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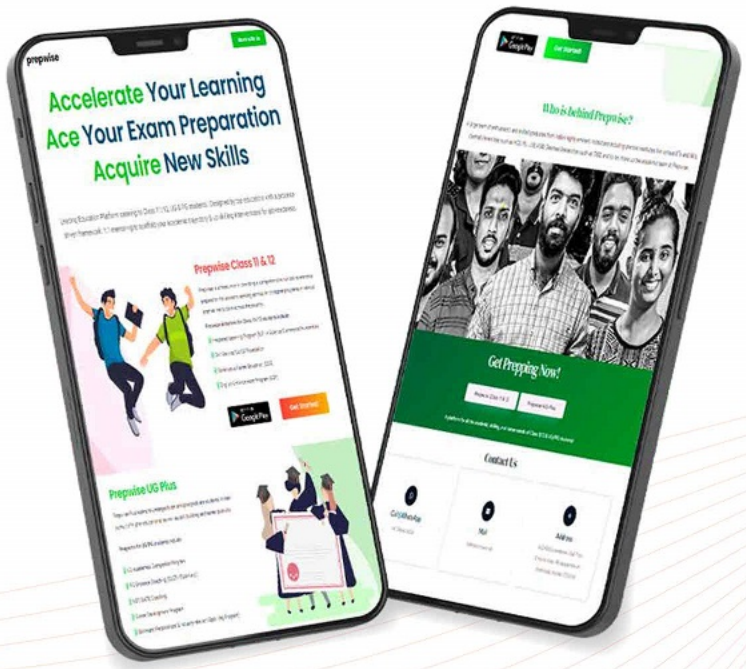

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Previous Year Question Paper

2022

Section II
Chemistry

Section Name:CHEMISTRY
Question:

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

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

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

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

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

Section Name:CHEMISTRY
Question:

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 the **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

Section Name:CHEMISTRY
Question:

AlN is an example of :

(1) Molecular solid

(2) Covalent solid

(3) Metallic solid

(4) Ionic solid

Section Name:CHEMISTRY
Question:

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.

Section Name:CHEMISTRY
Question:

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

(I) He - 144.97/Kbar

(II) H_2 - 69.16/Kbar

(III) N_2 - 76.48/Kbar

(IV) O_2 - 34.86/Kbar

Which gas has the lowest solubility in water ?

(1) He

(2) H_2

(3) N_2

(4) O_2

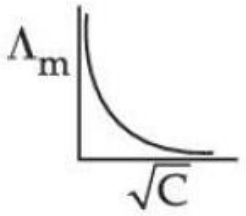
Section Name:CHEMISTRY
Question:

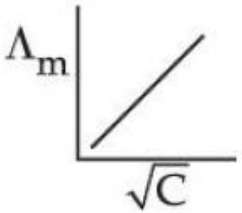
Which one of the following will have the highest value of Van't Hoff factor, *i* ?

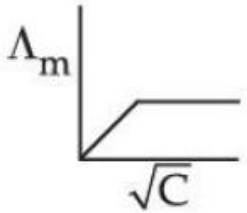
(1) K_2SO_4
(2) $MgSO_4$
(3) KCl
(4) NaCl

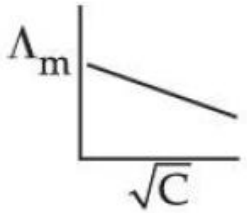
Section Name:CHEMISTRY
Question:

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

(1) 

(2) 

(3) 

(4) 

Question:

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$. The quantity of charge, in coulombs, needed to reduce 1 mol of $Cr_2O_7^{2-}$ is :

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

(1) $57.9 \times 10^5 C$

(2) $5.79 \times 10^5 C$

(3) $1.9 \times 10^5 C$

(4) $19.3 \times 10^5 C$

Section Name:CHEMISTRY
Question:

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

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

(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 :

(1) (A) and (C) only
(2) (A) and (B) only
(3) (B) and (C) only
(4) (C) and (D) only

Question:

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

(1) NaCl

(2) $Ba(NO_3)_2$

(3) $Al_2(SO_4)_3$

(4) Na_2SO_4

A	1
B	2
C	3
D	4

Section Name:CHEMISTRY
Question:

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

(1) Brownian movement

(2) Electro osmosis

(3) Electrodialysis

(4) Electrophorosis

Section Name:CHEMISTRY
Question:

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 :

(1) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
(2) (A) - (II), (B) - (I), (C) - (III), (D) - (IV)
(3) (A) - (III), (B) - (II), (C) - (IV), (D) - (I)
(4) (A) - (II), (B) - (III), (C) - (I), (D) - (IV)

Section Name:CHEMISTRY
Question:

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 :

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

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

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

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

Section Name:CHEMISTRY
Question:

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

(1) copper
(2) silver
(3) zinc
(4) cobalt

Question:

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

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

(1) It is an exothermic reaction

(2) It is a reversible reaction

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

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

Section Name:CHEMISTRY
Question:

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 :

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

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

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

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

Question:

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 :

(1) (A) and (B) only

(2) (B) and (C) only

(3) (C) and (D) only

(4) (A) and (C) only

Section Name:CHEMISTRY
Question:

The presence of SO_2 is not detected by :

(1) its characteristic pungent smell.

(2) turning of red litmus blue.

(3) turning of acidified potassium dichromate solution green.

(4) decolorisation of acidified potassium permanganate solution.

Section Name:CHEMISTRY
Question:

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 :

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

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

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

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

Section Name:CHEMISTRY
Question:

The basic oxide of chromium is :

(1) CrO

(2) Cr_2O_3

(3) CrO_2

(4) CrO_3

Section Name:CHEMISTRY
Question:

The species, which is not a ligand is :

(1) NO_3^-

(2) NO

(3) NO^+

(4) NO_2

Section Name:CHEMISTRY
Question:

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

(1) It explains the formation and structures of the coordination compounds.

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

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

(4) Assumes that ligands are point charges.

Section Name:CHEMISTRY
Question:

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

(1) S^{2-}

(2) OH^{-}

(3) CN^{-}

(4) $Edta^{4-}$

Section Name:CHEMISTRY
Question:

Identify the correct IUPAC name for the complex.

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

(1) triethylene diammine cobalt(II) sulphate

(2) triethaneammine cobalt(II) trisulphate

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

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

Section Name:CHEMISTRY
Question:

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.

Question:

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

Section Name:CHEMISTRY
Question:

Which one amongst the following has highest ionisation enthalpy ?

(1) oxygen
(2) sulphur
(3) selenium
(4) tellurium

Section Name:CHEMISTRY
Question:

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)

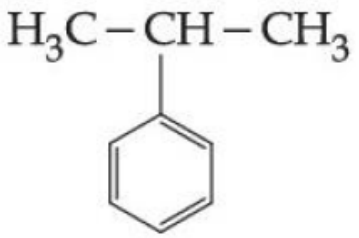
(2) (A) < (B) < (D) < (C)

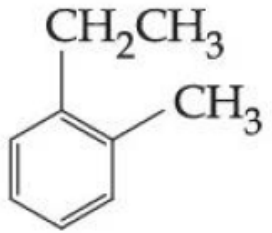
(3) (C) < (D) < (A) < (B)

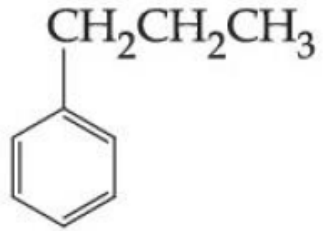
(4) (B) < (A) < (C) < (D)

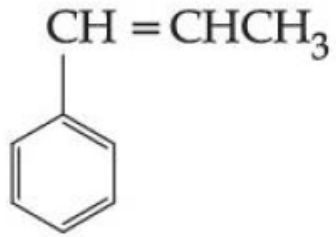
Section Name:CHEMISTRY
Question:

Which is used in preparation of phenol has the structure ?

(1) 

(2) 

(3) 

(4) 

Section Name:CHEMISTRY
Question:

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)

Section Name:CHEMISTRY
Question:

The species, which is not a ligand is :

(1) NO_3^-

(2) NO

(3) NO^+

(4) NO_2

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(3) selenium
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(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)

Section Name:CHEMISTRY
Question:

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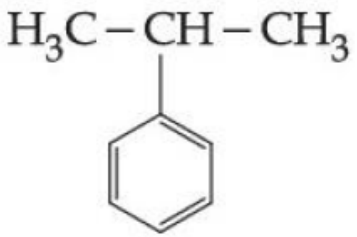
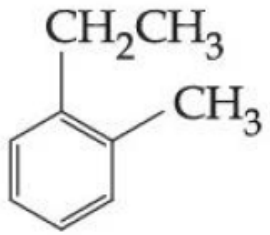
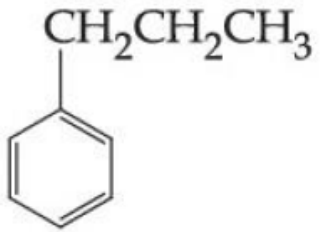
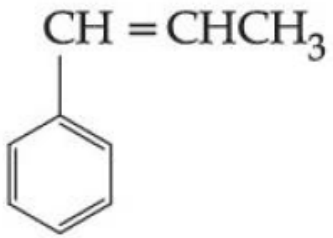
(1) 

(2) 

(3) 

(4) 

Section Name:CHEMISTRY
Question:

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)

Section Name:CHEMISTRY
Question:

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

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) 0.5555×10^{3} hr

(4) 2×10^{-3} s

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

Given below is a biomolecular elements reaction.

$2HI \rightarrow H_2 + I_2$

The order of the above reaction is :

(1) 1

(2) 0

(3) 2

(4) 2.5

Identify the incorrect statement from the following.

(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

Section Name:CHEMISTRY
Question:

Read the passage given below 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 Benadryl also contains 3° amino group.

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

(1) sp^2

(2) sp

(3) d^2sp^3

(4) sp^3

From the following, which one contains tertiary amino group ?

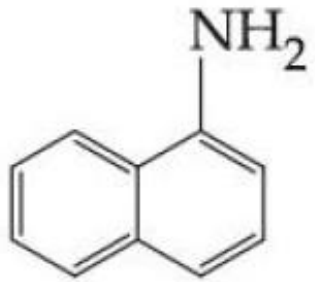
(1) Ephedrine

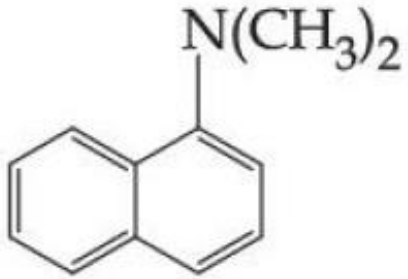
(2) Benadryl

(3) Ammonia

(4) Adrenaline

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)

Among the following, the weakest base is :

(1) $C_2H_5NH_2$

(2) $(C_2H_5)_2NH$

(3) $(C_2H_5)_3N$

(4) NH_3

Which one amongst the following will have lowest pK_b ?

(1) Ethanamine

(2) Methanamine

(3) N,N-dimethylmethanamine

(4) Phenyl methanamine