

SHANMUGAM'S COMMON HALF YEARLY EXAMINATION -2019

XI - STD

Chemistry answer key

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PART - I

I. Choose the best answer

1. a) CH_2O
2. a) azimuthal quantum number.
3. b) Unununium
4. c) $\text{CO} + \text{H}_2$
5. a) (p) - (2) (q)- (3) (r)-(4) (s)- (1)
6. (d) both assertion and reasons are false
7. d) Isobaric process
8. b) 5
9. d) $\Delta G_{\text{mix}} = 0$
10. c) T- shape (slightly bent-T)
11. b) $\text{CH}_3 - \text{CO} - \text{CH}_3$
12. c) $-\text{C}(\text{CH}_3)_3 > -\text{CH}(\text{CH}_3)_2 > -\text{CH}_2\text{CH}_3 > -\text{CH}_3$
13. c) 2-methyl propane
14. b) Freon - 113
15. c) trickling filters

PART - II

II. Answer any 6 questions(Question no.24 is compulsory)

16. Aufbau principle ('building up')

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

17. Two properties are important in determining ionization energies:

(i) nuclear charge; (ii) shielding by other electrons.

iii) In partially filled shells, electrons shield each other very imperfectly, so across the Period (from left to right) as the nuclear charge increases, ionization energies markedly increase.

iv) On the other hand, down a Group, the increased nuclear charge is effectively shielded by the filled electronic shells. Nucleus/valence electron attraction becomes attenuated, and ionization energies decrease.

18. Uses of Plaster of Paris

I) The Plaster of Paris is in the building industry as well as plasters.

It is used for immobilising the affected part of organ where there is a bone fracture or sprain.

It is also employed in dentistry, in ornamental work and for making casts of statues and busts

19. First law of thermodynamics : $\Delta U = q + w$

"Energy can neither be created nor destroyed, but may be converted from one form to another".

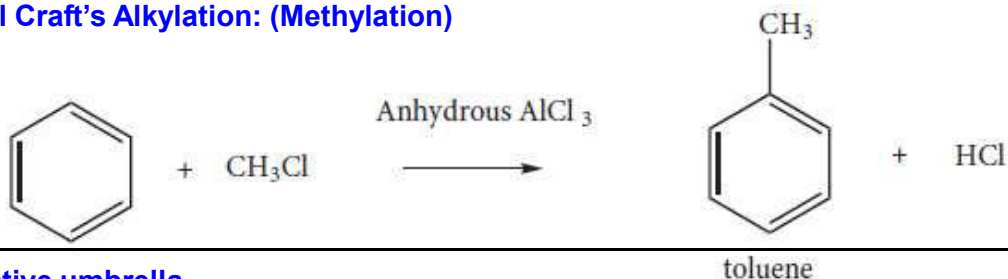
(or)

Other statements of first law of thermodynamics

20. Dissociation of PCl_5 for K_c value $K_c = \frac{[\text{PCl}_3][\text{Cl}_2]}{[\text{PCl}_5]}$

21. **Homologous series:**
A series of organic compounds each containing a characteristic functional group and the successive members differ from each other in molecular formula by a CH_2 group is called homologous series

22. **Friedel Craft's Alkylation: (Methylation)**

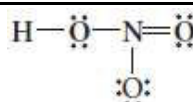


23. **Protective umbrella**

At high altitudes the atmosphere consists of a layer of ozone (O_3) which acts as an umbrella or shield for harmful UV radiations.

It protects us from harmful effect such as skin cancer

24. **The Lewis structure of nitric acid is given as**



PART - III

III. **Answer any 6 questions(Question no.33 is compulsory) 6 x 3 = 18**

<u>oxidation</u>	<u>reduction</u>
1. Addition of oxygen	1. Removal of oxygen
2. Removal of hydrogen	2. Addition of hydrogen
3. Addition of an electronegative element	3. Removal of an electronegative element
4. Removal of an electropositive element	4. Addition of an electropositive element
5. Loss of electron	5. Gain of electron

26. **Postulates of Bohr atom model**

- The energies of electrons are quantised
- The electron is revolving around the nucleus in a certain fixed circular path called stationary orbit.
- Electron can revolve only in those orbits in which the angular momentum (mvr) of the electron must be equal to an integral multiple of $h/2\pi$.
- As long as an electron revolves in the fixed stationary orbit, it doesn't lose its energy.

27. **Characteristics of internal energy (U):**

- It is an extensive property and state function
- The change in internal energy of a system is expressed as $\Delta U = U_f - U_i$
- In a cyclic process, $\Delta U = 0$
- $\Delta U = U_f - U_i = -ve$ ($U_f < U_i$) and $\Delta U = U_f - U_i = +ve$ ($U_f > U_i$)

28. **Henry's law**

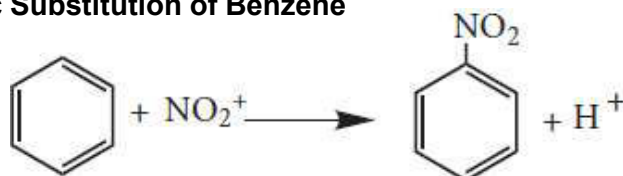
"the partial pressure of the gas in vapour phase (vapour pressure of the solute) is directly proportional to the mole fraction(x) of the gaseous solute in the solution at low concentrations"

29. **Bond order** $B.O = \frac{N_b - N_a}{2}$

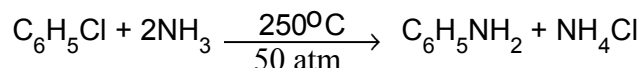
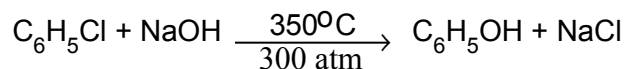
30. C_2H_6O has 2 isomers in total, they are ethanol and methoxymethane (functional isomer)



31. **Electrophilic Substitution of Benzene**



32. **Conversion of chloro benzene into phenol & aniline**



33. **The electronic configuration of K atom is $K_{19} = (1s^2) (2s^2 2p^6) (3s^2 3p^6) 4s^1$**

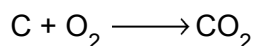
Effective nuclear charge (Z^*) = $Z - S$

$$Z^* = 19 - [0.85 \times (8) + (1.00 \times 10)] \quad \quad \quad \mathbf{Z^* = 2.20}$$

PART - IV

IV. Answer all the questions

34. a) i) Redox reactions in which two substances combine to form a single compound are called **combination reaction.**



ii) **Modern Periodic Law**

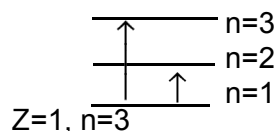
"the physical and chemical properties of the elements are periodic functions of their atomic numbers."

(OR)

b) i) Energy of an electron in hydrogen atom in ground state is -13.6 eV.

$$E_n = -13.6 \frac{Z^2}{n^2} \text{ eV}$$

Energy of electron in second excited state means :



$Z=1, n=3$

$$E_n = -13.6 \frac{(1)^2}{(3)^2} \quad \quad \quad E_n = -13.6 \frac{1}{9} = -1.5 \text{ eV}$$

Energy of the electron in the second excited state in hydrogen atom is **-1.5 electron volt.**

ii) **Gibbs free energy is defined as below**

$$G = H - TS$$

Gibbs free energy and the net work done by the system:

$$\Delta G = \Delta H - T\Delta S$$

We know that,

$$\Delta H = \Delta U + P\Delta V$$

..
$$\Delta G = \Delta U + P\Delta V - T\Delta S$$

from first law of thermodynamics $\Delta U = q + w$

from second law of thermodynamics

$$\Delta G = q + w + P\Delta V - T\Delta S \qquad \Delta S = \frac{q}{T}, \quad T\Delta S = q$$

$$\Delta G = q + w + P\Delta V - q \qquad \Delta G = w + P\Delta V$$

Net work of the system is - $\Delta G = -w - P\Delta V$

But - $P\Delta V$ represents the work done due to expansion against a constant external pressure

35. i) **Hydrides**

The dihydrogen combines with number of elements to form Hydrides

Ionic (Saline) hydrides

These are hydrides composed of an electropositive metal, generally, an alkali or alkaline-earth metal, except beryllium and magnesium, formed by transfer of electrons from metal to hydrogen atoms.

eg) LiH, CaH₂

Covalent (Molecular) hydrides :

They are compounds in which hydrogen is attached to another element by sharing of electrons

eg) electronprecise (CH₄, C₂H₆, SiH₄, GeH₄),

electrondeficient (B₂H₆)

electron-rich hydrides(NH₃, H₂O).

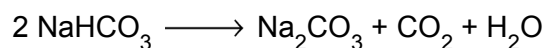
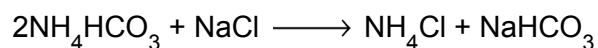
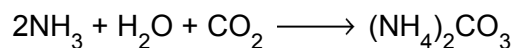
Metallic (Interstitial) hydrides

Metallic hydrides are usually obtained by hydrogenation of metals and alloys in which hydrogen occupies the interstitial sites(voids).

non-stoichiometric with variable composition (TiH_{1.5-1.8} and PdH_{0.6-0.8})

(OR)

a) i) **Solvay process**



ii) **Criteria for spontaneity of a process**

a) If the enthalpy change of a process is negative, then the process is exothermic and may be spontaneous. (ΔH is negative).

b) If the entropy change of a process is positive, then the process may occur spontaneously. (ΔS is positive).

c) The gibbs free energy which is the combination of the above two ($\Delta H - T\Delta S$) should be negative for a reaction to occur spontaneously, i.e. the necessary condition for a reaction to be spontaneous is $\Delta H - T\Delta S < 0$

36. a) i) **Ideal gas equation**

Boyle's law $V \propto \frac{1}{P}$

Charles law $V \propto T$

Avogadro's law $V \propto n$

$$V \propto \frac{nT}{P}$$

$$V = \frac{nRT}{P}$$

R is the proportionality constant called universal gas constant.

$$PV = nRT$$

ii) Equilibrium in Chemical Processes. You may have learnt about reversible reactions. However, this equilibrium is said to be dynamic in nature. This is because it consists of a forward reaction where the reactants react to give products and reverse reaction where the products can react to give back the original reactants

(OR)

b) i)

$$K_c = \frac{[\text{HCl}]^4 [\text{O}_2]}{[\text{H}_2\text{O}]^2 [\text{Cl}_2]^2}, \quad K_p = \frac{P_{\text{HCl}}^4 \times P_{\text{O}_2}}{P_{\text{H}_2\text{O}}^2 \times P_{\text{Cl}_2}^2}$$

ii) **Solubility**

Solubility of a solute is the maximum amount of solute that can be dissolved in a specific amount of solvent at a specified temperature

Factors influencing the solubility

i) Nature of solute and solvent

ii) Effect of temperature:

1. Solid solute in liquid solvent
2. Gaseous solute in liquid solvent

iv) Effect of pressure:

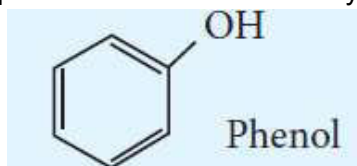
37. **a) i) Characteristics of organic compounds**

- 1) soluble in organic solvent such as benzene, toluene, ether, chloroform
- 2) Many of the organic compounds are inflammable
- 3) Organic compounds are characterised by functional groups
- 4) They exhibit isomerism which is a unique phenomenon.

ii) Name of the member	Molecular formula	IUPAC Name	Structural formula
(1) Methyl alcohol	$\begin{array}{c} \text{OH} \\ \\ \text{CH} \end{array}$	Methanol	CH_3OH
(2) Ethyl alcohol	$\text{C}_2\text{H}_5\text{OH}$	Ethanol	$\text{CH}_3\text{CH}_2\text{OH}$
(3) Propyl alcohol	$\text{C}_3\text{H}_7\text{OH}$	Propanol	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
(4) Butyl alcohol	$\text{C}_4\text{H}_9\text{OH}$	Butanol	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

(OR)

b) i) 1) Benzenoid compounds or aromatic homocyclic



2) Non-Benzenoid compounds also aromatic homocyclic



II) Inductive effect

Their ability to release or withdraw the electron through sigma covalent bond is called +I effect and -I effect respectively.

1) Positive inductive effect (+I)

Refers to electron releasing tendency of functional groups.

For example, alkyl, aryl, metals, etc.

2) Negative inductive effect (-I)

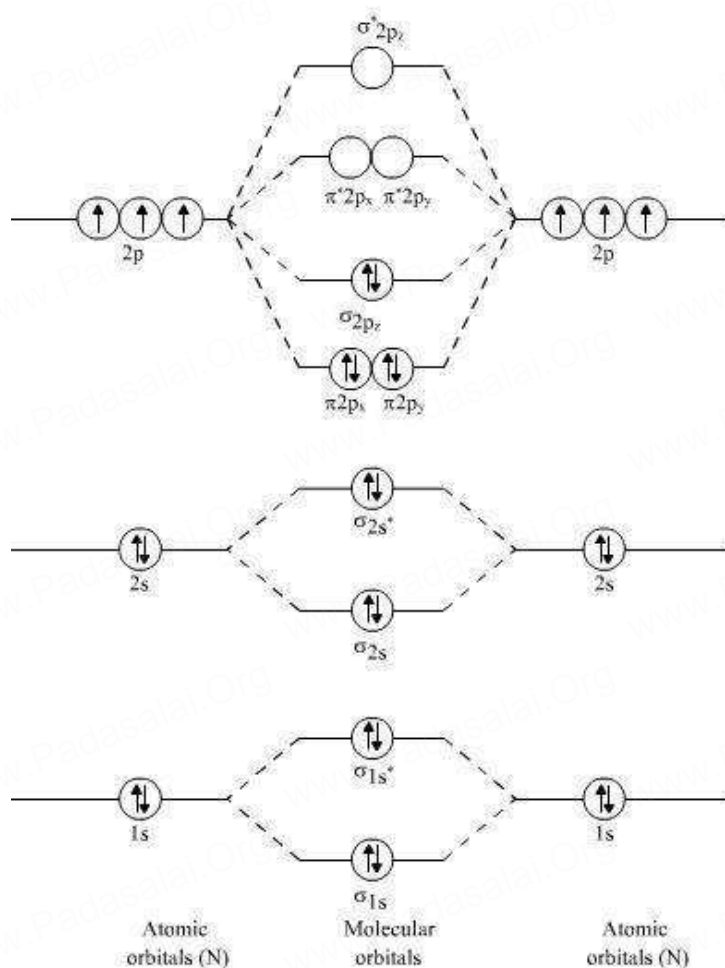
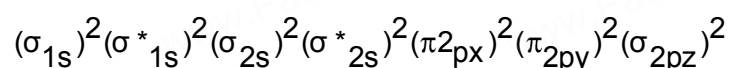
refers to electron accepting tendency of functional groups.

Example: -F, -Cl, -COOH, -NO₂, NH₂

38. Molecular orbital diagram of nitrogen molecule (N₂)

Electronic configuration of N atom $1s^2 2s^2 2p^3$

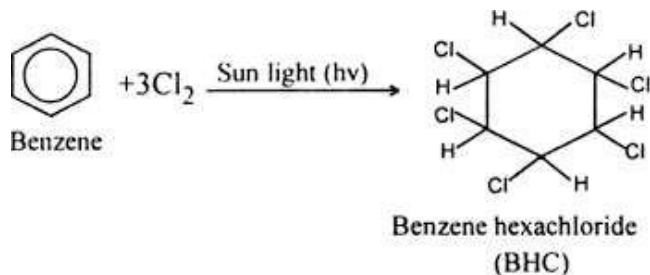
Electronic configuration of N₂ molecule



$$\text{Bond order} = \frac{N_b - N_a}{2} = \frac{10 - 4}{2} = 3$$

Molecule has no unpaired electrons hence it is diamagnetic.

ii)

Gammexane

Benzene hexachloride (BHC), any of several stereoisomers of 1,2,3,4,5,6-hexachlorocyclohexane formed by the light-induced addition of chlorine to benzene. One of these isomers is an insecticide called lindane, or Gammexane.

Uses: has been used both as an agricultural insecticide and as a pharmaceutical treatment for lice and scabies

(OR)

b) i) The carbylamine reaction, also known as Hoffman's isocyanide test is a chemical test for detection of primary amines

iii) In this reaction, the analyte is heated with alcoholic potassium hydroxide and chloroform. If a primary

$$\text{CH}_3\text{CH}_2\text{NH}_2 + \text{CHCl}_3 + 3\text{KOH} \longrightarrow \text{CH}_3\text{CH}_2\text{NC} + 3\text{KCl} + 3\text{H}_2\text{O}$$

Ethyl Amine alcoholic Ethyl isocyanide

pungent smelling substances

ii) Harmful effects of acid rain

(i) Acid rain affects plants and animal life in aquatic ecosystem.

(ii) It is harmful for agriculture, trees and plants as it dissolves and removes the nutrients needed for their growth.

(iii) It corrodes water pipes resulting in the leaching of heavy metals such as iron, lead and copper into the drinking water which have toxic effects.

(iv) It causes respiratory ailment in humans and animals.

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