PU M Sc Chemical Sciences

103 PU_2015_369_N
Find the increasing order of stability of the oxidation state of the elements.

○ $Sn^{4+} < Ge^{4+} < Si^{4+} < Pb^{4+}$

○ $Pb^{4+} < Sn^{4+} < Ge^{4+} < Si^{4+}$

○ $Pb^{4+} < Sn^{4+} < Si^{4+} < Ge^{4+}$

○ $Pb^{4+} < Ge^{4+} < Si^{4+} < Sn^{4+}$

145 PU_2015_369_N
Pyrolotic elimination of 2-butylacetate, besides giving 1-butene, also gives trans-2-butene and the given compound.

○ 2-butene

○ cis-2-butene

○ 2-butane

○ n-pentane

113 PU_2015_369_N
Complete the reaction with the given ion: $Cr_2O_7^{2-} + 14H^+ + 3Sn^{2+} \rightarrow 2Cr^{3+} + ? + 7H_2O$

○ chromate ion

○ stannic ion

○ chromous ion

○ stannous ion

159 PU_2015_369_N
Pick out a reaction that is not affected by pressure variation:-

○ $2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g)$

○ $N_2(g) + O_2(g) \leftrightarrow 2NO(g)$

○ $N_2(g) + 3H_2(g) \leftrightarrow 2NH_3(g)$

○ $2O_3(g) \leftrightarrow 3O_2(g)$

108 PU_2015_369_N
Passivity of iron when contacted with oxidizing agents is due to the formation of the following compound on the surface of iron.

○ Ferrous oxide

○ Ferric oxide

○ Ferrite

○ Ferroso-ferric oxide

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105 PU_2015_369_N
Burning potassium reacts with sulphur dioxide to give:-
(i) potassium sulphite and
(ii) potassium sulphate.

○ (i) is correct and (ii) is wrong

○ (i) and (ii) are correct

○ (i) is wrong and (ii) is correct

○ (i) and (ii) are wrong

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148 PU_2015_369_N
Consider the statements in the stereochemistry of S_N2 reaction.
(i) takes ploace with a concerted one step reaction by the attack of a nucleophile from the backside through a transition state.
(ii) there occurs Walden inversion.

○ (i) is false and (ii) is true

○ (i) is true and (ii) is false

○ (i) and (ii) are true

○ (i) and (ii) are false

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116 PU_2015_369_N
The partial reduction of iron ore occurs as in $Fe_3O_4 + CO \rightarrow ? + CO_2$. The compound is:-

○ FeO_3

○ Fe_3O_4

○ Fe_2O_3

○ FeO

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157 PU_2015_369_N
Consider Daniel cell Zn / $ZnSO_4$ (0.01M) // $CuSO_4$ (1.0 M) / Cu with emf at 298K is E_1 when the concentration of $ZnSO_4$ is changed into 1.0 M and $CuSO_4$ is 0.01 M, the emf is E_2, then:-

○ <![$E_1 < E_2$

○ $E_1 = 0$, $E_2 = 1$

○ $E_1 < E_2$

○ $E_1 > E_2$

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155 PU_2015_369_N
Energy released in the reaction, $^2D_1 + {}^3H_1 \rightarrow {}^4He_2 + {}^2n_0$ is due to the following:-

○ Nuclear fission

○ Artificial radioactivity

○ Radioactive disintegration

○ Nuclear fusion

123 PU_2015_369_N
Which statement about organoaluminium compounds is *incorrect*?

○ $Al_2\{CH(SiMe_3)_2\}_4$ contains an Al-Al bond

○ Dimers of $AlMe_3$ possess delocalized Al-C-Al bonding interactions

○ The bonding in $Al_2Me_4Cl_2$ can be described in terms of a localized scheme

○ In $Al_2Ph_4(\mu\text{-}C\equiv CPh)_2$, the bridge bonds can be described in a similar way to those in $Al_2Me_4(\mu\text{-}Ph)_2$

114 PU_2015_369_N
Predict the molecular formula of the organic compound which gives the peaks in the isotopic clusters of its mass spectrum.

m/z (relative abundance) = 94 (100), 95 (6.1), 96 (96), 97 (1.1).

○ CH_3Cl

○ C_2H_3Cl

○ CH_3Br

○ C_2H_5Br

144 PU_2015_369_N
Find the antidepressant.

○ Clopinic

○ Fluoxetine

○ Propargyl bromide

○ Ethyl acetoacetate

127 PU_2015_369_N
Emission without a change in spin multiplicity:-

○ is called phosphorescence

○ involves an intersystem crossing

○ is spin forbidden

is called fluorescence

106 PU_2015_369_N
Bromine dissolves in water to produce hypobromous acid in presence of the given compound.

○ FeO

○ NiO

○ CuO

○ HgO

129 PU_2015_369_N
Which statement is *incorrect*?

○ Tc_2O_7 and Re_2O_7 have molecular structures in the solid state

○ $HTcO_4$ and $HReO_4$ can be isolated as crystalline solids

○ $HTcO_4$ and $HReO_4$ are strong acids in aqueous solution

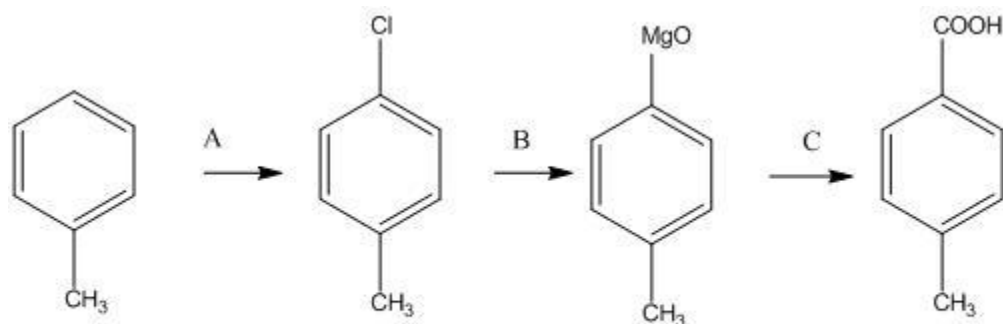○ Re_2O_5 is unstable with respect to disproportionation

107 PU_2015_369_N
Mention the species having four lone pair of electrons.

○ He

○ O-

○ Cl-

○ I

141 PU_2015_369_N

$B = Mg/ether, C = CO_2$ followed by H_2O/H^+

○ A = $Cl_2/AlCl_3$

○ A = $Cl_2/FeCl_3$

○ A = $Cl_2/ZnCl_2$

○ A = $Cl_2/SnCl_2$

151 PU_2015_369_N

Hydrolysis of $EtSCH_2CH_2Cl$ is 10^4 times faster than that of $EtOCH_2CH_2Cl$ under comparable conditions, because:-

○ S is acting as neighbouring atom

○ EtS is acting as neighbouring group

○ Et is acting as neighbouring group

○ EtS is not involved in the mechanism

101 PU_2015_369_N

Pure alumina is obtained upon ignition of the given compound.

○ $Al(OH)_3$

○ Al with O_2

○ $Al_2(SO_4)_3$

○ $NaAlO_2$

120 PU_2015_369_N

Which statement is *incorrect* about carbaboranesuperacids in the family $HCHB_{11}R_5X_6$ (R = H, Me; X = Cl, Br, I)?

○ $HCHB_{11}R_5X_6$ protonates benzene

○ The conjugate base of $HCHB_{11}R_5X_6$ is extremely weak

○ The conjugate base of $HCHB_{11}R_5X_6$ is a strongly coordinating anion

○ $HCHB_{11}R_5X_6$ protonates SO_2

134 PU_2015_369_N

Aniline undergoes halogenation, supfonation and nitration due to:-

(i) +M effect of amino group,
(ii) -M effect of amino group and
(iii) Amino group is o- and p-directing.

The correct statements are:-

○ (i) and (iii)
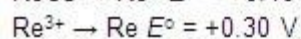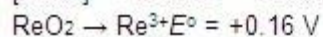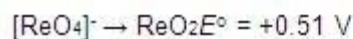
○ (i) and (ii)

○ (ii) and (iii)

136 PU_2015_369_N
Calculate the empirical formula of an organic compound containing C, 14.5; H, 1.8; Cl, 64.46; O, 19.24 observed in an elemental analysis.

- ○ $C_2H_3Cl_3O_2$

- ○ $C_2H_2Cl_3O_2$

- ○ $C_2H_3Cl_2O_2$

- ○ $C_3H_3Cl_2O_2$

119 PU_2015_369_N
A potential diagram for rhenium at pH 0 shows the following E° values:-

$[ReO_4]^- \rightarrow ReO_2 E° = +0.51$ V
$ReO_2 \rightarrow Re^{3+} E° = +0.16$ V
$Re^{3+} \rightarrow Re\ E° = +0.30$ V
The value of E° for the reduction of $[ReO_4]^-$ to Re(0) is:-

- ○ +0.32 V

- ○ +0.14 V

- ○ +0.97 V

- ○ +0.37 V

100 PU_2015_369_N
Consider the statements:-
(i) Silver ore dissolves in cyanide to give argentocyanide. Air prevents the reversibility of the reaction.
(ii) Alkaline earth metals can be easily reduced by chemical reducing agents

- ○ (i) is false and (ii) is true

- ○ (i) and (ii) are true

- ○ (i) and (ii) are false

- ○ (i) is true and (ii) is false

135 PU_2015_369_N
Salicylic acid is treated with $(CH_3CO)_2O$ and conc. sulfuric acid to give:-

- ○ Benzophenone

- ○ Aspirin

- ○ Paraacetamol

- ○ Sulphanilic acid

130 PU_2015_369_N
Pick up the false statement(s);

(i) the central carbon in carbene has a sextet of electrons out of which two electrons are unshared,
(ii) for sulfonation of alkanes, the number of carbon atoms should be six or less,
(iii) direct fluorination of alkanes is usually explosive.

○ (i) and (iii)

○ (i)

○ (ii)

○ (iii)

152 PU_2015_369_N
Photochemical chlorination of 1-chlorobutane gives a mixture of monochlorination products at different carbon atoms in different proportion. Find the correct one.

○ $H_3C^4H_2C^3H_2C^2H_2C^1Cl$; 4,3,2,1 = 75%,:0%,:17%,:3%

○ $H_3C^4H_2C^3H_2C^2H_2C^1Cl$; 4,3,2,1 = 25%,:50%,:17%,:3%

○ $H_3C^4H_2C^3H_2C^2H_2C^1Cl$; 4,3,2,1 = 25%,:50%,:20%,:0%

○ $H_3C^4H_2C^3H_2C^2H_2C^1Cl$; 4,3,2,1 = 0%,:75%,:17%,:3%

104 PU_2015_369_N
Concentration of acid used in the reaction; $4Cu + 10HNO_3 \rightarrow 4Cu(NO_3)_2 + N_2O + 5H_2O$ is:-

○ Dil. Acid

○ 50% Acid

○ Conc. Acid

○ Hot Conc. Acid

126 PU_2015_369_N
Match up the correct formula and magnetic property. Which pair is *correct*?

○ $[V(OH_2)_6]^{2+}$; diamagnetic]

○ $[Co(NH_3)_6]^{3+}$; diamagnetic

○ $[CoF_6]^{3-}$; diamagnetic]

○ $[Zn(OH_2)_6]^{2+}$; paramagnetic

102 PU_2015_369_N
Disodium hydrogen phosphate and ammonium chloride are dissolved in hot water to give microcosmic salt:-

○ $NaCuPO_4$

○ NaPO₃

○ Na₂CO₃

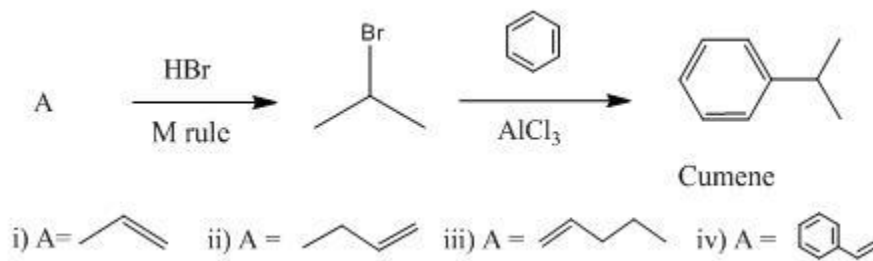○ Na(NH₄)HPO₄.4H₂O

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164 PU_2015_369
The chemical compound leaked during the Bhopal gas tragedy on Dec. 4-5, 1984 is:-

○ sodium cyanide

○ methyl isocyanate

○ methyl isocyanide

○ methyl isocyanite

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147 PU_2015_369_N
In the reaction:-

○ (iv)

○ (iii)

○ (ii)

○ (i)

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156 PU_2015_369_N
Infrared spectra are associated with the given concept.

○ Interaction of nuclear spins with external magnetic field

○ Moment of inertia and force constant

○ Stretching and bending of chemical bonds

○ Interaction of electron spin with external magnetic field

35 of 100
117 PU_2015_369_N
The titaration carried out between the following pair is:-

○ gravimetric analysis

○ Precipitation titration

○ Potentiometric titration

○ Conductometric titration

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143 PU_2015_369_N

Urethane functional group behaves as an ester on one side and as ___ on the other side.

○ carboxylic acid

○ amide

○ ketone

○ carboxylic acid amide

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109 PU_2015_369_N

Calomel when treated with conc. nitric acid in the reaction to give; $3Hg_2Cl_2 + 8HNO_3 \rightarrow 3HgCl_2 + ? + 4H_2O + 2NO$

○ mercuric oxide

○ mercurous nitrate

○ mercuric nitrate

○ mercurous oxide

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124 PU_2015_369_N

In the complex $[Ni(NH_3)_6]^{2+}$, the approximate charge distribution in accord with the electroneutrality principle is:-

○ Ni, -4; NH_3, +1

○ Ni, +1; NH_3, $+^1/_6$

○ Ni, 0; NH_3, $+^1/_3$

○ Ni, +2; NH_3, 0

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112 PU_2015_369_N

Transition metal elements form coordination compounds due to:-
(i) low nuclear charge to ionic size ratio and
(ii) presence of (n-1) vacant d orbital of suitable energy.

○ (i) and (ii) are false

○ (i) and (ii) are true

○ (i) is false and (ii) is true

○ (i) is true and (ii) is false

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158 PU_2015_369_N
Determine the equivalent mass of $Na_3PO_4 \cdot 12H_2O$ (molecular mass = X) and $Ca_3(PO_4)_2$ (molecular mass = Y)

○ X/2, Y/2

○ X/2, Y/3

○ X/3, Y/6

○ X/3, Y/5

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139 PU_2015_369_N
Clemmensen reduction of benzaldehyde reaction with zinc amalgam yields:-

○ Benzoic acid

○ Hydrobenzamide

○ Benzyl alcohol

○ Toluene

42 of 100
154 PU_2015_369_N
The corrosion inhibiting efficiency of the series of compounds are:-

○ $NH_3 < R_2NH_3 < RNH_3 < R_3N$

○ $RNH_3 < NH_3 < R_2NH_3 < R_3N$

○ $NH_3 < RNH_3 < R_2NH_3 < R_3N$

○ $NH_3 < R_3NH_3 < R_2NH_3 < RN$

43 of 100
140 PU_2015_369_N
(i) When nicotine is treated with methyl iodide , it gives dimethiodide. This shows that the two nitrogen atoms in nicotine are tertiary.
(ii) When nicotine is oxidized with nitric acid, it gives nicotinic acid, this shows that nicotine contains a pyridine ring.

○ (i) and (ii) are false

○ (i) is false and (ii) is true

○ (i) is true and (ii) is false

○ (i) and (ii) are true

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110 PU_2015_369_N
Electronic configuration of europium is:-

○ [Xe] $4f^75d^06s^2$

○ [Xe] $4f^05d^76s^2$

○ [Xe] $4f^75d^26s^0$

○   [Xe] $4f^7 5d^5 6s^2$

128 PU_2015_369_N
The Y^{3+} ion is:-

○   hard, and favours ligands with *S*- and/or *P*-donor atoms

○   hard, and favours ligands with *N*- and/or *O*-donor atoms

○   soft, and favours ligands with *S*- and/or *P*-donor atoms

○   soft, and favours ligands with *N*- and/or *O*-donor atoms

137 PU_2015_369_N
Citral is synthesized using methylheptenone as the reactant in which the following reaction is involved.

○   Reduction reaction

○   Kolbe-Schmit reaction

○   Reformatsky reaction

○   Oxidation reaction

146 PU_2015_369_N
Dyotropic reaction is a rearrangement in which:-

○   two σ bonds simultaneously migrate intramolecularly in an uncatalyzed process.

○   two σ bonds simultaneously migrate intramolecularly in a catalyzed process.

○   two σ bonds simultaneously migrate intermolecularly in a catalyzed process.

○   two σ bonds simultaneously migrate intermolecularly in an uncatalyzed process.

142 PU_2015_369_N
The o-nitrophenol has a lower boiling point than p-nitrophenol, because the latter shows:-

○   chelate effect

○   intramolecular hydrogen bonding

○   acidic property

○   intermolecular hydrogen bonding

115 PU_2015_369_N
Calculate the lattice energy of NaCl crystals from the following data; A = 1.748, r_o = 0.2814 nm, n = 8, ε_0 = 8.854 x 10^{-12} $C^2 m^{-1} J^{-1}$, e = 1.6 x 10^{-19} C.

○   -75.49 kJmol^{-1}

○   -7.549 kJmol^{-1}

○
   -7549 kJmol^{-1}

○
   -754.9 kJmol^{-1}

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133 PU_2015_369_N
Consider the statements in the mechanism of halogenations of benzene:

(i) chloronium ion can attack the π-electron cloud of benzene to form π-complex.
(ii) the π-complex is then converted into σ-complex.
(iii) the σ-complex thus formed is a carbonium ion which is stabilized by resonance.

○
   (i), (ii) and (iii) are false

○
   (i), (ii) and (iii) are true

○
   (i), (ii) are true and (iii) is false

○
   (i), (ii) are false and (iii) is true

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150 PU_2015_369_N
In the electrophilic addition of bromine to an alkene the NMR spectroscopy in presence of HF.SbF$_5$ in liq. SO$_2$ at -60°C shows that the intermediate from 2-butene has been found to illustrate the given number of equivalent proton signals at δ 2.9.

○
   12

○
   10

○
   2

○
   two sets of protons at two different places

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111 PU_2015_369_N
Cyclopentadienylmagnesium bromide reacts with ferrous chloride to produce:-

○
   Dibenzene iron

○
   Ferrocene

○
   Phenyl magnesium bromide

○
   Phenyl magnesium

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125 PU_2015_369_N
Which metal complex ion is expected to be subject to a Jahn-Teller distortion?

○
   Cr(OH$_2$)$_6$]$^{3+}$

○
   [Cr(bpy)$_3$]$^{2+}$

○
   [Cr(NH$_3$)$_6$]$^{2+}$

○
   [Cr(CN)$_6$]$^{3-}$

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121 PU_2015_369_N

Self-ionization of BrF$_3$ gives [BrF$_2$]$^+$ and [BrF$_4$]$^-$. Which list of species and molecular shape is correct?

○ BrF$_3$, trigonal pyramidal; [BrF$_2$]$^+$, non-linear; [BrF$_4$]$^-$, square planar

○ BrF$_3$, T-shaped; [BrF$_2$]$^+$, non-linear; [BrF$_4$]$^-$, square planar

○ BrF$_3$, T-shaped; [BrF$_2$]$^+$, linear; [BrF$_4$]$^-$, tetrahedral

○ BrF$_3$, trigonal planar; [BrF$_2$]$^+$, linear; [BrF$_4$]$^-$, square planar

132 PU_2015_369_N

Hell-Volhard-Zelinsky reaction involves treatment of carboxylic acid with chlorine in presence of phosphorus to give:-

○ RCH$_2$COCl

○ RCCl$_2$COOH

○ RCHClCOCl

○ RCHClCOOH

138 PU_2015_369_N

Benzenediazonium chloride reacts with aniline to give:-

○ Azo benzene

○ p-Dimethylaminoazobenzene

○ p-Hydroxyazobenzene

○ p-Aminoazobenzene

131 PU_2015_369_N

Which is the correct order of relative acid strengths of given compounds:-

○ C$_2$H$_5$OH > H$_2$O > C$_6$H$_5$OH

○ H$_2$O > C$_6$H$_5$OH > C$_2$H$_5$OH

○ C$_6$H$_5$OH > C$_2$H$_5$OH > H$_2$O

○ C$_6$H$_5$OH > H$_2$O > C$_2$H$_5$OH

149 PU_2015_369_N

Hydrated sodium alumino silicates are known as:-

○ permuits

○ ultrmarines

○ ortho silicates

○ zeolites

153 PU_2015_369_N
Haemoglobin belongs to the following structure.

○ α-Pleated sheet structure

○ β-Pleated sheet structure

○ Tertiary structure

○ Quaternary structure

118 PU_2015_369_N
For a thermodynamically spontaneous cell reaction, which statement is correct?

○ E° (reduction) must be more negative than E° (oxidation)

○ E° (oxidation) must be more negative than E° (reduction)

○ The difference between E° (reduction) and E° (oxidation) must be more than 1.0 V

○ E° cell should be negative

161 PU_2015_369_N
The radius of the sodium atom can be obtained using the following formula. Sodium metal crystallizes in body centered crystal lattice with the cell edge, a = 4.29 A°.

○ r = a√2/4

○ r = a√3/4

○ r = a√6/4

○ r = a√5/4

174 PU_2015_369_N
Supercooled water ↔ Vapour equilibrium is:-

○ Dynamic equilibrium

○ Supercooled state

○ Metastable equilibrium

○ Stable equilibrium

169 PU_2015_369_N
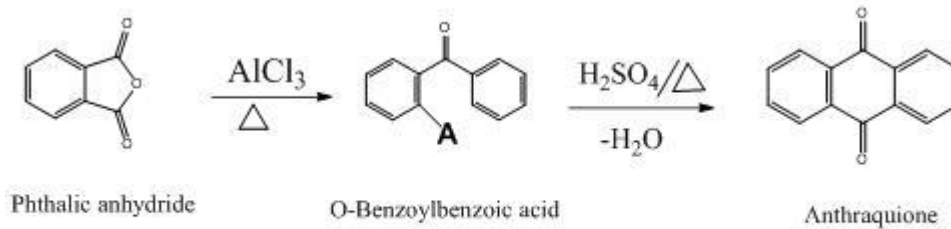Acridine is non-fluorescent while acridine derivative containing auxochromes are fluorescent; the auxochromes are:-

○ electron donors

○ electron acceptors

○ hydrogen bond donors

alkyl group

164 PU_2015_369_N
In the following reaction:-

Phthalic anhydride   O-Benzoylbenzoic acid   Anthraquione

i) A = OH,   ii) A = CHO,   iii) A = CHOH,   iv) A = COOH

○ (ii)

○ (iv)

○ (iii)

○ (i)

179 PU_2015_369_N
When two solutions having same osmotic pressure separated with a semipermeable membrane are said to be:-

○ supersaturated solutions

○ colloidal solutions

○ very dilute solutions
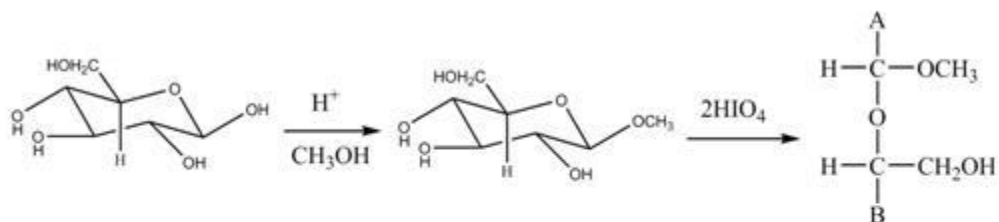
○ isotonic solutions

176 PU_2015_369_N
The effect in which the energy of a photon is reduced and that of an electron is increased is:-

○ Einstein effect

○ Compton effect

○ Zeeman effect

○ Chadvick effect

163 PU_2015_369_N

Consider the reaction:-

β-D-glucopyranose   Methyl β-D-glucopyranoside

i) A = CH₂OH, B = CHO,   ii) A = CHO, B = CHO,

iii) A = CHO, B = CH₂OH,   iv) A = CHO, B = OH,

- (iii)
- (i)
- (iv)
- (ii)

172 PU_2015_369_N
Pick out the false statement
(i) molecularity of a reaction can be zero,
(ii) order of a reaction can be zero and
(iii) order of a reaction is experimentally determined.

- (i)
- (iii) and (i)
- (iii)
- (ii)

170 PU_2015_369_N
A solution of copper(II) sulphate is electrolysed between two copper electrodes by a current of 10.2 amp for 62 min at 298K. About 0.1875 mole of copper is dissolved from anode, calculate the amount of copper deposited from cathode.

- 6.3 moles
- 63 moles
- 0.1875 mole
- 1.875 moles

253 PU_2015_369

In an FCC arrangement the volume occupied by the spheres is _____ of the total space available.

○ 68%

○ 66%

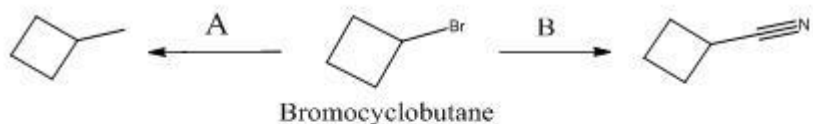○ 100%

○ 74%

171 PU_2015_369_N
The wavelength dependence of a great number of optically active substances in optical rotatory dispersion is;-

○ $\alpha = K/\lambda^2 - \lambda^2_0$

○ $\alpha = K^2/\lambda - \lambda^2_0$

○ $\alpha = K/\lambda - \lambda^2_0$

○ $\alpha = K/\lambda^2 - \lambda_0$

165 PU_2015_369_N
Find A and B in the following equation.

Bromocyclobutane

i)   A = CH_3Li and B = HC≡ C:⁻ Na⁺
ii) A = CH_3Cl and B = HC≡ C:⁻ Li⁺
iii) A = CH_3Li and B = H_2C= C:⁻ Na⁺
iv) A = CH_3Cl and B = HC≡ C:⁻ Na⁺

○ (i)

○ (iii)

○ (iv)

○ (ii)

166 PU_2015_369_N
Calculate $\Delta H°$ for the reaction at 298K; $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$, given $\Delta H°_f$ of $Ba^{2+}(aq)$ = -538.4 kJ, $SO_4^{2-}(aq)$ = -907.51 kJ and $BaSO_4(s)$ = -1465.24 kJ.

○ -193.7 kJ

○ -19.37 kJ

○ -1937 kJ

○ -1.937 kJ

175 PU_2015_369_N
de Broglie showed that an electron with mass m moving with a velocity v should be associated with:-

○ wavenumber

○ moment

○ spin

○ wavelength

177 PU_2015_369_N
The potential energy of a particle revolving about the centre of mass at a distance r from the origin is V, equal to:-

○ $-Z^2e/r$

○ $-Ze^2/r$

○ $-Ze^2/r^3$

○ $-Ze/r^2$

160 PU_2015_369_N
A weather balloon is filled with hydrogen at 1 atm pressure and at 27°C occupies the volume 12000 lit. It reaches a place with temperature -23°C and pressure at 0.5 atm, the volume of the balloon becomes.

○ 12000 lit

○ 1000 lit

○ 24000 lit

○ 20000 lit

162 PU_2015_369_N
Decomposition of ethylene oxide into methane and CO is described as in the first order expression log k (s^{-1}) = 14.34 - 1.25 x 10^4 / T (K). Energy of activation is:-

○ 2.4 kJ mol^{-1}

○ 240 kJ mol^{-1}

○ 24 kJ mol^{-1}

○ 2400 kJ mol^{-1}

168 PU_2015_369_N
Sodium chloride belongs to a crystal system which has elements of symmetry:-

○ nine planes, thirteen axes

○ thirteen planes, nine axes

four planes, six axes

six planes, four axes

167 PU_2015_369_N

The isotropic effect in rotational spectra brings a change in the following

mass

mass and moment of inertia

moment of inertia

mass, dipole moment and moment of inertia

173 PU_2015_369_N

Adsorbed molecule on a surface forms an activated complex, this process involves:-

increase in energy

no change in energy

enormous amount of heat is liberated

decrease in energy

180 PU_2015_369_N

The phase diagram of zinc-cadmium illustrates the eutectic point consists of:-

Zn

Zn, Cd

Cd

neither Zn nor Cd

191 PU_2015_369_N

Estimate the normal boiling temperature of propan-1-ol, C_3H_7OH, given that its vapour pressure is 2701 Pa at 298 K and 9129 Pa at 318 K.

367 K

420 K

323 K

393 K

189 PU_2015_369_N

Calculate the change in free energy in cals for a change which occurs when 2 moles of a perfect gas expands reversibly and isothermally at 37°C from an initial volume of 55 lit to 1000 lit.

-3574 cals mol^{-1}

○ -35.74 cals mol^{-1}

○ -357.4 cals mol^{-1}

○ -3.574 cals mol^{-1}

84 of 100
198 PU_2015_369_N
The Lennard-Jones parameters for the interactions between benzene, C_6H_6, molecules are ε = 454 kJ mol^{-1} and σ = 527 pm. Calculate the separation that corresponds to the minimum in the Lennard-Jones potential.

○ 592 pm

○ 527 pm

○ 745 pm

○ 1054 pm

85 of 100
187 PU_2015_369_N
The C_v for uranium metal is 3.04 JK^{-1} mol^{-1} at 20K. Calculate the absolute entropy of the metal.

○ 10.1 JK^{-1}

○ 1.01 JK^{-1}

○ 0.101 JK^{-1}

○ 101 JK^{-1}

86 of 100
181 PU_2015_369_N
Debye-Huckel theory explains the relaxation time is the time required:-

○ new ionic atmosphere to build up

○ new ionic atmosphere to build up and grows

○ old atmosphere to decay

○ new ionic atmosphere to build up and old atmosphere to decay

87 of 100
194 PU_2015_369_N
The magnetic susceptibilities of some metals at 298 K are given below. Which of the compounds is paramagnetic? Sodium χ = +7.3 x 10^{-6}, Aluminium χ = +22 x 10^{-6}, Copper χ = -96 x 10^{-6}, Platinum χ = +262 x 10^{-6}

○ Copper and Platinum

○ Copper

○ Sodium, Aluminium and Platinum

○ Aluminium

88 of 100

192 PU_2015_369_N
Use the radius ratio rule to predict the crystal structure of rubidium fluoride, RbF. The ionic radius of a rubidium ion, Rb^+ is 149 pm and of a fluoride ion, F^-, is 133 pm

○   4-fold coordination, zinc blende

○   6-fold coordination, rock salt

○   8-fold coordination, caesium chloride

○   12-fold coordination

199 PU_2015_369_N
What is the separation between the highest occupied and lowest unoccupied molecular orbitals of benzene?

○ $2\sqrt{2}\ \beta$

○ β

○ 2β

○ $\sqrt{2}\ \beta$

195 PU_2015_369_N
Calculate the work done when a spherical bubble of air in water expands from a radius of 1.0 to 1.5 mm. The surface tension of water is 72.0 mN m^{-1}.

○   1.4 J

○ 2.2×10^{-7} J

○ 1.1×10^{-6} J

○   1.4 kJ

193 PU_2015_369_N
Rutile, the high-temperature form of titanium oxide, TiO_2, adopts a tetragonal P structure with $a = 4.59$ Å and $c = 2.96$ Å. Calculate the separation between the planes with the Miller indices (111).

○   7.13 Å

○   2.26 Å

○   2.19 Å

○   5.27 Å

186 PU_2015_369_N
Calculate the temperature of a reaction in which half life is 2 min, A is 5000×10^{10} s^{-1} and Ea = 10^5 Jmol^{-1}

○   32.77 K

○   327.7 K

○   3277 K

○ 3.277 K

190 PU_2015_369_N
For the equilibrium $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ how many phases are present?

○ 5

○ 2

○ 1

○ 3

182 PU_2015_369_N
A collection of large number of essentially independent assemblies each of which possess the same energy E, volume V, and the number of systems N is known as:-

○ Canonical ensemble

○ Uniform ensemble

○ Micro canonical ensemble

○ Grand canonical ensemble

196 PU_2015_369_N
How are liquid crystals in which the molecules are arranged in a nearly parallel alignment, but which do not form layers, best described?

○ Nematic

○ Smectic

○ Cholesteric

○ Isotropic

185 PU_2015_369_N
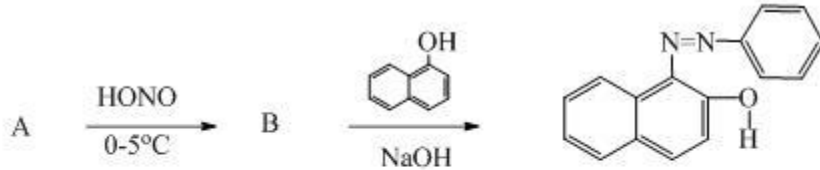Calculate the value of d_{200} in lead. Lead has a fcc structure and a = 4.96 A°.

○ 247.5 A°

○ 2.475 A°

○ 0.2475 A°

○ 24.75 A°

183 PU_2015_369_N

In the following reaction:-

i) A = Aniline,   B = diazonium salt
ii) A = Benzene, B = diazonium salt
iii) A = diazonium salt, B = Aniline
iv) A = Napthalene,   B= diazonium salt

○ (i)

○ (iii)

○ (iv)

○ (ii)

184 PU_2015_369_N
Measurement of $E°$ enables for the calculation of equilibrium constant using the formula:-

○ ln K_{eq} = $nE°$/FRT

○ ln K_{eq} = nFE°T/R

○ ln K_{eq} = nRFE°/T

○ ln K_{eq} = nFE°/RT

197 PU_2015_369_N
Measurements made using neutron scattering show the radius of gyration of a monodisperse sample of polystyrene to be 3.4 nm. The length of an individual monomer unit is known to be 154 pm. Determine the number of monomer units in each chain.

○ 17600

○ 28

○ 132

○ 3000

188 PU_2015_369_N
For an ideal gas, the internal energy of a system is a function of temperature and volume, thus, C_P-C_V is:-

○ $[(\delta E/\delta V)_T + P](\delta P/\delta T)_V]$

○ $[(\delta E/\delta V)_T + P](\delta V/\delta T)_P]$

○ $[(\delta E/\delta V)_V + P](\delta P/\delta T)_P]$

$[(\delta E/\delta V)_P + P](\delta V/\delta T)_P]$