equal to an integral multiple of $h/2\pi$
$mvr = nh/2\pi$ where n = 1,2,3,...etc.,

4. As long as an electron revolves in a fixed stationary orbit, it doesn't lose its energy. But if an electron jumps from a higher energy state (E_2) to a lower energy state (E_1), the excess energy is emitted as radiation.

35. A) i) Define Modern Periodic law. (2)

The physical and chemical properties of the elements are periodic functions of their atomic numbers.

ii) Explain the periodic trend of ionisation potential. (3)

	Group	Periods
Ionisation potential	Decreases	Increases
Reason	1.When an electron is added to the new shell of an atom	1.When an electron is added to the same shell of an atom
	2. Nuclear charge decreases.	2. Nuclear charge increases.

[OR]

B) i) Give the uses of heavy water. (2)

- Moderators in Nuclear reactor.
- Coolant in nuclear reactors.
- Tracer element to study the mechanisms of organic reactions.

ii) What are the three types of Covalent hydrides. Give examples. (3)

- Electron deficient hydride – B_2H_6
- Electron rich hydride – Water, NH_3
- Electron Precise Hydride – Methane

36. A) i) State Boyle's law. (2)

At a given temperature the volume occupied by a fixed mass of a gas is inversely proportional to its pressure. $V \propto 1/P$

ii) What is Joule – Thompson effect. (3)

The lowering of temperature when a gas is made to expand adiabatically from a region of high pressure into low pressure is known as Joule- Thomson effect.

[OR]

B) i) State the third law of thermodynamics. (2)

- The entropy of pure crystalline substance at absolute zero is zero.
- It can be stated as it is impossible to lower the temperature of an object to absolute zero in a finite number of steps.

ii) List out the characteristics of internal energy. (3)

- The internal energy of a system is an extensive property. It depends on the amount of the substances present in the system.
- The internal energy of a system is a state function. It depends only upon the state variables (T, P, V, n) of the system.
- The change in internal energy of a system is expressed as $\Delta U = U_f - U_i$
- In a cyclic process, there is no internal energy change. $\Delta U_{(cyclic)} = 0$
- $\Delta U = U_f - U_i$ = -ve ($U_f < U_i$)
- $\Delta U = U_f - U_i$ = +ve ($U_f > U_i$)

37. A) i) Define Gibb's free energy. (2)

The "available energy" to do work in a system.

$G = H - TS$ H - Enthalpy T - Temperature S - Entropy

Gibbs free energy (G) is an extensive property and it is a single valued state function

ii) What are state and path functions? Give two examples. (3)

State function:

A state function of a system, which has a specific value for a given state and does not depend on the path by which the particular state is reached.

Ex. Pressure (P), Volume (V), Temperature(T).

Path function:

A path function of a system whose value depends on the path by which the system changes from its initial to final states. Ex. Work (*w*), Heat (*q*).

[OR]

B) Derive the relation between Kp and Kc. (5)

Let us consider the general reaction in which all reactants and products are ideal gases.

$xA + yB \rightleftharpoons lC + mD$

$$K_c = \frac{[C]^l [D]^m}{[A]^x [B]^y} \quad (1) \qquad K_p = \frac{p_C^l \times p_D^m}{p_A^x \times p_B^y} \quad (2)$$

The ideal gas equation is,

$PV = nRT$

$P = nV/RT$

since, Active mass = molar concentration = n/V

P = active mass × RT

Based on the above expression the partial pressure of the reactants and products can be expresssed as,

$$p_A^x = [A]^x (RT)^x \quad p_B^y = [B]^y (RT)^y \quad p_C^l = [C]^l (RT)^l \quad p_D^m = [D]^m (RT)^m$$

On substitution in Eqn. 2

$$K_p = \frac{[C]^l [RT]^l [D]^m (RT)^m}{[A]^x [RT]^x [B]^y (RT)^y} \quad (3)$$

$$K_p = \frac{[C]^l [D]^m (RT)^{l+m}}{[A]^x [B]^y (RT)^{x+y}}$$

$$K_p = \frac{[C]^l [D]^m}{[A]^x [B]^y} (RT)^{(l+m)-(x+y)} \quad (4)$$

By comparing equation (1) and (4), we get

$$K_p = K_c (RT)^{\Delta ng} \text{ —— } (5)$$

38. A) Give a brief description of the principles of (5)

i) Fractional distillation

- This is one method to purify and separate liquids present in the mixture having their boiling point close to each other.
- In the fractional distillation, a fractionating column is fitted with distillation flask and a condenser.
- The process of separation of the components in a liquid mixture at their respective boiling points in the form of vapours and the subsequent condensation of those vapours is called fractional distillation.

ii) Column chromatography.

- This is the simplest chromatographic method carried out in long glass column having a stop cock near the lower end.

- This method involves separation of a mixture over a column of adsorbent (Stationery phase) packed in a column.
- In the column a plug of cotton or glass wool is placed at the lower end of the column to support the adsorbent powder.
- The tube is uniformly packed with suitable absorbent constitute the stationary phase
- The mixture to be separated is placed on the top of the adsorbent column.
- Eluent which is a liquid or a mixture of liquids is allowed to flow down the column slowly.
- Different components are eluted depending upon the degree to which the components are adsorbed and complete separation takes place.

[OR]

b) What are electrophiles and nucleophiles? Give Example. (5)

	Nucleophiles	Electrophiles
1	Negatively charged ions	Positive charged ions
2	They are electron rich	They are electron deficient
3	Donates a pair of electron	Accept a pair of electron
4	Lewis bases	Lewis acids
5	Ex: NH_3	Ex: BF_3

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