2021

CHEMISTRY (General)

Paper Code : I-A & B

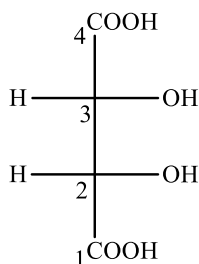## [New Syllabus]

Paper Code : I-A

Full Marks: 30 Time   Thirty Minutes

Choose the correct answer.
Each question carries 2 marks.

1. Following configuration of the tartaric acid represents

(A) 2R, 3R

(B) 2R, 3S

(C) 2S, 3S

(A) 2S, 3R

2. Which of the following intermediates involves Aromatic nucleophilic substitution reaction?

(A) Carbene

(B) Benzyne

(C) Nitrene

(D) Azide

3. Reduction of a ketone to hydrocarbon in presence of hydrazine (NH_2-NH_2) and base is called

(A) Wolff-Kishner reduction

(B) Clemensen reduction

(C) Cannizaro reduction

(D) Mozingo reduction

4. Which of the following can be prepared by Perkin reaction?

(A) Cinnamic acid

(B) Benzaldehyde

(C) Benzilic acid

(D) Cyanohydrin

5. Which of the following exerts +I effect?

(A) $-NO_2$

(B) $-CN$

(C) $-CH_3$

(D) $-COOH$

6. In a compound SP^3 hybridized carbon possesses following geometry

(A) Trigonal planar

(B) Tetrahedral

(C) Octahedral

(D) Square planar

7. According to Fajan's rule which of the following ions has maximum polarizing power?

(A) Na^+

(B) Ca^{2+}

(C) Mg^{2+}

(D) Al^{3+}

8. Which of the following hybridization involves "Trigonal bipyramidal" geometry?
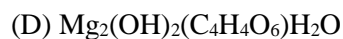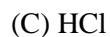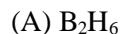
(A) SP^3

(B) SP^2

(C) SP

(D) SP^3d

9. The common name, "Cream of tartar" refers to

(A) $C_4H_5O_6K$

(B) $K(SbO)C_4H_4O_6$

(C) $KNaC_4H_4O_6$

(D) $Mg_2(OH)_2(C_4H_4O_6)H_2O$

10. Following is an example of inter-halogen compound

(A) B_2H_6

(B) NaBr

(C) HCl

(D) IF_7

11. The ratio of Most probable velocity (α), Average velocity (v), Root mean square velocity (u) is

(A) 3.732 : 1.141 : 2.150

(B) 1 : 1.128 : 1.224

(C) 1.041: 1.191 : 3.144

(D) 2.506 : 3.015 : 1.109

12. For an ideal gas

(A) $\left(\dfrac{dU}{dV}\right)_T = 0$

(B) $\left(\dfrac{dH}{dV}\right)_T = 0$

(C) $\left(\dfrac{dT}{dH}\right)_P = 0$

(D) $\left(\dfrac{dG}{dP}\right)_T = 0$

13. According to Raoult's law relative lowering of vapour pressure of a solvent in solution depends on

(A) Mole fraction of solvent

(B) Mole fraction of solute

(C)Mole fraction of the solution

(D) None of the above

14. Which of the following is an example of Photochemical reaction

(A) Photosynthesis

(B) Decomposition of ammonia

(C) Formation of NaOH

(D) Decomposition of HCl

15. For one mole of an ideal gas, the value of $C_p - C_v$ is equal to

(A) $R^2/2$

(B) RT

(C) R

(D) T

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CHEMISTRY (General)

Paper Code : I-B
[New Syllabus]

Full Marks : 60   Time: Two Hours Thirty Minutes

The figures in the margin indicate full marks.
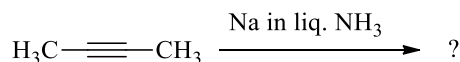Answer total *six* questions taking *two* from each group.

Group – A

[Organic Chemistry]
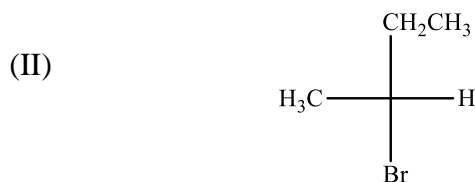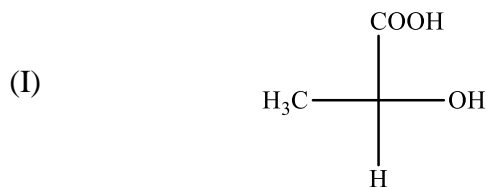
Answer any two questions   10 x 2 = 20

1. (a) Identify the correct product of the following reaction.   2

$$H_3C \equiv CH_3 \xrightarrow{\text{Na in liq. } NH_3} \quad ?$$

(b) Write a note on Markownikoff's rule and peroxide effect.   2 + 2

(c) *n*-Butyl alcohol has higher boiling point than *iso*-butyl alcohol. Explain.   2

(d) Why is benzyl carbocation more stable than ethyl carbocation?   2

2. (a) Assign R/S notation of the following molecules.   2 + 2 = 4

(I)
$$\begin{array}{c} COOH \\ | \\ H_3C - C - OH \\ | \\ H \end{array}$$

(II)
$$\begin{array}{c} CH_2CH_3 \\ | \\ H_3C - C - H \\ | \\ Br \end{array}$$

(b) Predict E/Z configuration of the following molecules. $1 + 1 = 2$

(I)

(II)
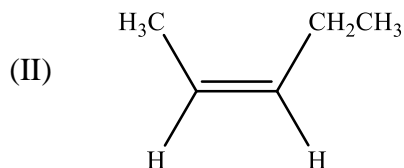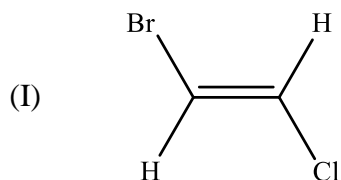
(c) Describe reaction between alkene and OsO_4 followed by hydrolysis.   2

(d) What is active methylene group? Give two examples.   2

3. (a) Write short note on inductive effect and hyper conjugation. $2.5 + 2.5 = 5$

(b) Draw Sawhorse and Newman projection formula for ethane.   2

(c) What is Perkin reaction?   1

(d) Discuss the Huckel's $(4n + 2)$ rule for aromaticity.   2

Group - B

[Inorganic Chemistry]

Answer any two questions $10×2=20$

1. (a) What is meant by effective nuclear charge? Calculate the effective nuclear charge for a $3d$ electron and a $4s$ electron of a Cu atom. $1 + 1 + 1 = 3$

(b) Define ionisation energy. Explain by giving reasons how the ionization energies of elements vary in a group. $1+2=3$

(c) Give reasons why the first ionization energy of nitrogen is higher than that of oxygen.   2

(d) Calculate the wavelength of an electron of mass 9.11×10^{-31} kg moving with a velocity of 2.5×10^{-7} ms^{-1} (Given $h = 6.63 \times 10^{-34}$ J-s).   2

2. (a) Using VSEPR theory, predict and draw the shape of the following molecules :   3

           (i) SF_4

           (ii) NH_3 :

(b) Both BH_3 and NH_3 are tetra-atomic. The dipole moment of BH_3 is zero but NH_3 is having 1·49D. Give reason.   2

(c) Write short note on

    (i) Inert pair effect

    (ii) Pauli's exclusion principle   2.5 + 2.5 = 5

3. (a) What do you mean by diagonal relationship? Give example.   2

(b) Electron affinity of chlorine is greater than that of fluorine. Explain.   2

(c) Between BCl_3 and BF_3 which one is stronger acid and why?   2

(d) H_3PO_2 is monobasic acid but H_3PO_3 is dibasic. Explain.   2

(e) He_2 does not exist. Explain in terms of M.O. theory.   2

Group - C

[Physical Chemistry]

Answer any two questions   10×2=20

7. (a) For ammonia gas Van der Waals constants a and b are 4.0 litre^2 atm mole^{-2} and 0.036 litre mole^{-1} respectively, calculate critical volume. (R=0.0821 litre atm degree^{-1}).   3

(b) Define law of corresponding states.   2

(c) What do you mean by Root mean square velocity or RMS velocity? Give its mathematical expression.   3

(d) Give one example of each extensive and intensive property.   2

8. (a) For an ideal gas, show $\left(\dfrac{dU}{dV}\right)_T = 0$ 3

(b) State Laws of thermochemistry - (i) Lavoisier and Laplas,

(ii) Hess's law of constant heat summation   4

(c) Discuss the main differences between lyophilic and lyophobic colloids.   3

9. (a) State Lambert-Beer's law in photochemistry. Give its mathematical expression.   3

(b) Deltas are formed at a place where the rivers pour their water into the sea. Explain   2

(c) What is Brownian motion?   2

(d) The molal elevation constant for water is $0.513°$ C kg mol^{-1}. When 0.2 mole of sugar is dissolved in 250 g of water, calculate the temperature at which the solution boils under atmospheric pressure.   3