21/08/2022
Slot-2

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Answers & Solutions

for

CUET UG-2022

(Chemistry)

Time : 45 min. M.M. : 200

IMPORTANT INSTRUCTIONS:

1. The test is of 45 Minutes duration.
2. The test contains 50 Questions out of which 40 questions need to be attempted.
3. Marking Scheme of the test:
   a. Correct answer or the most appropriate answer: Five marks (+5)
   b. Any incorrect option marked will be given minus one mark (–1).
   c. Unanswered/Marked for Review will be given no mark (0).

Choose the correct answer :

Question ID: 1101051

In which of the following close packed structures, the radii r of their spheres respectively is correctly represented?

(A) hcp, bcc : $\frac{\sqrt{3}}{4}a, \frac{a}{2\sqrt{2}}$

(B) hcp, ccp : $\frac{a}{2\sqrt{2}}, \frac{a}{2\sqrt{2}}$

(C) bcc, simple cubic : $\frac{a}{2\sqrt{2}}, 2a$

(D) ccp, simple cubic : $\frac{a}{2\sqrt{2}}, a^2$

Answer (B)

Sol. In hcp,

$$4r = \sqrt{2}a$$

$$r = \frac{\sqrt{2}a}{4} = \frac{a}{2\sqrt{2}}$$

In ccp,

$$4r = \sqrt{2}a$$

$$r = \frac{\sqrt{2}a}{4} = \frac{a}{2\sqrt{2}}$$

hcp, ccp : $\frac{a}{2\sqrt{2}}, \frac{a}{2\sqrt{2}}$

Question ID: 1101052

Which of the following are not characteristic properties of ionic solids?

A. The bonding forces are Coulombic or electrostatic attraction.

B. They are hard but brittle.

C. They are malleable and ductile.

D. They are insulators in solid and liquid states.

E. Their melting points are high.

Choose their **correct** answer from the options given below.

1. A and B only
2. B and D only
3. C and D only
4. A and E only

(A) 1 (B) 2

(C) 3 (D) 4

Answer (C)

Sol.

- Ionic solids are not malleable and ductile. But metallic solids are highly malleable and ductile.
- Ionic solids are electrical insulators in the solid state. However, in the molten state or when dissolved in water, the ions become free to move about and they conduct electricity.

Question ID: 1101053

AIN is an example of

1. Molecular solid
2. Covalent solid
3. Metallic solid
4. Ionic solid

(A) 1 (B) 2

(C) 3 (D) 4

Answer (B)

Sol. AIN is an example of covalent or network solids.

Question ID: 1101054

The **incorrect** statement about azeotropes is

1. They are binary mixtures of liquids.
2. The composition remains the same in liquid and vapour phase, at constant temperature.
3. The components can be separated by fractional distillation.
4. They show deviations from Raoult's law.

(A) 1 (B) 2

(C) 3 (D) 4

Answer (C)

Sol.

- Azeotropes are binary mixtures of liquids.
- Azeotropes having the same composition in liquid and vapour phase, at constant temperature.
- In azeotropes, it is not possible to separate the component by fractional distillation.

Question ID: 1101055

The values of Henry's law constant for the given gases in water, at 293 K, are

I. He - 144.97/K bar II. H_2 - 69.16/K bar

III. N_2 - 76.48/K bar IV. O_2 - 34.86/K bar

Which gas has the lowest solubility in water?

(A) He (B) H_2

(C) N_2 (D) O_2

Answer (A)

Sol.
- Higher the value of Henry's law constant (K_H) at a given pressure and temperature, the lower is the solubility of the gas in the liquid.
- He has maximum value of K_H among the following gases. Hence, it is lowest soluble in water.

Question ID: 1101056

Which one of the following will have the highest value of van't Hoff factor, i?

1. K_2SO_4 2. $MgSO_4$
3. KCl 4. NaCl

(A) 1 (B) 2

(C) 3 (D) 4

Answer (A)

Sol. van't Hoff factor (i) = 1 + α(n – 1)

[$\therefore$ α = 1 for all strong electrolytes]

(1) K_2SO_4; (n = 3)

i = 1 + (3 – 1) = 3

(2) $MgSO_4$; (n = 2)

i = 1 + (2 – 1) = 2

(3) KCl; (n = 2)

i = 1 + (2 – 1) = 2

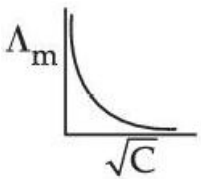
(4) NaCl; (n = 2)

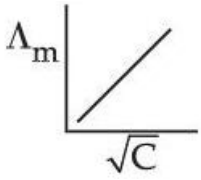
i = 1 + (2 – 1) = 2

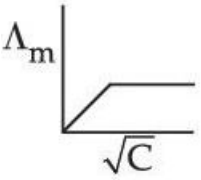
- K_2SO_4 has highest value of i.

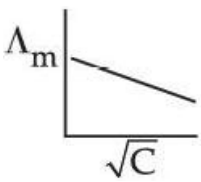
Question ID:1101057

The variation of Λ_m with $\sqrt{c}$ for a strong electrolyte is shown in the graph. Identify the correct representation for the same.

(A) 

(B) 

(C) 

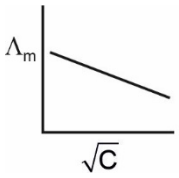
(D) 

Answer (D)

Sol.
- For strong electrolytes

$\Lambda_m = \Lambda_m^\circ - A\sqrt{C}$

Y = C + MX



- For strong electrolytes, Λ_m increase slowly with dilution and the plot of Λ_m against $\sqrt{C}$, we obtain a straight line.

Question ID:1101058

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

The quantity of charge, in coulombs, needed to reduce 1 mole of $Cr_2O_7^{2-}$ is

(Given 1 F = 96500 C mol^{-1})

(A) 57.9×10^5C (B) 5.79×10^5C

(C) 1.9×10^5C (D) 19.3×10^5C

Answer (B)

Sol. $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

- Faraday's law of electrolysis

Mole × n-factor = $\frac{Q}{F}$ [$\therefore$ n-factor = 6]

$1 \times 6 = \frac{Q}{F}$

Q = 6F

= 6 × 96500

= 579000C

Q = 5.79×10^5C

Question ID:1101059

Identify the correct equations for the emf of a cell at equilibrium.

(A) $E^\theta_{cell} = \frac{2.303RT}{nF}\log K_C$

(B) $E^\theta_{cell} = \frac{\Delta G}{nF}$

(C) $E_{cell} = E^\theta_{cell} - \frac{RT}{nF}\ln\frac{[Products]}{[Reactants]}$

(D) $E^\theta_{cell} = E^\theta_{left} - E^\theta_{right}$

Choose the **correct** answer from the options given below:

(A) (A) and (C) only (B) (A) and (B) only

(C) (B) and (C) only (D) (C) and (D) only

Answer (A)

Sol. • Nerst equation

$$E_{cell} = E^{o}_{cell} - \frac{RT}{nF}\ln\frac{[Product]}{[Reactant]}$$

$$\left[\therefore\ Q = \frac{[Product]}{[Reactant]}\right]$$

At equilibrium, $E_{cell} = 0$ and $Q = K_C$

$$E^{o}_{cell} = \frac{2.303RT}{nF}\log K_C$$

- $\Delta G^{o} = -nFE^{o}_{cell}$
- $E^{o}_{cell} = E^{o}_{right} - E^{o}_{left}$

Question ID:1101060

Which one of the following electrolytes will have maximum coagulating power for AgI/I^- sol?

(A) NaCl (B) $Ba(NO_3)_2$

(C) $Al_2(SO_4)_3$ (D) Na_2SO_4

Answer (C)

Sol. • Hardy-Schulze rule

Greater the valence of the coagulating ion added, the greater is its power to cause precipitation.

- In the coagulation of a negative sol, (AgI/I^-) the coagulation power is maximum for $Al_2(SO_4)_3$
- The coagulation power is in the order :

$Al^{3+} > Ba^{2+} > Na^{+}$

Question ID:1101061

The movement of colloidal particles from a colloidal solution, under the influence of applied electric potential towards one or the other electrode is called

(A) Brownian movement

(B) Electro osmosis

(C) Electrodialysis

(D) Electrophorosis

Answer (D)

Sol. The movement of colloidal particles under an applied electric potential is called electrophoresis.

Question ID:1101062

Match List-I with List-II.

	List-I (Metal/Alloy)		**List-II (Uses)**
A.	Cast iron	I.	Cutting tools and crushing machines
B.	Nickel steel	II.	Railway sleepers
C.	Chrome steel	III.	Cables, automobiles, aeroplane parts
D.	Stainless steel	IV.	Cycles, automobile parts

Choose the **correct** answer from the options given below :

(A) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)

(B) (A)-(II), (B)-(I), (C)-(III), (D)-(IV)

(C) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)

(D) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

Answer (D)

Sol. • Cast iron is used for casting stoves, railway sleepers, gutter piper, toys, etc.

- Nickel steel is used for making cables, automobiles and aeroplane parts, etc.
- Chrome steel is used for cutting tools and crushing machines.
- Stainless steel is used for cycles, automobiles, utensils, pen, etc.

	List-I		**List-II**
A.	Cast iron	II.	Railway sleepers
B.	Nickel steel	III.	Cables, automobiles, aeroplane parts
C.	Chrome steel	I.	Cutting tools and crushing machines
D.	Stainless steel	IV.	Cycles, automobile parts

(A)-(II), (B)-(III), (C)-(I), (D)-(IV)

Question ID 1101063

Match List I with List II

List I (Alloys)	List II (Constituents)
(A) Brass	(I) Copper + tin
(B) German Silver	(II) Copper + Zinc
(C) Coinage alloy	(III) Copper + Zinc + Nickel
(D) Bronze	(IV) Copper + Nickel

Choose the correct answer from the options given below :

(A) A(IV), B(I), C(II), D(III)

(B) A(III), B(IV), C(I), D(II)

(C) A(II), B(III), C(IV), D(I)

(D) A(IV), B(I), C(III), D(II)

Answer (C)

Sol.

List I (Alloys)	List II (Constituents)
(A) Brass	(II) Copper + Zinc
(B) German Silver	(III) Copper + Zinc + Nickel
(C) Coinage alloy	(IV) Copper + Nickel
(D) Bronze	(I) Copper + tin

A-(II), B(III), C(IV), D(I)

Question ID 1101064

Which one of the following metals produces dinitrogen oxide with dilute nitric acid and nitrogen dioxide with concentrated nitric acid?

(A) Copper

(B) Silver

(C) Zinc

(D) Cobalt

Answer (C)

Sol.

I. $4Zn + 10\ HNO_3(\text{dilute}) \longrightarrow 4Zn(NO_3)_2 + 5H_2O + N_2O$

II. $Zn + 4HNO_3\ (\text{Conc.}) \longrightarrow Zn(NO_3)_2 + H_2O + 2N_2O$

zinc react with dilute nitric acid to given dinitrogen oxide and with concentrated acid to give nitrogen dioxide.

Question ID 1101065

$2SO_{2(g)} + O_{2(g)} \xrightarrow{V_2O_5} 2SO_{3(g)}\ \Delta H = -196.6\ kJ\ mol^{-1}$

For the above given reaction, identify the incorrect statement from the following

(A) It is an exothermic reaction

(B) It is a reversible reaction

(C) The forward reaction leads to an increase in volume

(D) The forward reaction leads to a decrease in volume

Answer (C)

Sol. $2SO_2(g) + O_2(g) \rightleftharpoons^{V_2O_5} 2SO_3(g)$

- $\Delta H = -196.6\ kJ\ mol^{-1}$ Hence it is an exothermic reaction .
- It is a reversible reaction.
- When volume decreases reaction move in such direction where number of gases molecules are minimum. Hence reaction moves in forward direction leads to the formation of product.

Question ID 1101066

Match List I with List II

List I (Oxides of nitrogen)	List II (Proper method of preparation)
(A) N_2O	(I) Prepared from sodium nitrite
(B) N_2O_3	(II) Dimerises easily
(C) NO_2	(III) Blue solid
(D) NO	(IV) Prepared by heating ammonium nitrate

Choose the correct answer from the options given below :

(A) A(III), B(IV), C(II), D(I)

(B) A(IV), B(I), C(III), D(II)

(C) A(I), B(II), C(IV), D(III)

(D) A(IV), B(III), C(II), D(I)

Answer (D)

Sol.

- $NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$
- $2NaNO_2 + 2FeSO_4 + 3H_2SO_4 \longrightarrow Fe_2(SO_4)_3 + 2NaHSO_4 + 2H_2O + 2NO$

- NO_2 contains odd number of valence electrons. On dimerization, it is converted to stable N_2O_4 molecule with even number of electrons
- N_2O_3 is blue solid

List I (Oxides of nitrogen)	List II (Proper method of preparation)
(A) N_2O	(IV) Prepared by heating ammonium nitrate
(B) N_2O_3	(III) Blue solid
(C) NO_2	(II) Dimerises easily
(D) NO	(I) Prepared from sodium nitrite

(D) A(IV), B(III), C(II), D(I)

Question ID 1101067

Oxygen shows anomalous behaviour due to its :

(A) Small size

(B) Covalency of four

(C) High electronegativity

(D) Tendency to form weak H-bonds

Choose the correct answer from the options given below:

(A) (A) and (B) only

(B) (B) and (C) only

(C) (C) and (D) only

(D) (A) and (C) only

Answer (D)

Sol. Oxygen show anomalous behaviour due to its :

- Small size
- High electronegativity in the presence of strong hydrogen bonding in H_2O

Question ID 1101068

The presence of SO_2 is not detected by

(A) Its characteristic pungent smell

(B) Turning of red litmus blue

(C) Turning of acidified potassium dichromate solution green

(D) Decolorisation of acidified potassium permanganate solution

Answer (C)

Sol.

- SO_2 is colourless gas with pungent smell
- SO_2 decolouriser acidified potassium paramagnet solution

$$2SO_2 + 2MnO_4^- + 2H_2O \longrightarrow 4SO_4^{2-} + 4H^+ + 2Mn^{2+}$$

- SO_2 tuns acidified K2Cr2O7 solution green

$$K_2Cr_2O_7 + 3SO_2 + H_2SO_4 \longrightarrow K_2SO_4 + \underset{\text{(Green)}}{Cr_2(SO_4)_3} + H_2O$$

- SO_2 is acidic oxides, so it turns blue litmus paper into red.

Question ID: 1101069

Which one of the following ions would be coloured?

(A) Cu^+ (B) Ni^{2+}

(C) Mn^{2+} (D) Sc^{3+}

(E) Fe^{3+}

Choose the **correct** answer from the options given below:

(A) (A), (D) and (E) only

(B) (A), (B) and (C) only

(C) (B), (C) and (E) only

(D) (C), (D) and (E) only

Answer (C)

Sol.

	Configuration	Example	Colour
(A)	Cu^+	$3d^{10}$	Colourless
(B)	Ni^{2+}	$3d^8$	green
(C)	Mn^{2+}	$3d^5$	pink
(D)	Sc^{3+}	$3d^0$	Colourless
(E)	Fe^{3+}	$3d^5$	yellow

Ni^{2+}, Mn^{2+} and Fe^{3+} is coloured

Question ID: 1101070

The basic oxide of chromium is:

(A) CrO (B) Cr_2O_3

(C) CrO_2 (D) CrO_3

Answer (A)

Sol.

Oxide	Nature
CrO	Basic
Cr_2O_3	Amphoteric
CrO_2	Acidic
CrO_3	Acidic

Question ID: 1101071

The species, which is not a ligand is:

(A) NO_3^- (B) NO

(C) NO^+ (D) NO_2

Answer (D)

Sol.
- NO_2 is not a ligand
- NO_2^- is a ligand

Question ID: 1101072

Which of the following is a limitation of crystal field theory ?

(A) It explains the formation and structures of the coordination compound.

(B) The colour and magnetic properties can be predicted.

(C) The covalent character of bonding between the ligand and the central atom is not taken into account.

(D) Assumes that ligands are point charges.

Answer (C)

Sol.
- Crystal field theory does not take into account the covalent character of bonding between the ligand and the central atom.
- Crystal field theory consider only electrostatic interaction between the metal ion and the ligand.

Question ID: 1101073

Which one of the following will yield the highest splitting of *d* orbitals?

(A) S^{2-} (B) OH^-

(C) CN^- (D) $Edta^{4-}$

Answer (C)

Sol.
- The crystal field splitting Δ_0, depends upon the field produced by the ligand and charge on the metal of ion.
- Order of field strength of ligands is $S^{2-} < OH^- < Edta^{4-} < CN^-$
- CN^- yield the hight splitting of *d*-orbitals

Question ID: 1101074

Identify the correct IUPAC name for the complex.

$[(Co(H_2NCH_2CH_2NH_2)_3]_2\ (SO_4)_3$

(A) triethylene diamine cobalt(II) sulphate

(B) triethaneammine cobalt(II) trisulphate

(C) tris (ethane-1,2-diamine) cobalt(III) sulphate

(D) tri (ethane-1,2-diamine) cobalt(II) sulphate

Answer (C)

Sol. $[Co(H_2NCH_2CH_2NH_2)_3]_2\ (SO_4)_3$

IUPAC name = tris (ethane-1,2-diamine) cobalt(III) Sulphate

Question ID: 1101075

The product due to racemisation is optically inactive because :

(1) an optically inactive compound is obtained

(2) a compound with inversion of configuration is obtained.

(3) an enantiomer is obtained

(4) two enantiomers in equal proportion are obtained.

(A) 1 (B) 2

(C) 3 (D) 4

Answer (D)

Sol. When 50 : 50 mixture of two enantiomers is obtained then the process is called racemisation and the product is optically inactive, as one isomer will rotate light in the direction opposite to another.

Question ID: 1101076

The species which does not show high reactivity towards S_N1 reaction is :

(1) Primary halide (2) Allylic halide

(3) Benzylic halide (4) Tertiary halide

(A) 1 (B) 2

(C) 3 (D) 4

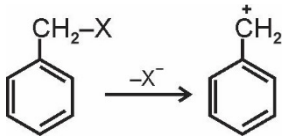
Answer (A)

Sol. • Species which form highly stable carbocation will show high reactivity toward S_N1 reaction

Primary halide → $CH_3–CH_2–X \xrightarrow{-X^-} CH_3 - \overset{+}{C}H_2$

Allylic halide → $CH_2 = CH - CH_2 - X$

$$\xrightarrow{-X^-} CH_2 = CH - \overset{+}{C}H_2$$

Benzylic halide → 

Tertiary halide → $CH_3 - \underset{CH_3}{\overset{CH_3}{C}} - X \xrightarrow{-X^-} CH_3 - \underset{CH_3}{\overset{CH_3}{\overset{+}{C}}}$

- Primary carbocation is least stable so it does not show high reactivity towards S_N1 reaction

Question ID: 1101077

Which one amongst the following has highest ionisation enthalpy?

(1) oxygen (2) sulphur

(3) selenium (4) tellurium

(A) 1 (B) 2

(C) 3 (D) 4

Answer (A)

Sol.

Elements	Ionisation enthalpy (kJ mol^{-1})
Oxygen	1314
Sulphur	1000
Selenium	941
Tellurium	869

Question ID: 1101078

Arrange the following in the increasing order of effective delocalisation of negative charge in phenoxide ion :

(A) 2, 4, 6-trinitrophenol (B) 3, 5-dinitrophenol

(C) 4-methylphenol (D) 3-nitrophenol

The **correct** option is :

(1) (C) < (D) < (B) < (A) (2) (A) < (B) < (D) < (C)

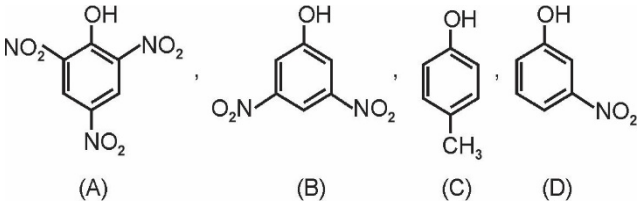
(3) (C) < (D) < (A) < (B) (4) (B) < (A) < (C) < (D)

(A) 1 (B) 2

(C) 3 (D) 4

Answer (A)

Sol. • More electron withdrawing groups attached with phenol at ortho or para position more effectively delocalisation of negative charge in phenoxide ion takes place.



(A) (B) (C) (D)

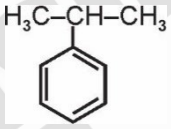
- (A) has maximum electron withdrawing group at ortho and para position.

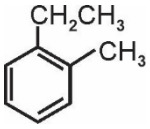
Order of delocalisation of negative charge is :

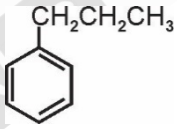
(C) < (D) < (B) < (A)

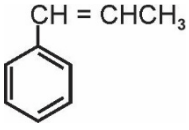
Question ID: 1101079

Which is used in preparation of phenol has the structure?

(1) 

(2) 

(3) 

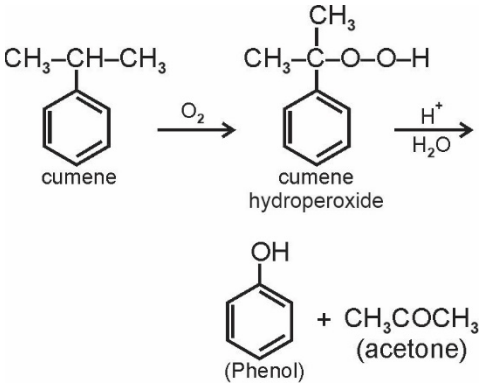
(4) 

(A) 1 (B) 2

(C) 3 (D) 4

Answer (A)

Sol. • From cumene phenol is manufactured by oxidation in the presence of air to cumene hydroperoxide. It is converted to phenol and acetone by treating it with dilute acid.



Question ID: 1101080

The mechanism of the acid catalysed hydration of alkenes involves :

(A) Nucleophilic attack of water on carbocation

(B) deprotonation to form an alcohol

(C) Protonation of water

(D) Protonation of alkene to form carbocation by electrophilic attack of H_3O^+.

Arrange the above steps in **correct** order.

(1) (C), (D), (A), (B) (2) (D), (C), (B), (A)

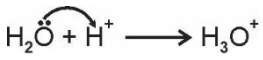
(3) (A), (B), (C), (D) (4) (C), (B), (A), (D)

(A) 1 (B) 2

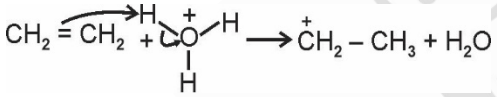
(C) 3 (D) 4

Answer (A)

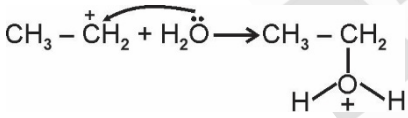
Sol. **Step-1** Protonation of water



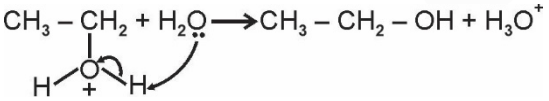
Step-2 Protonation of alkene to form carbocation by electrophilic attack of H_3O^+



Step-3 Nucleophilic attack of water on carbocation



Step-4 Deprotonation to form an alcohol

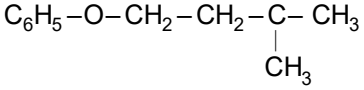


Correct arrangement of above steps is

(C) → (D) → (A) → (B)

Question ID:1101081

The IUPAC name of the given compound



(A) 2-Methylbutoxybenzene

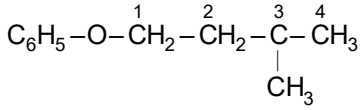
(B) 3-Methylbutoxybenzene

(C) 3-Methylphenoxybenzene

(D) 2-methyl-4-phenoxybutane

Answer (B)

Sol.



3-Methylbutoxybenzene

Question ID:1101082

$C_6H_5COOC_2H_5$ on acid catalysed hydrolysis produces:

(A) Benzoic acid + Ethanol

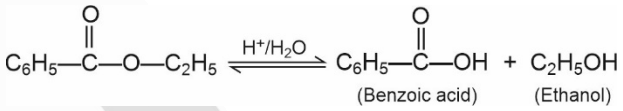
(B) Ethanoic acid + Phenol

(C) Benzoic acid + Ethanoic acid

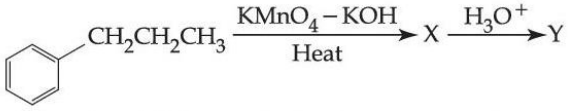
(D) Ethanoic acid + Benzene

Answer (A)

Sol.

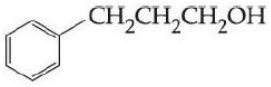


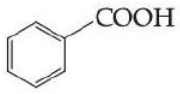
Question ID:1101083

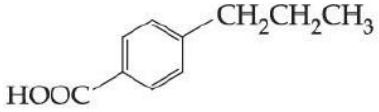


The product 'Y' formed in the above reaction is:

(A) 

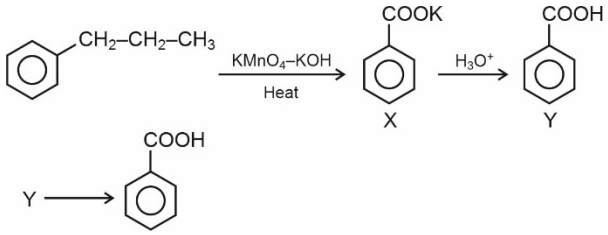
(B) 

(C) 

(D) 

Answer (C)

Sol.



Question ID:1101084

The reagent which converts alkylbenzenes to carboxylic acids is:

(A) CrO_2Cl_2

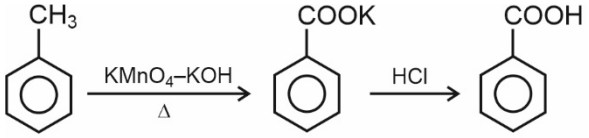
(B) CrO_3

(C) Anhydrous $AlCl_3/CuCl$

(D) $KMnO_4$ – KOH/Δ, HCl

Answer (D)

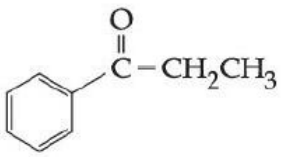
Sol. Let alkyl benzene is 

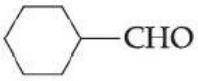


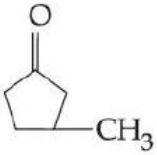
(Benzoic acid)

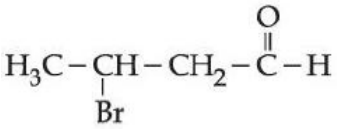
Question ID:1101085

Which one of the following will be named as a carbaldehyde?

(A) 

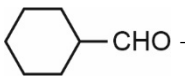
(B) 

(C) 

(D) 

Answer (D)

Sol. When the aldehyde group is attached to a ring, the suffix carbaldehyde is added after the full name of cycloalkane.

 → Cyclohexane carbaldehyde

Question ID: 1101086

Water soluble vitamins are

(A) Vitamin A (B) Vitamin D

(C) Vitamin B (D) Vitamin C

(E) Vitamin E

Choose the most appropriate answer from the options given below:

(A) (A) and (B) only (B) (B) and (C) only

(C) (C) and (D) only (D) (D) and (E) only

Answer (C)

Sol. Water soluble vitamins are B and C.

Question ID: 1101087

Terylene is also known as:

(A) Orlon (B) Acrilan

(C) Dacron (D) Teflon

Answer (C)

Sol. Terylene is also known as Dacron.

Question ID: 1101088

The weakest intermolecular forces are present in

(A) Neoprene (B) Nylon 6, 6

(C) Polyvinyl chloride (D) Polystyrene

Answer (A)

Sol. Weakest intermolecular forces are present in elastomers such as neoprene.

Question ID: 1101089

Receptors as drug targets are actually:

(A) Lipids (B) Carbohydrates

(C) Nucleic acids (D) Proteins

Answer (D)

Sol. Receptors as drug targets are actually proteins.

Question ID: 1101090

Which one of the following is refined by van Arkel method?

(A) Titanium (B) Germanium

(C) Zinc (D) Tin

Answer (A)

Sol. van Arkel method is use to refine Ti or Zr

$$\underset{\text{impure}}{Ti} + 2I_2 \xrightarrow{523\ K} TiI_4(g)$$

$$TiI_4(g) \xrightarrow{1700\ K} \underset{\text{Pure}}{Ti} + 2I_2$$

Question ID:1101091

Read the passage given below and answer based it.

The rate of a reaction is concerned with decrease in concentration of reactants or increase in concentration of products per unit time. It can be expressed as instantaneous rate at a particular instant of time and average rate over a large interval of time. A number of factors such as temperature, concentration of reactants, catalyst, affect the rate of a reaction. Mathematical representation of rate of a reaction is given by rate law. It has to be determined experimentally and cannot be predicted. Order of a reaction with respect to a reactant is the power of its concentration which appears in the rate law equation. Molecularity is defined only for an elementary reaction. Molecularity and order of an elementary reaction are same.

Which of the following expressions is correct for the rate of the reaction given below?

$$H_2O_2(aq) + 3I^-(aq) + 2H^+ \rightarrow 2H_2O(l) + I_3^-$$

(1) $\frac{\Delta[I^-]}{\Delta t} = 3\frac{[\Delta H^+]}{\Delta t}$

(2) $\frac{\Delta[I^-]}{\Delta t} = \frac{2}{3}\frac{[\Delta H^+]}{\Delta t}$

(3) $\frac{\Delta[I^-]}{\Delta t} = \frac{3}{2}\frac{[\Delta H^+]}{\Delta t}$

(4) $\frac{\Delta[I^-]}{\Delta t} = 2\frac{[\Delta H^+]}{\Delta t}$

(A) 1 (B) 2

(C) 3 (D) 4

Answer (C)

Sol. $H_2O_2 + 3I^- + 2H^+ \rightarrow 2H_2O + I_3^-$

$$\text{Rate} = \frac{-\Delta[H_2O_2]}{\Delta t} = \frac{-1}{3}\frac{\Delta[I^-]}{\Delta t} = \frac{-1}{2}\frac{[\Delta H^+]}{\Delta t} = \frac{1}{2}\frac{\Delta[H_2O]}{\Delta t} = \frac{\Delta\left[I_3^-\right]}{\Delta t}$$

$$\frac{\Delta[I^-]}{\Delta t} = \frac{3}{2}\frac{[\Delta H^+]}{\Delta t}$$

Question ID:1101092

Read the passage given below and answer based it.

The rate of a reaction is concerned with decrease in concentration of reactants or increase in concentration of products per unit time. It can be expressed as instantaneous rate at a particular instant of time and average rate over a large interval of time. A number of factors such as temperature, concentration of reactants, catalyst, affect the rate of a reaction. Mathematical representation of rate of a reaction is given by rate law. It has to be determined experimentally and cannot be predicted. Order of a reaction with respect to a reactant is the power of its concentration which appears in the rate law equation. Molecularity is defined only for an elementary reaction. Molecularity and order of an elementary reaction are same.

Rate constant for a first order reaction is $0.3465 \times 10^{-3}\ s^{-1}$. The $t_{1/2}$ for the same reaction is:

(1) 2000 s (2) 33.33 hr

(3) 0.555×10^3 hr (4) 2×10^{-3} s

(A) 1 (B) 2

(C) 3 (D) 4

Answer (A)

Sol. $t_{1/2} = \frac{0.693}{k} = \frac{0.693}{0.3465 \times 10^{-3}}$

= 2000 s

Question ID:1101093

Read the passage given below and answer based it.

The rate of a reaction is concerned with decrease in concentration of reactants or increase in concentration of products per unit time. It can be expressed as instantaneous rate at a particular instant of time and average rate over a large interval of time. A number of factors such as temperature, concentration of reactants, catalyst, affect the rate of a reaction. Mathematical representation of rate of a reaction is given by rate law. It has to be determined experimentally and cannot be predicted. Order of a reaction with

respect to a reactant is the power of its concentration which appears in the rate law equation. Molecularity is defined only for an elementary reaction. Molecularity and order of an elementary reaction are same.

75% of a first order reaction was completed in 32 minutes. 50% of the reaction was completed in

(1) 24 minutes (2) 16 minutes

(3) 8 minutes (4) 4 minutes

(A) 1 (B) 2

(C) 3 (D) 4

Answer (B)

Sol. $\because \quad t_{75\%} = 2t_{50\%}$

$\therefore \quad t_{50\%} = \frac{t_{75\%}}{2} = \frac{32}{2} = 16\,\text{min}$

Question ID:1101094

Read the passage given below and answer based it.

The rate of a reaction is concerned with decrease in concentration of reactants or increase in concentration of products per unit time. It can be expressed as instantaneous rate at a particular instant of time and average rate over a large interval of time. A number of factors such as temperature, concentration of reactants, catalyst, affect the rate of a reaction. Mathematical representation of rate of a reaction is given by rate law. It has to be determined experimentally and cannot be predicted. Order of a reaction with respect to a reactant is the power of its concentration which appears in the rate law equation. Molecularity is defined only of its concentration which appears in the rate law equation. Molecularity is defined only for an elementary reaction. Molecularity and order of an elementary reaction are same.

Given below is a biomolecular elementary reaction.

$2HI \rightarrow H_2 + I_2$

The order of the above reaction is

(1) 1 (2) 0

(3) 2 (4) 2.5

(A) 1 (B) 2

(C) 3 (D) 4

Answer (C)

Sol. $2HI \longrightarrow H_2 + I_2$

The order of above reaction is 2 i.e. $r = k[HI]^2$

Question ID:1101095

Read the passage given below and answer based it.

The rate of a reaction is concerned with decrease in concentration of reactants or increase in concentration of products per unit time. It can be expressed as instantaneous rate at a particular instant of time and average rate over a large interval of time. A number of factors such as temperature, concentration of reactants, catalyst, affect the rate of a reaction. Mathematical representation of rate of a reaction is given by rate law. It has to be determined experimentally and cannot be predicted. Order of a reaction with respect to a reactant is the power of its concentration which appears in the rate law equation. Molecularity is defined only for an elementary reaction. Molecularity and order of an elementary reaction are same.

(1) Order and molecularity for an elementary reaction are always same

(2) Rate of reaction can be expressed as increase in concentration of products formed in unit time

(3) Rate law can be written with the help of balanced chemical equation

(4) Rate of reaction depends upon temperature of the reaction

(A) 1 (B) 2

(C) 3 (D) 4

Answer (C)

Sol. Rate law of reaction can only be determined by the experimental methods.

Questions ID : 1101096

Passage:

Read the passage given and answer the questions.

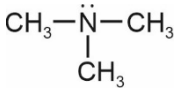
Amines constitute an important class of organic compounds derived by replacing one or more hydrogen atoms of ammonia molecule by alkyl/aryl group(s). Like ammonia, nitrogen atom of amines is trivalent and carries an unshared pair of electrons. Nitrogen orbitals in amines are therefore, sp^3 hybridised and the geometry of amines is pyramidal. Amines are classified as primary (1°), secondary (2°) and tertiary (3°) depending upon the number of hydrogen atoms replaced by alkyl or aryl groups in ammonia molecule. Due to the electron releasing nature of alkyl group, it (R) pushes electrons towards nitrogen and thus, makes the unshared electron pair more available for sharing with the proton of the acid. Moreover, the substituted ammonium ion formed from the amine gets stabilised due to dispersal of the positive charge by the +I effect of the alkyl group. Hence, alkyl amines are stronger bases than ammonia. Thus, the basic nature of aliphatic amines should increase with increase in the number alkyl groups. The order of basicity of amines of amines in the gaseous phase follows the expected order: 3° > 2° > 1° > NH_3. Adrenaline and ephedrine both containing 2° amino group used to increase blood pressure. Well known antihistamine drug Bendadryl also contains 3

Find out the hybridization of nitrogen in N, N-dimethyl methanamine.

(A) sp^2 (B) sp

(C) d^2sp^3 (D) sp^3

Answer (D)

Sol. 

Hybridisation of N, N-dimethyl methenamine is sp^3 as nitrogen has three bond pairs and one lone pair

Questions ID : 1101097

Passage:

Read the passage given and answer the questions.

Amines constitute an important class of organic compounds derived by replacing one or more hydrogen atoms of ammonia molecule by alkyl/aryl group(s). Like ammonia, nitrogen atom of amines is trivalent and carries an unshared pair of electrons. Nitrogen orbitals in amines are therefore, sp^3 hybridised and the geometry of amines is pyramidal. Amines are classified as primary (1°), secondary (2°) and tertiary (3°) depending upon the number of hydrogen atoms replaced by alkyl or aryl groups in ammonia molecule. Due to the electron releasing nature of alkyl group, it (R) pushes electrons towards nitrogen and thus, makes the unshared electron pair more available for sharing with the proton of the acid. Moreover, the substituted ammonium ion formed from the amine gets stabilised due to dispersal of the positive charge by the +I effect of the alkyl group. Hence, alkyl amines are stronger bases than ammonia. Thus, the basic nature of aliphatic amines should increase with increase in the number alkyl groups. The order of basicity of amines of amines in the gaseous phase follows the expected order: 3° > 2° > 1° > NH_3. Adrenaline and ephedrine both containing 2° amino group used to increase blood pressure. Well known antihistamine drug Bendadryl also contains 3

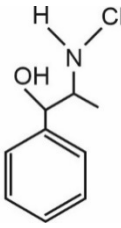
From the following, which one contains tertiary amino group?

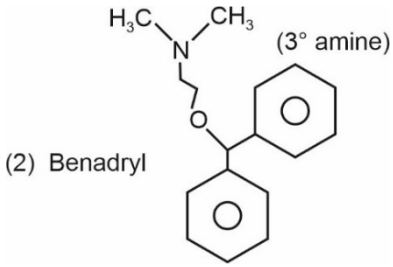
(A) Ephedrine (B) Benadryl

(C) Ammonia (D) Adrenaline

Answer (B)

Sol.

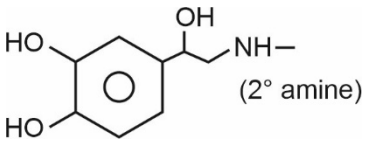
(1) Ephedrine  (2° amine)



(2) Benadryl

(3) Ammonia NH_3

(4) Adrenaline



- Benadryl has tertiary amino group.

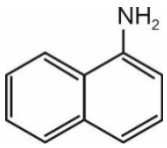
Questions ID : 1101098

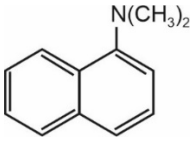
Passage:

Read the passage given and answer the questions.

Amines constitute an important class of organic compounds derived by replacing one or more hydrogen atoms of ammonia molecule by alkyl/aryl group(s). Like ammonia, nitrogen atom of amines is trivalent and carries an unshared pair of electrons. Nitrogen orbitals in amines are therefore, sp^3 hybridised and the geometry of amines is pyramidal. Amines are classified as primary (1°), secondary (2°) and tertiary (3°) depending upon the number of hydrogen atoms replaced by alkyl or aryl groups in ammonia molecule. Due to the electron releasing nature of alkyl group, it (R) pushes electrons towards nitrogen and thus, makes the unshared electron pair more available for sharing with the proton of the acid. Moreover, the substituted ammonium ion formed from the amine gets stabilised due to dispersal of the positive charge by the +I effect of the alkyl group. Hence, alkyl amines are stronger bases than ammonia. Thus, the basic nature of aliphatic amines should increase with increase in the number alkyl groups. The order of basicity of amines of amines in the gaseous phase follows the expected order: 3° > 2° > 1° > NH_3. Adrenaline and ephedrine both containing 2° amino group used to increase blood pressure. Well known antihistamine drug Bendadryl also contains 3

Identify the secondary amine from the following given amines.

(A) 

(B) 

(C) $(C_2H_5)_2CHNH_2$

(D) $(C_2H_5)_2NH$

Choose the **correct** answer from the options given below:

(1) (A) and (C) only

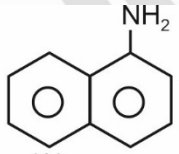
(2) (C) and (D) only

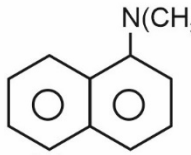
(3) (B) and (D) only

(4) Only (D)

Answer (D)

Sol.

- 

(A) (1° Amine)
- 

(B) (3° Amine)
- $(C_2H_5)_2 CHNH_2$ (1° Amine)
(C)
- $(C_2H_5)_2 NH$ (2° Amine)
(D)

Questions ID : 1101099

Passage:

Read the passage given and answer the questions.

Amines constitute an important class of organic compounds derived by replacing one or more hydrogen atoms of ammonia molecule by alkyl/aryl group(s). Like ammonia, nitrogen atom of amines is trivalent and carries an unshared pair of electrons. Nitrogen orbitals in amines are therefore, sp^3

hybridised and the geometry of amines is pyramidal. Amines are classified as primary (1°), secondary (2°) and tertiary (3°) depending upon the number of hydrogen atoms replaced by alkyl or aryl groups in ammonia molecule. Due to the electron releasing nature of alkyl group, it (R) pushes electrons towards nitrogen and thus, makes the unshared electron pair more available for sharing with the proton of the acid. Moreover, the substituted ammonium ion formed from the amine gets stabilised due to dispersal of the positive charge by the +I effect of the alkyl group. Hence, alkyl amines are stronger bases than ammonia. Thus, the basic nature of aliphatic amines should increase with increase in the number alkyl groups. The order of basicity of amines of amines in the gaseous phase follows the expected order: 3° > 2° > 1° > NH_3. Adrenaline and ephedrine both containing 2° amino group used to increase blood pressure. Well known antihistamine drug Bendadryl also contains 3

Among the following, the weakest base is:

(A) $C_2H_5NH_2$ (B) $(C_2H_5)_2NH$

(C) $(C_2H_5)_3N$ (D) NH_3

Answer (D)

Sol. Order of basicity

$(C_2H_5)_2NH > (C_2H_5)_3N > C_2H_5NH_2 > NH_3$

Questions ID : 110100

Passage:

Read the passage given and answer the questions.

Amines constitute an important class of organic compounds derived by replacing one or more hydrogen atoms of ammonia molecule by alkyl/aryl group(s). Like ammonia, nitrogen atom of amines is trivalent and carries an unshared pair of electrons. Nitrogen orbitals in amines are therefore, sp^3 hybridised and the geometry of amines is pyramidal. Amines are classified as primary (1°), secondary (2°) and tertiary (3°) depending upon the number of hydrogen atoms replaced by alkyl or aryl groups in ammonia molecule. Due to the electron releasing nature of alkyl group, it (R) pushes electrons towards nitrogen and thus, makes the unshared electron pair more available for sharing with the proton of the acid. Moreover, the substituted ammonium ion formed from the amine gets stabilised due to dispersal of the positive charge by the +I effect of the alkyl group. Hence, alkyl amines are stronger bases than ammonia. Thus, the basic nature of aliphatic amines should increase with increase in the number alkyl groups. The order of basicity of amines of amines in the gaseous phase follows the expected order: 3° > 2° > 1° > NH_3. Adrenaline and ephedrine both containing 2° amino group used to increase blood pressure. Well known antihistamine drug Bendadryl also contains 3

Which one amongst the following will have lowest pK_b?

(A) Ethanamine

(B) Methanamine

(C) N, N-dimethylmethanamine

(D) Phenyl Methanamine

Answer (A)

Sol.

Compounds	pK_b values
Ethanamine	3.29
Methanamine	3.38
N, N-dimethylmethanamine	4.22
Phenyl methanamine	4.70

Ethanamine has lowest pK_b value.

❑ ❑ ❑