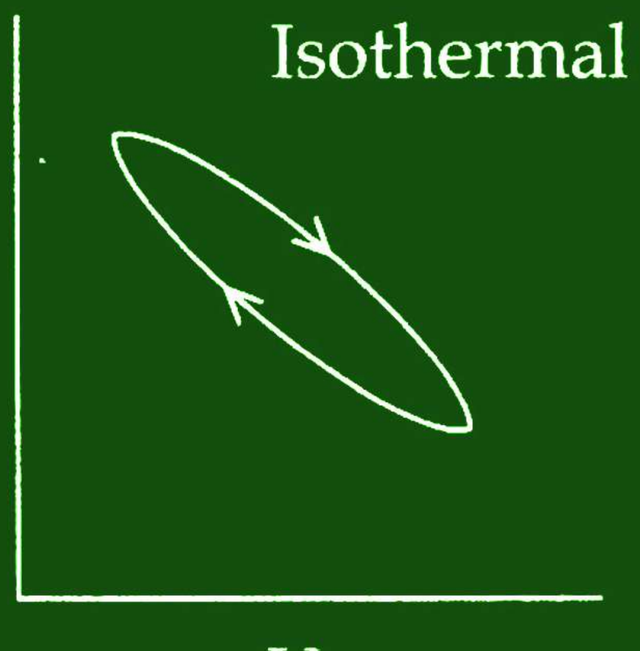
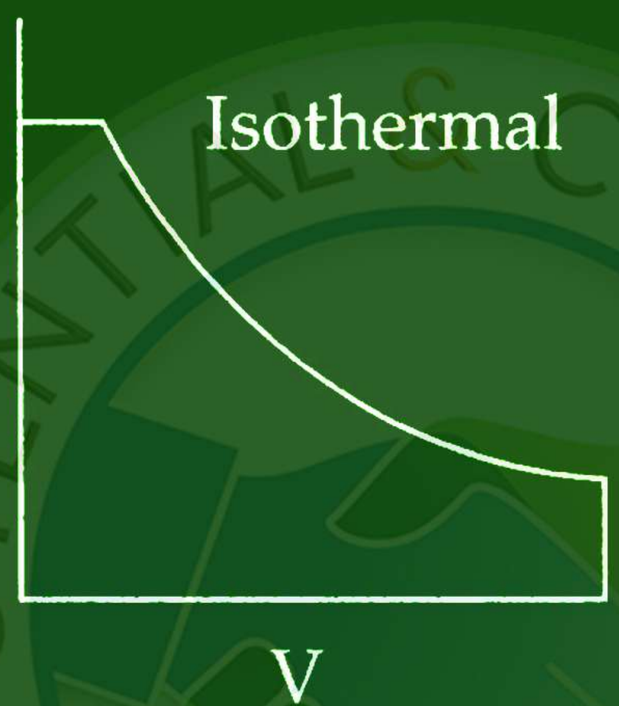
51. Which of the following p-V curve represents maximum work done ?

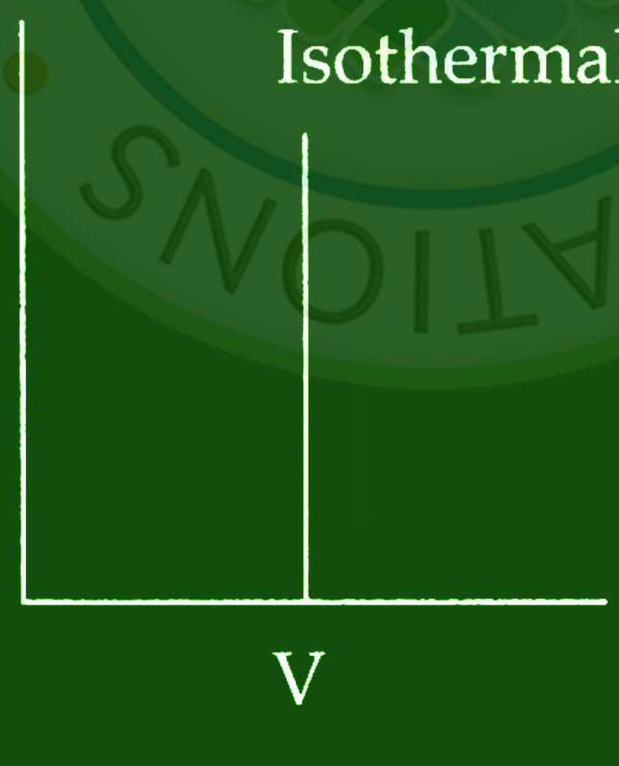
(1)



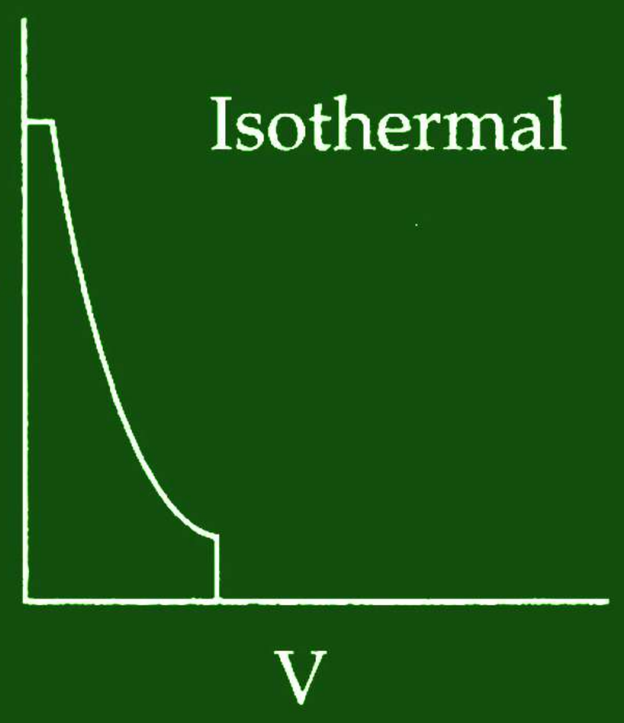

(2)




(3)




(4)



52. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

**Assertion (A) :** ICl is more reactive than $I_2$.

**Reason (R) :** I-Cl bond is weaker than I-I bond.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

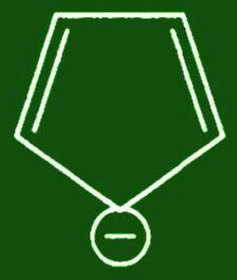
(1) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**.

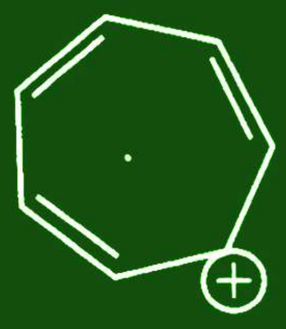
(2) Both **(A)** and **(R)** are correct but **(R)** is **not** the correct explanation of **(A)**.

(3) **(A)** is correct but **(R)** is not correct.

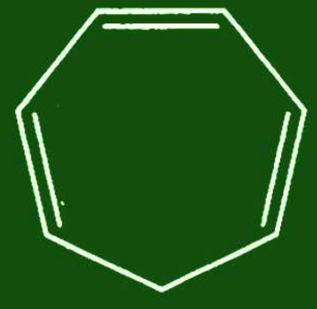
(4) **(A)** is not correct but **(R)** is correct.

53. Which compound amongst the following is **not** an aromatic compound ?

(1) 

(2) 

(3) 

(4) 

54. The IUPAC name of an element with atomic number 119 is

(1) ununennium

(2) unnilennium

(3) unununnium

(4) ununoctium

55. Match List - I with List - II.

| | List - I (Drug class) | | List - II (Drug molecule) |
|---|---|---|---|
| (a) | Antacids | (i) | Salvarsan |
| (b) | Antihistamines | (ii) | Morphine |
| (c) | Analgesics | (iii) | Cimetidine |
| (d) | Antimicrobials | (iv) | Seldane |

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

(1) (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i)

(2) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

(3) (a) - (i), (b) - (iv), (c) - (ii), (d) - (iii)

(4) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)

56. Match List - I with List - II.

| | List - I (Hydrides) | | List - II (Nature) |
|---|---|---|---|
| (a) | $MgH_2$ | (i) | Electron precise |
| (b) | $GeH_4$ | (ii) | Electron deficient |
| (c) | $B_2H_6$ | (iii) | Electron rich |
| (d) | HF | (iv) | Ionic |

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

(1) (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii)

(2) (a) - (iii), (b) - (i), (c) - (ii), (d) - (iv)

(3) (a) - (i), (b) - (ii), (c) - (iv), (d) - (iii)

(4) (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

57. The **incorrect** statement regarding enzymes is :

(1) Enzymes are biocatalysts.

(2) Like chemical catalysts enzymes reduce the activation energy of bio processes.

(3) Enzymes are polysaccharides.

(4) Enzymes are very specific for a particular reaction and substrate.

58. The IUPAC name of the complex - $[Ag(H_2O)_2][Ag(CN)_2]$ is :

(1) dicyanidosilver(II) diaquaargentate(II)

(2) diaquasilver(II) dicyanidoargentate(II)

(3) dicyanidosilver(I) diaquaargentate(I)

(4) diaquasilver(I) dicyanidoargentate(I)

59. Gadolinium has a low value of third ionisation enthalpy because of

(1) small size

(2) high exchange enthalpy

(3) high electronegativity

(4) high basic character

60. Amongst the following which one will have maximum 'lone pair - lone pair' electron repulsions ?

(1) $ClF_3$

(2) $IF_5$

(3) $SF_4$

(4) $XeF_2$

61. Which of the following statement is **not** correct about diborane ?

(1) There are two 3-centre-2-electron bonds.

(2) The four terminal B-H bonds are two centre two electron bonds.

(3) The four terminal Hydrogen atoms and the two Boron atoms lie in one plane.

(4) Both the Boron atoms are $sp^2$ hybridised.

62. Given below are two statements :

**Statement I :**

The boiling points of aldehydes and ketones are higher than hydrocarbons of comparable molecular masses because of weak molecular association in aldehydes and ketones due to dipole - dipole interactions.

**Statement II :**

The boiling points of aldehydes and ketones are lower than the alcohols of similar molecular masses due to the absence of H-bonding.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) Both **Statement I** and **Statement II** are correct.

(2) Both **Statement I** and **Statement II** are incorrect.

(3) **Statement I** is correct but **Statement II** is incorrect.

(4) **Statement I** is incorrect but **Statement II** is correct.

63. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

**Assertion (A) :**

In a particular point defect, an ionic solid is electrically neutral, even if few of its cations are missing from its unit cells.

**Reason (R) :**

In an ionic solid, Frenkel defect arises due to dislocation of cation from its lattice site to interstitial site, maintaining overall electrical neutrality.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**

(2) Both **(A)** and **(R)** are correct but **(R)** is **not** the correct explanation of **(A)**

(3) **(A)** is correct but **(R)** is not correct

(4) **(A)** is not correct but **(R)** is correct

64. Given below are two statements :

**Statement I :**

The boiling points of the following hydrides of group 16 elements increases in the order -

$H_2O < H_2S < H_2Se < H_2Te$.

**Statement II :**

The boiling points of these hydrides increase with increase in molar mass.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

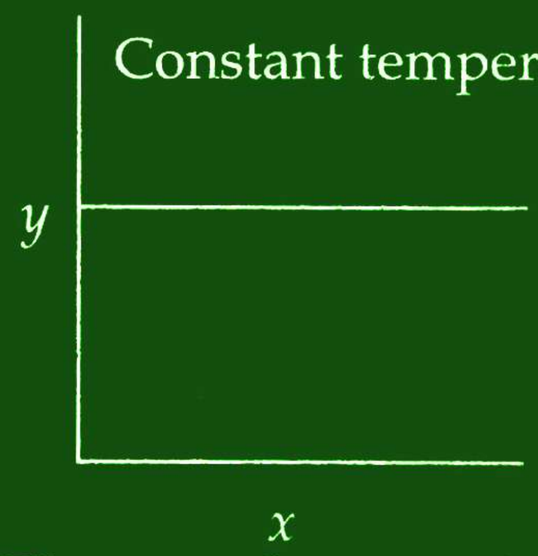
(1) Both **Statement I** and **Statement II** are correct

(2) Both **Statement I** and **Statement II** are incorrect

(3) **Statement I** is correct but **Statement II** is incorrect

(4) **Statement I** is incorrect but **Statement II** is correct

65. The given graph is a representation of kinetics of a reaction.




The $y$ and $x$ axes for zero and first order reactions, respectively are

(1) zero order ($y$ = concentration and $x$ = time), first order ($y = t_{1/2}$ and $x$ = concentration)

(2) zero order ($y$ = concentration and $x$ = time), first order ($y$ = rate constant and $x$ = concentration)

(3) zero order ($y$ = rate and $x$ = concentration), first order ($y = t_{1/2}$ and $x$ = concenration)

(4) zero order ($y$ = rate and $x$ = concentration), first order ($y$ = rate and $x = t_{1/2}$)

66. The **incorrect** statement regarding chirality is :

(1) $S_N1$ reaction yields 1 : 1 mixture of both enantiomers.

(2) The product obtained by $S_N2$ reaction of haloalkane having chirality at the reactive site shows inversion of configuration.

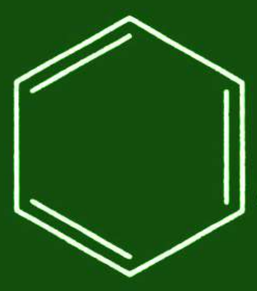
(3) Enantiomers are superimposable mirror images on each other.

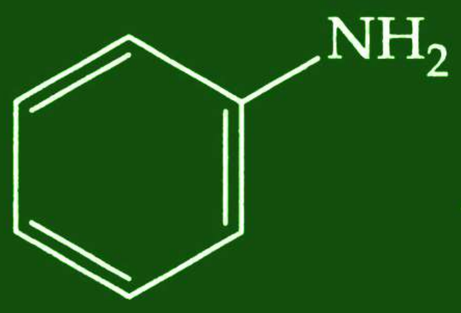
(4) A racemic mixture shows zero optical rotation.

67. Which of the following is suitable to synthesize chlorobenzene ?

(1) Benzene, $Cl_2$, anhydrous $FeCl_3$

(2) Phenol, $NaNO_2$, HCl, CuCl

(3)  , HCl

(4) 

, HCl, Heating

68. Identify the **incorrect** statement from the following.

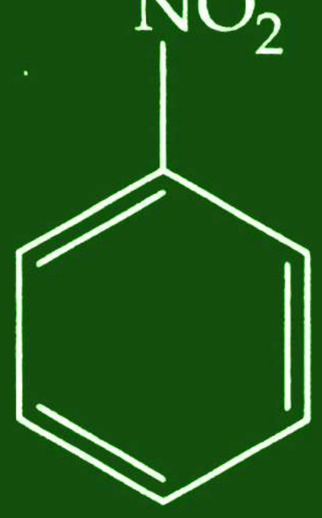
(1) All the five 5*d* orbitals are different in size when compared to the respective 4*d* orbitals.

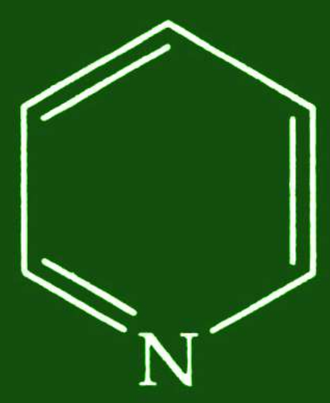
(2) All the five 4*d* orbitals have shapes similar to the respective 3*d* orbitals.

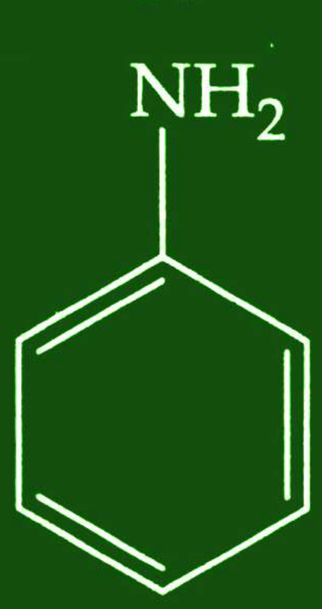
(3) In an atom, all the five 3*d* orbitals are equal in energy in free state.

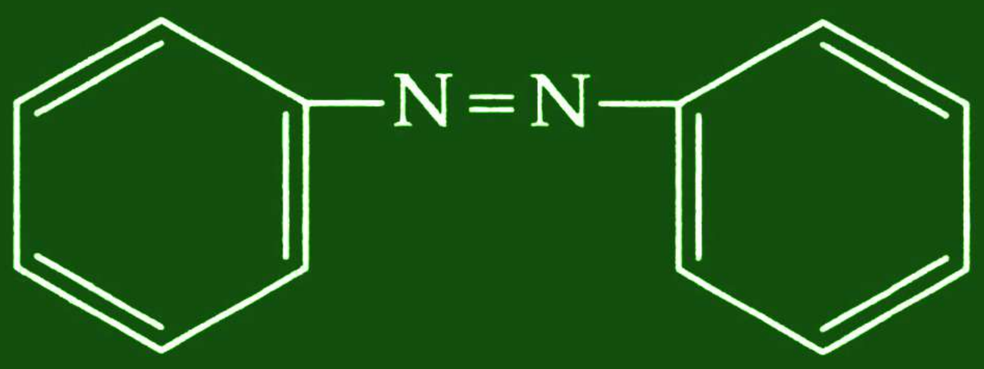
(4) The shapes of $d_{xy}$, $d_{yz}$, and $d_{zx}$ orbitals are similar to each other ; and $d_{x^2-y^2}$ and $d_{z^2}$ are similar to each other.

69. The Kjeldahl's method for the estimation of nitrogen can be used to estimate the amount of nitrogen in which one of the following compounds ?

(1) 


(2) 


(3) 


(4) 

70. Choose the **correct** statement :

(1) Diamond and graphite have two dimensional network.

(2) Diamond is covalent and graphite is ionic.

(3) Diamond is $sp^3$ hybridised and graphite is $sp^2$ hybridized.

(4) Both diamond and graphite are used as dry lubricants.

71. Identify the **incorrect** statement from the following

(1) Alkali metals react with water to form their hydroxides.

(2) The oxidation number of K in $KO_2$ is $+4$.

(3) Ionisation enthalpy of alkali metals decreases from top to bottom in the group.

(4) Lithium is the strongest reducing agent among the alkali metals.

72. Which one is **not** correct mathematical equation for Dalton's Law of partial pressure ? Here p = total pressure of gaseous mixture

(1) $p = p_1 + p_2 + p_3$

(2) $p = n_1 \frac{RT}{V} + n_2 \frac{RT}{V} + n_3 \frac{RT}{V}$

(3) $p_i = \chi_i p$, where $p_i$ = partial pressure of $i^{th}$ gas
$\chi_i$ = mole fraction of $i^{th}$ gas in gaseous mixture

(4) $p_i = \chi_i p_i^o$, where $\chi_i$ = mole fraction of $i^{th}$ gas in gaseous mixture
$p_i^o$ = pressure of $i^{th}$ gas in pure state

73. Given below are two statements :

**Statement I :**

The acidic strength of monosubstituted nitrophenol is higher than phenol because of electron withdrawing nitro group.

**Statement II :**

*o*-nitrophenol, *m*-nitrophenol and *p*-nitrophenol will have same acidic strength as they have one nitro group attached to the phenolic ring.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) Both **Statement I** and **Statement II** are correct.

(2) Both **Statement I** and **Statement II** are incorrect.

(3) **Statement I** is correct but **Statement II** is incorrect.

(4) **Statement I** is incorrect but **Statement II** is correct.

74. At 298 K, the standard electrode potentials of $Cu^{2+}/Cu$, $Zn^{2+}/Zn$, $Fe^{2+}/Fe$ and $Ag^{+}/Ag$ are 0.34 V, −0.76 V, −0.44 V and 0.80 V, respectively.

On the basis of standard electrode potential, predict which of the following reaction can not occur ?

(1) $CuSO_4(aq) + Zn(s) \rightarrow ZnSO_4(aq) + Cu(s)$

(2) $CuSO_4(aq) + Fe(s) \rightarrow FeSO_4(aq) + Cu(s)$

(3) $FeSO_4(aq) + Zn(s) \rightarrow ZnSO_4(aq) + Fe(s)$

(4) $2CuSO_4(aq) + 2Ag(s) \rightarrow 2Cu(s) + Ag_2SO_4(aq)$

75. Given below are two statements :

**Statement I :**

In the coagulation of a negative sol, the flocculating power of the three given ions is in the order -

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

**Statement II :**

In the coagulation of a positive sol, the flocculating power of the three given salts is in the order -

$$NaCl > Na_2SO_4 > Na_3PO_4$$

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) Both **Statement I** and **Statement II** are correct.

(2) Both **Statement I** and **Statement II** are incorrect.

(3) **Statement I** is correct but **Statement II** is incorrect.

(4) **Statement I** is incorrect but **Statement II** is correct.

76. Match List - I with List - II.

| List - I | | List - II | |
|---|---|---|---|
| (a) | Li | (i) | absorbent for carbon dioxide |
| (b) | Na | (ii) | electrochemical cells |
| (c) | KOH | (iii) | coolant in fast breeder reactors |
| (d) | Cs | (iv) | photoelectric cell |

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

(1) (a) - (iv), (b) - (i), (c) - (iii), (d) - (ii)

(2) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

(3) (a) - (i), (b) - (iii), (c) - (iv), (d) - (ii)

(4) (a) - (ii), (b) - (iii), (c) - (i), (d) - (iv)

77. Given below are two statements :

**Statement I :**

Primary aliphatic amines react with $HNO_2$ to give unstable diazonium salts.

**Statement II :**

Primary aromatic amines react with $HNO_2$ to form diazonium salts which are stable even above 300 K.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) Both **Statement I** and **Statement II** are correct.

(2) Both **Statement I** and **Statement II** are incorrect.

(3) **Statement I** is correct but **Statement II** is incorrect.

(4) **Statement I** is incorrect but **Statement II** is correct.

78. Which statement regarding polymers is **not correct** ?

(1) Elastomers have polymer chains held together by weak intermolecular forces.

(2) Fibers possess high tensile strength.

(3) Thermoplastic polymers are capable of repeatedly softening and hardening on heating and cooling respectively.

(4) Thermosetting polymers are reusable.

79. In one molal solution that contains 0.5 mole of a solute, there is

(1) 500 mL of solvent

(2) 500 g of solvent

(3) 100 mL of solvent

(4) 1000 g of solvent

80. $RMgX + CO_2 \xrightarrow[ether]{dry} Y \xrightarrow{H_3O^+} RCOOH$

What is Y in the above reaction ?

(1) $RCOO^-Mg^+X$

(2) $R_3CO^-Mg^+X$

(3) $RCOO^-X^+$

(4) $(RCOO)_2Mg$

81. Given below are half cell reactions :

$$MnO_4^- + 8\,H^+ + 5\,e^- \rightarrow Mn^{2+} + 4\,H_2O\,,$$

$$E^\circ_{Mn^{2+}/MnO_4^-} = -1.510\ V$$

$$\frac{1}{2}\,O_2 + 2\,H^+ + 2\,e^- \rightarrow H_2O,$$

$$E^\circ_{O_2/H_2O} = +\,1.223\ V$$

Will the permanganate ion, $MnO_4^-$ liberate $O_2$ from water in the presence of an acid ?

(1) Yes, because $E^\circ_{cell} = +0.287\ V$

(2) No, because $E^\circ_{cell} = -0.287\ V$

(3) Yes, because $E^\circ_{cell} = +2.733\ V$

(4) No, because $E^\circ_{cell} = -2.733\ V$

82. What mass of 95% pure $CaCO_3$ will be required to neutralise 50 mL of 0.5 M HCl solution according to the following reaction ?

$$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + 2H_2O_{(l)}$$

[Calculate upto second place of decimal point]

(1) 1.25 g

(2) 1.32 g

(3) 3.65 g

(4) 9.50 g

83. The pH of the solution containing 50 mL each of 0.10 M sodium acetate and 0.01 M acetic acid is

[Given $pK_a$ of $CH_3COOH = 4.57$]

(1) 5.57

(2) 3.57

(3) 4.57

(4) 2.57

84. Match List - I with List - II.

| List - I (Products formed) | | List - II (Reaction of carbonyl compound with) | |
|---|---|---|---|
| (a) | Cyanohydrin | (i) | $NH_2OH$ |
| (b) | Acetal | (ii) | $RNH_2$ |
| (c) | Schiff's base | (iii) | alcohol |
| (d) | Oxime | (iv) | HCN |

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

(1) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

(2) (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

(3) (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)

(4) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)

85. Which amongst the following is incorrect statement ?

(1) The bond orders of $O_2^+$, $O_2$, $O_2^-$ and $O_2^{2-}$ are 2.5, 2, 1.5 and 1, respectively.

(2) $C_2$ molecule has four electrons in its two degenerate $\pi$ molecular orbitals.

(3) $H_2^+$ ion has one electron.

(4) $O_2^+$ ion is diamagnetic.

## Section - B (Chemistry)

86. Given below are two statements :

**Statement I :**

In Lucas test, primary, secondary and tertiary alcohols are distinguished on the basis of their reactivity with conc. HCl + $ZnCl_2$, known as Lucas Reagent.

**Statement II :**

Primary alcohols are most reactive and immediately produce turbidity at room temperature on reaction with Lucas Reagent.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) Both **Statement I** and **Statement II** are correct.

(2) Both **Statement I** and **Statement II** are incorrect.

(3) **Statement I** is correct but **Statement II** is incorrect.

(4) **Statement I** is incorrect but **Statement II** is correct.

87. If radius of second Bohr orbit of the $He^+$ ion is 105.8 pm, what is the radius of third Bohr orbit of $Li^{2+}$ ion ?

(1) 158.7 pm

(2) 15.87 pm

(3) 1.587 pm

(4) 158.7 Å

88. For a first order reaction A $\rightarrow$ Products, initial concentration of A is 0.1 M, which becomes 0.001 M after 5 minutes. Rate constant for the reaction in $min^{-1}$ is

(1) 1.3818

(2) 0.9212

(3) 0.4606

(4) 0.2303

89. A 10.0 L flask contains 64 g of oxygen at 27°C. (Assume $O_2$ gas is behaving ideally). The pressure inside the flask in bar is

(Given R = 0.0831 L bar $K^{-1}$ $mol^{-1}$)

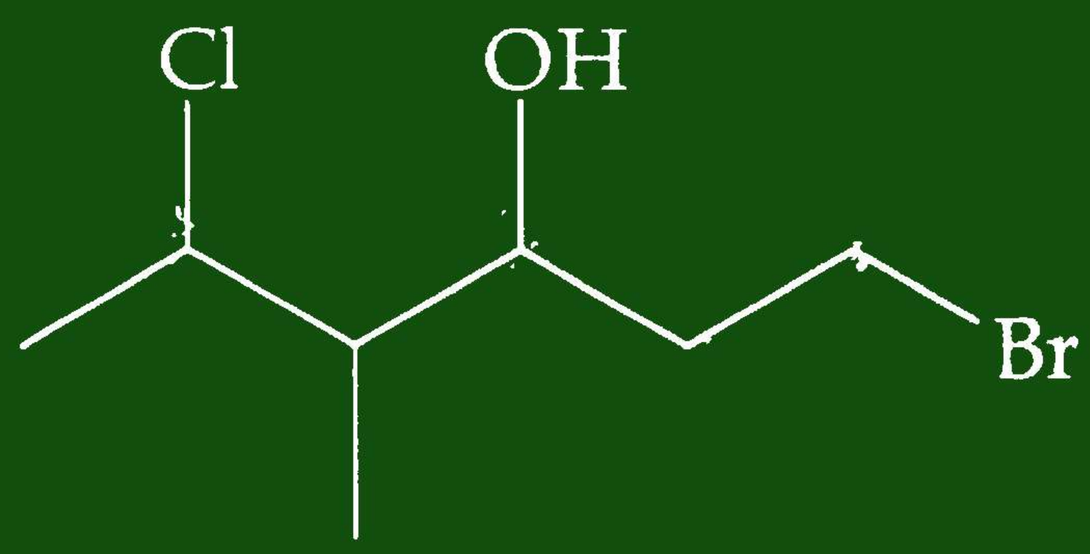
(1) 2.5

(2) 498.6

(3) 49.8

(4) 4.9

90. The correct IUPAC name of the following compound is :




(1) 1-bromo-5-chloro-4-methylhexan-3-ol

(2) 6-bromo-2-chloro-4-methylhexan-4-ol

(3) 1-bromo-4-methyl-5-chlorohexan-3-ol

(4) 6-bromo-4-methyl-2-chlorohexan-4-ol

91. The pollution due to oxides of sulphur gets enhanced due to the presence of :

(a) particulate matter

(b) ozone

(c) hydrocarbons

(d) hydrogen peroxide

Choose the **most appropriate** answer from the options given below :

(1) (a), (d) only

(2) (a), (b), (d) only

(3) (b), (c), (d) only

(4) (a), (c), (d) only

92. Copper crystallises in fcc unit cell with cell edge length of $3.608 \times 10^{-8}$ cm. The density of copper is 8.92 g $cm^{-3}$. Calculate the atomic mass of copper.

(1) 63.1 u

(2) 31.55 u

(3) 60 u

(4) 65 u

93. Find the emf of the cell in which the following reaction takes place at 298 K

$Ni(s) + 2\,Ag^{+}\,(0.001\,M) \rightarrow Ni^{2+}\,(0.001\,M) + 2\,Ag(s)$

(Given that $E^{\circ}_{cell} = 10.5$ V, $\frac{2.303\,RT}{F} = 0.059$ at 298 K)

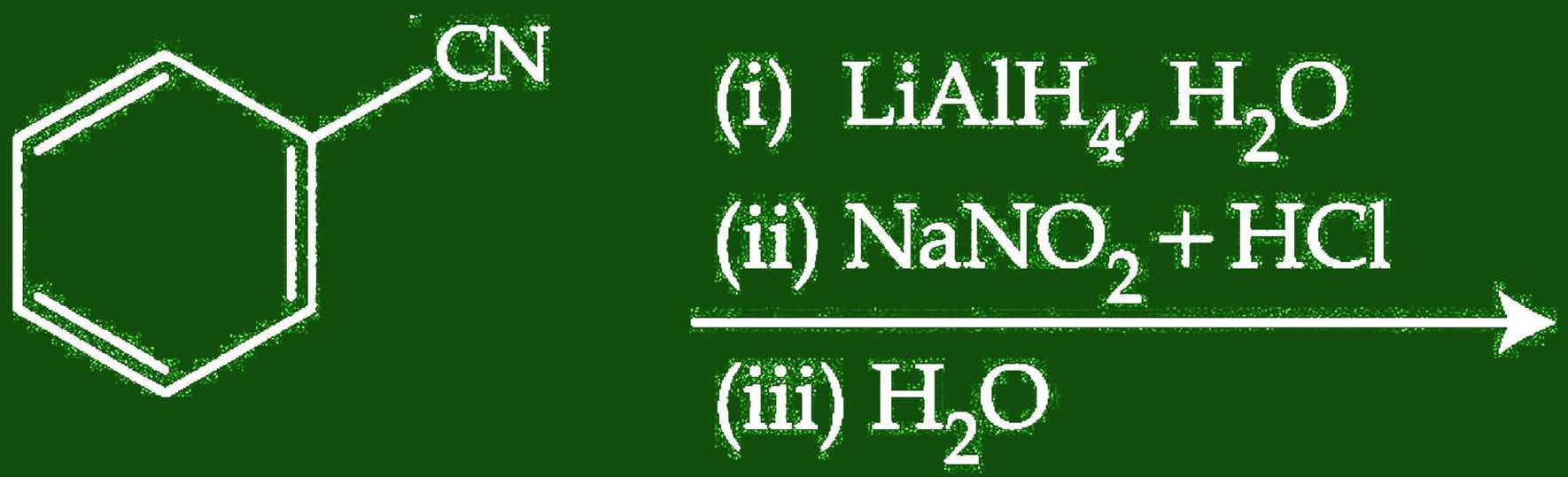
(1) 1.0385 V

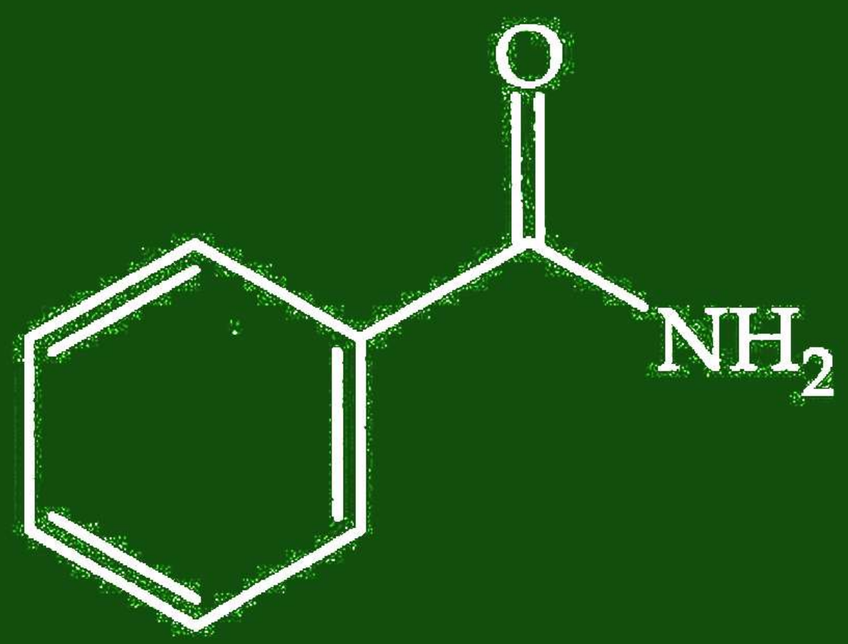
(2) 1.385 V

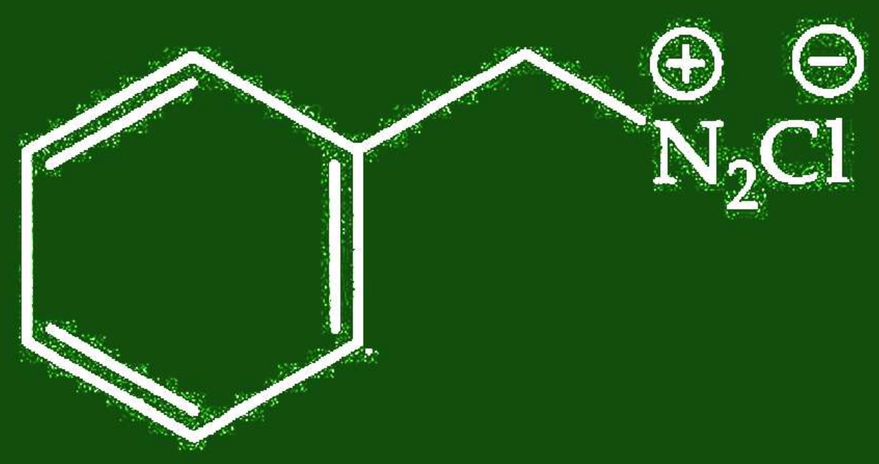
(3) 0.9615 V

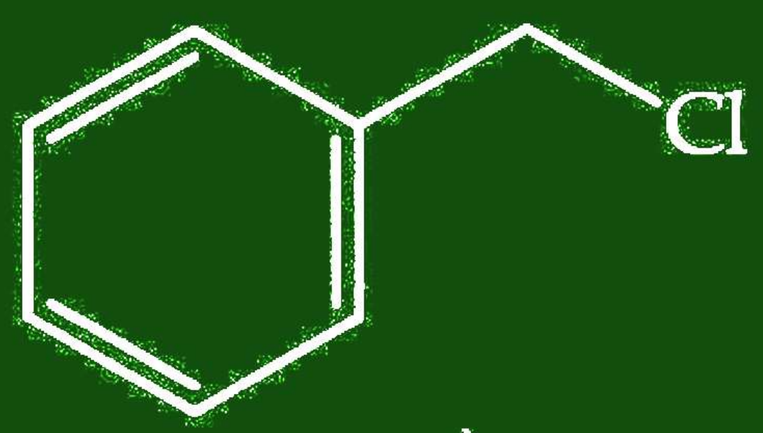
(4) 1.05 V

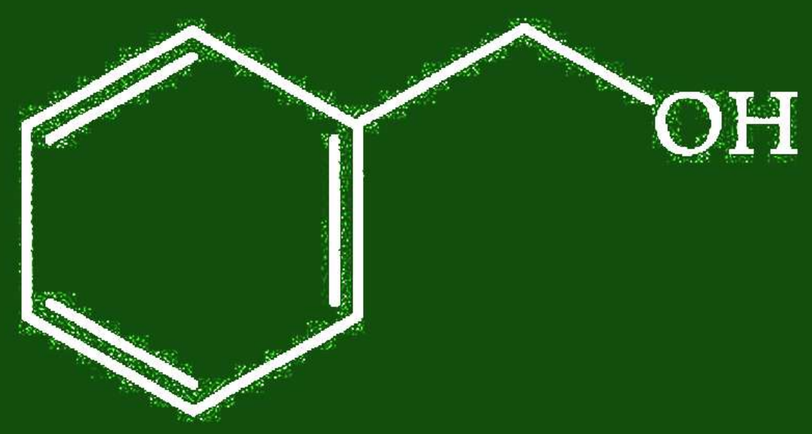
94. The product formed from the following reaction sequence is




(1) 


(2) 


(3) 


(4) 

95. The order of energy absorbed which is responsible for the color of complexes

(A) $[Ni(H_2O)_2(en)_2]^{2+}$

(B) $[Ni(H_2O)_4(en)]^{2+}$ and

(C) $[Ni(en)_3]^{2+}$

is

(1) (A) > (B) > (C)

(2) (C) > (B) > (A)

(3) (C) > (A) > (B)

(4) (B) > (A) > (C)

96. Match List - I with List - II.

| | List - I (Ores) | | List - II (Composition) |
|---|---|---|---|
| (a) | Haematite | (i) | $Fe_3O_4$ |
| (b) | Magnetite | (ii) | $ZnCO_3$ |
| (c) | Calamine | (iii) | $Fe_2O_3$ |
| (d) | Kaolinite | (iv) | $[Al_2(OH)_4 Si_2O_5]$ |

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

(1) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)

(2) (a) - (iii), (b) - (i), (c) - (ii), (d) - (iv)

(3) (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)

(4) (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)

97. In the neutral or faintly alkaline medium, $KMnO_4$ oxidises iodide into iodate. The change in oxidation state of manganese in this reaction is from

(1) $+7$ to $+4$

(2) $+6$ to $+4$

(3) $+7$ to $+3$

(4) $+6$ to $+5$

98. Compound X on reaction with $O_3$ followed by Zn/$H_2O$ gives formaldehyde and 2-methyl propanal as products. The compound X is :

(1) 3-Methylbut-1-ene

(2) 2-Methylbut-1-ene

(3) 2-Methylbut-2-ene

(4) Pent-2-ene

99. $3\,O_2(g) \rightleftharpoons 2\,O_3(g)$

for the above reaction at 298 K, $K_c$ is found to be $3.0 \times 10^{-59}$. If the concentration of $O_2$ at equilibrium is 0.040 M then concentration of $O_3$ in M is

(1) $4.38 \times 10^{-32}$

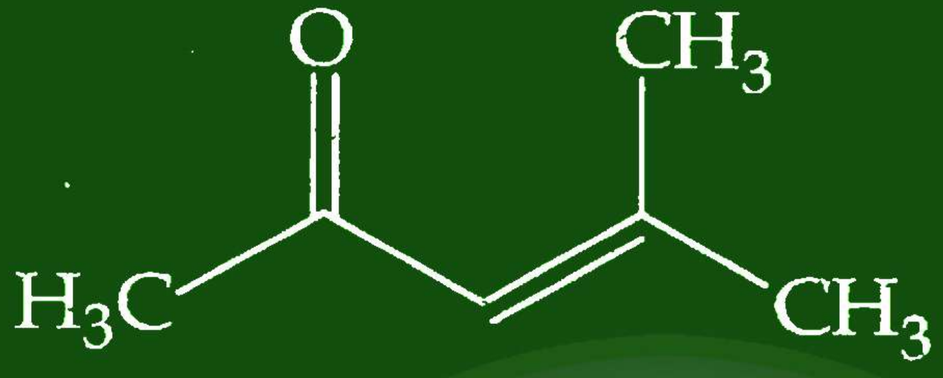
(2) $1.9 \times 10^{-63}$

(3) $2.4 \times 10^{31}$

(4) $1.2 \times 10^{21}$

100. Which one of the following is **not** formed when acetone reacts with 2-pentanone in the presence of dilute NaOH followed by heating ?

(1)



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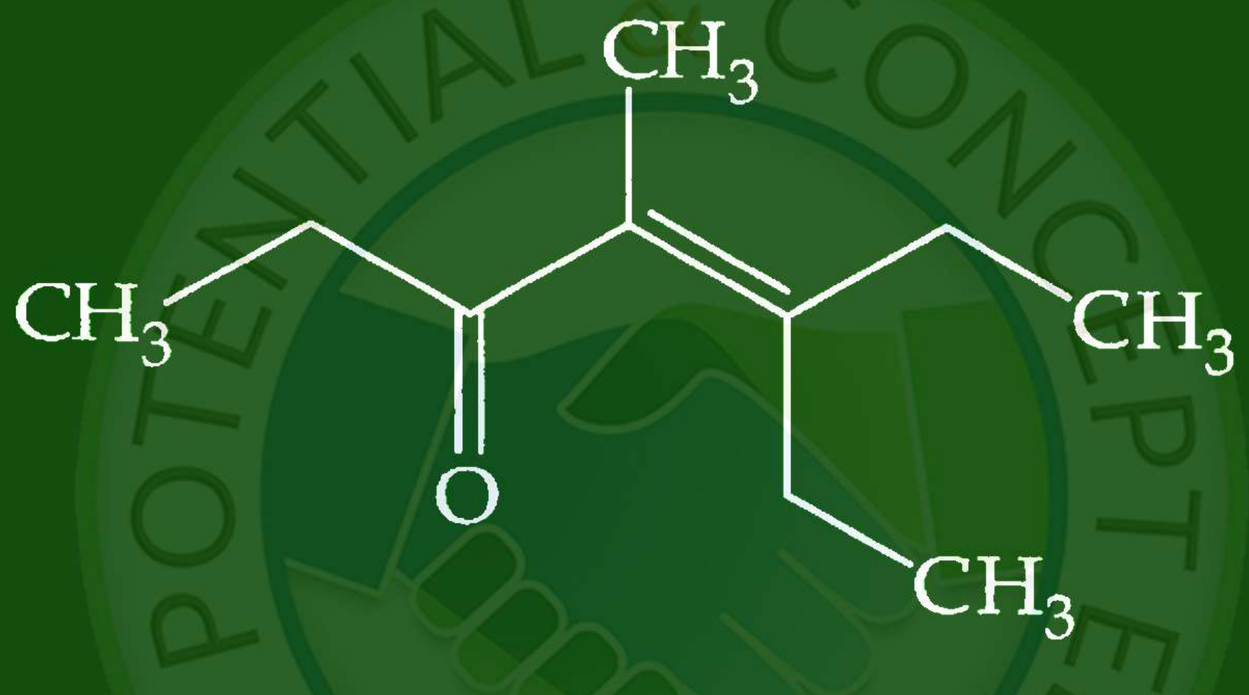
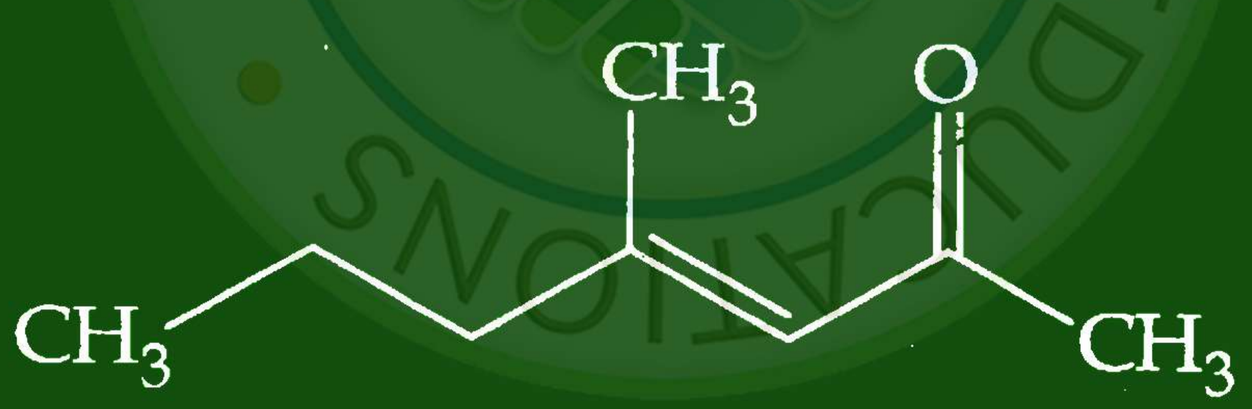


(3)



(4)