CHEMISTRY TEST PAPER WITH ANSWER & SOLUTIONS
FINAL NEET(UG)–2021 (EXAMINATION)

SECTION - A

51. The following solutions were prepared by dissolving 10 g of glucose ($C_6H_{12}O_6$) in 250 ml of water (P_1), 10 g of urea (CH_4N_2O) in 250 ml of water (P_2) and 10 g of sucrose ($C_{12}H_{22}O_{11}$) in 250 ml of water (P_3). The right option for the decreasing order of osmotic pressure of these solutions is :

(1) $P_1 > P_2 > P_3$ (2) $P_2 > P_3 > P_1$

(3) $P_3 > P_1 > P_2$ (4) $P_2 > P_1 > P_3$

Answer (4)

Sol.
- Osmotic pressure (π) = iCRT

  where C is molar concentration of the solution
- With increase in molar concentration of solution osmotic pressure increases.
- Since, weight of all solutes and its solution volume are equal, so higher will be the molar mass of solute, smaller will be molar concentration and smaller will be the osmotic pressure.
- Order of molar mass of solute decreases as

  Sucrose > Glucose > Urea
- So, correct order of osmotic pressure of solution is $P_3 < P_1 < P_2$

52. Which one among the following is the correct option for right relationship between C_P and C_V for one mole of ideal gas?

(1) $C_P - C_V = R$ (2) $C_P = RC_V$

(3) $C_V = RC_P$ (4) $C_P + C_V = R$

Answer (1)

Sol. At constant volume, $q_V = C_V\Delta T = \Delta U$

At constant pressure, $q_P = C_P\Delta T = \Delta H$

For a mole of an ideal gas,

$\Delta H = \Delta U + \Delta(PV)$

$= \Delta U + \Delta(RT)$

$= \Delta U + R\Delta T$

On putting the values of ΔH and ΔU, we have

$C_P\Delta T = C_V\Delta T + R\Delta T$

$C_P = C_V + R$

$C_P - C_V = R$

53. The major product formed in dehydrohalogenation reaction of 2-Bromo pentane is Pent-2-ene. This product formation is based on?

(1) Hund's Rule

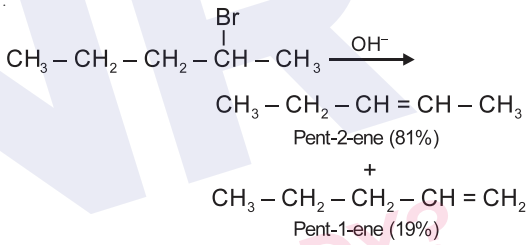
(2) Hofmann Rule

(3) Huckel's Rule

(4) Saytzeff's Rule

Answer (4)

Sol. Major product formed in dehydrohalogenation reaction of 2-bromopentane is pent-2-ene because according to Saytzeff's rule, in dehydrohalogenation reactions, the preferred product is that alkene which has greater number of alkyl group(s) attached to the doubly bonded carbon atoms.



54. An organic compound contains 78% (by wt.) carbon and remaining percentage of hydrogen. The right option for the empirical formula of this compound is : [Atomic wt. of C is 12, H is 1]

(1) CH_2 (2) CH_3

(3) CH_4 (4) CH

Answer (2)

Sol.

Element	Mass percentage	No. of mole	Mole ratio
C	78%	$\frac{78}{12} = 6.5$	$\frac{6.5}{6.5} = 1$
H	22%	$\frac{22}{1} = 22$	$\frac{22}{6.5} = 3.38 \simeq 3$

Based on above calculation, possible empirical formula is CH_3.

55. Zr (Z = 40) and Hf (Z = 72) have similar atomic and ionic radii because of :

(1) Diagonal relationship

(2) Lanthanoid contraction

(3) Having similar chemical properties

(4) Belonging to same group

Answer (2)

Sol.
- The cumulative effect of the contraction of the lanthanoid series, known as lanthanoid contraction, causes the radii of the members of the third transition series to be very similar to those of the corresponding members of the second series.
- The almost identical radii of Zr (160 pm) and Hf (159 pm) is a consequence of the lanthanoid contraction.

56. Which of the following reactions is the metal displacement reaction? Choose the right option.

(1) $Cr_2O_3 + 2Al \xrightarrow{\Delta} Al_2O_3 + 2Cr$

(2) $Fe + 2HCl \rightarrow FeCl_2 + H_2\uparrow$

(3) $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2\uparrow$

(4) $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$

Answer (1)

Sol.
- Both reactions (3) and (4) are examples of decomposition reactions.
- Reactions (1) and (2), both are examples of displacement reactions, while reaction (1) is an example of metal displacement reaction.

57. The structures of beryllium chloride in solid state and vapour phase, are :

(1) Linear in both

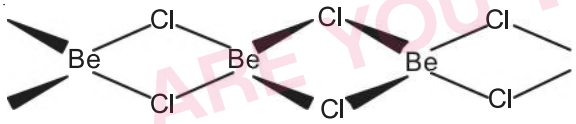
(2) Dimer and Linear, respectively

(3) Chain in both

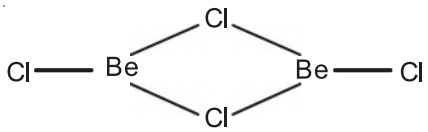
(4) Chain and dimer, respectively

Answer (4)

Sol. Beryllium chloride has a chain structure in the solid state as shown below



In vapour phase Beryllium chloride tends to form a chloro-bridged dimer.



58. The incorrect statement among the following is :

(1) Most of the trivalent Lanthanoid ions are colorless in the solid state

(2) Lanthanoids are good conductors of heat and electricity

(3) Actinoids are highly reactive metals, especially when finely divided.

(4) Actinoid contraction is greater for element to element than lanthanoid contraction

Answer (1)

Sol.
- Actinoids are highly reactive metals, especially when finely divided
- Actinoid contraction is greater from element to element than lanthanoid contraction resulting from poor shielding by 5f electrons
- Many trivalent lanthanoids ions are coloured both in the solid state and in aqueous solutions.
- Lanthanoids have typical metallic structure and are good conductors of heat and electricity

59. Ethylene diaminetetraacetate (EDTA) ion is :

(1) Unidentate ligand

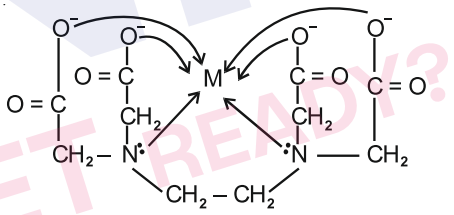
(2) Bidentate ligand with two "N" donor atoms

(3) Tridentate ligand with three "N" donor atoms

(4) Hexadentate ligand with four "O" and two "N" donor atoms

Answer (4)

Sol. Ethylene diaminetetraacetate (EDTA) ion is a hexadented ligand having four donor oxygen atoms and two donor nitrogen atoms



60. A particular station of All India Radio, New Delhi broadcasts on a frequency of 1,368 kHz (kilohertz). The wavelength of the electromagnetic radiation emitted by the transmitter is : [speed of light $c = 3.0 \times 10^8\ ms^{-1}$]

(1) 219.2 m (2) 2192 m

(3) 21.92 cm (4) 219.3 m

Answer (4)

Sol. Energy of electromagnetic radiation (E)

$$= \frac{hc}{\lambda} = h\gamma$$

$$\text{So, } \frac{c}{\lambda} = \gamma \qquad \Rightarrow \lambda = \frac{c}{\gamma}$$

$$\lambda = \frac{3\times10^8}{1368\times10^3} = 219.3\ m$$

61. **Statement I :** Acid strength increases in the order given as HF << HCl << HBr << HI.

Statement II : As the size of the elements F, Cl, Br, I increases down the group, the bond strength of HF, HCl, HBr and HI decreases and so the acid strength increases.

In the light of the above statements, choose the correct answer from the options given below.

(1) Both Statement I and Statement II are false

(2) Statement I is correct but statement II is false

(3) Statement I is incorrect but Statement II is true

(4) Both statement I and Statement II are true

Answer (4)

Sol. In the modern periodic table, moving down the group as the size of halogen atom increases, the H – X bond length also increases as a result the bond enthalpy decreases. Hence, The acidic strength also increases.

So, the correct order of acidic strength is

HI > HBr > HCl > HF

62. Noble gases are named because of their inertness towards reactivity. Identify an incorrect statement about them.

(1) Noble gases have very high melting and boiling points

(2) Noble gases have weak dispersion forces

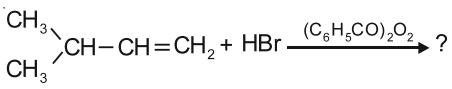
(3) Noble gases have large positive values of electron gain enthalpy

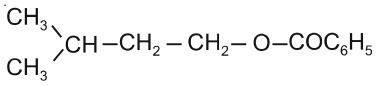
(4) Noble gases are sparingly soluble in water

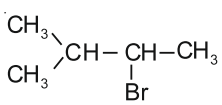
Answer (1)

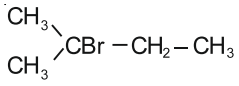
Sol. Noble gases have weak dispersion forces hence they have low melting and boiling points.

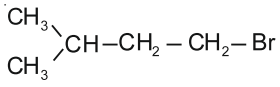
63. The major product of the following chemical reaction is :



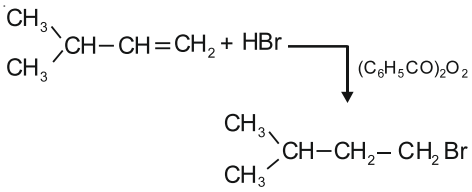
(1) 

(2) 

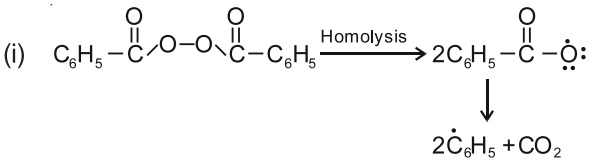
(3) 

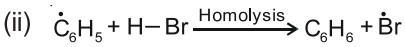
(4) 

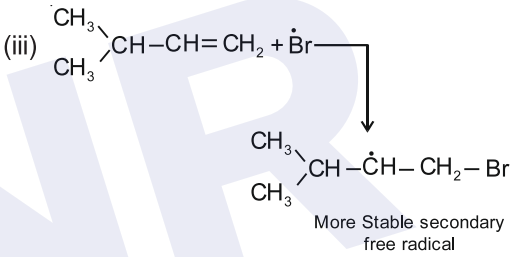
Answer (4)

Sol. 

Mechanism : Peroxide effect proceeds via free radical chain mechanism.

(i) 

(ii) 

(iii) 

(iv) 

64. The molar conductance of NaCl, HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and 91.0 S cm^2 mol^{-1} respectively. The molar conductance of CH_3COOH at infinite dilution is. Choose the right option for your answer.

(1) 390.71 S cm^2 mol^{-1}

(2) 698.28 S cm^2 mol^{-1}

(3) 540.48 S cm^2 mol^{-1}

(4) 201.28 S cm^2 mol^{-1}

Answer (1)

Sol. According to Kohlrausch law of independent migration of ions.

$$\Lambda_m^o(CH_3COOH)$$

$$= \Lambda_m^o(CH_3COONa) + \Lambda_m^o(HCl) - \Lambda_m^o(NaCl)$$

$$= 91.0 \text{ S cm}^2 \text{ mol}^{-1} + 426.16 \text{ S cm}^2 \text{ mol}^{-1} - 126.45 \text{ S cm}^2 \text{ mol}^{-1}$$

$$= 390.71 \text{ S cm}^2 \text{ mol}^{-1}$$

65. The compound which shows metamerism is :

(1) C_3H_8O (2) C_3H_6O

(3) $C_4H_{10}O$ (4) C_5H_{12}

Answer (3)

Sol. Compounds with formula $C_4H_{10}O$ can be ethers which may exhibit metamerism. For example

$CH_3-CH_2-O-CH_2-CH_3$, $CH_3-O-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

and CH_3—O—CH_2—CH_2—CH_3 are metamers as structure of alkyl chains are different around the functional group.

66. The correct sequence of bond enthalpy of 'C—X' bond is :

(1) $CH_3-F > CH_3-Cl > CH_3-Br > CH_3-I$

(2) $CH_3-F < CH_3-Cl > CH_3-Br > CH_3-I$

(3) $CH_3-Cl > CH_3-F > CH_3-Br > CH_3-I$

(4) $CH_3-F < CH_3-Cl < CH_3-Br < CH_3-I$

Answer (1)

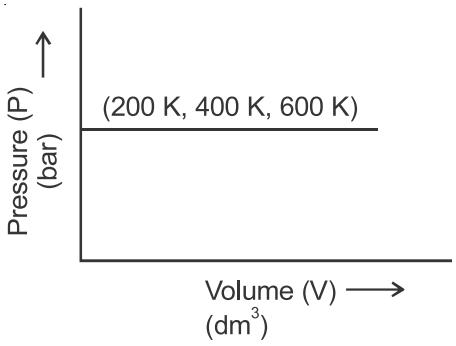
Sol. The size of halogen atom increases from F to I hence bond length from C – F to C – I increases

$\therefore$ Bond enthalpy from CH_3-F to CH_3-I decreases

C – X Bond	Bond dissociation enthalpies/kJ mol^{-1}
CH_3 — F	452
CH_3 — Cl	351
CH_3 — Br	293
CH_3 — I	234

67. Choose the correct option for graphical representation of Boyle's law, which shows a graph of pressure vs. volume of a gas at different temperatures :

(1)



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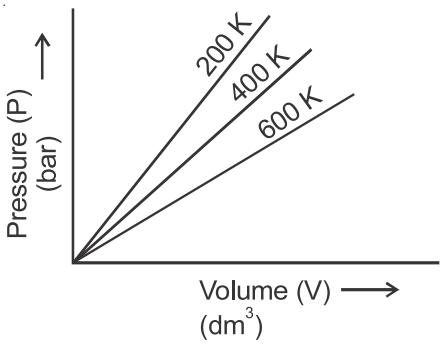
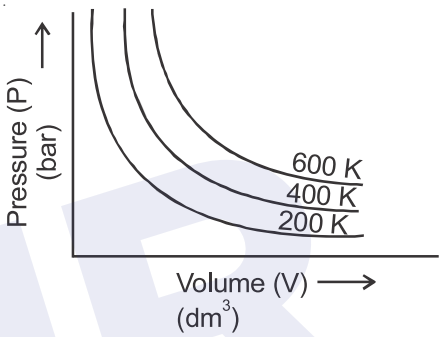
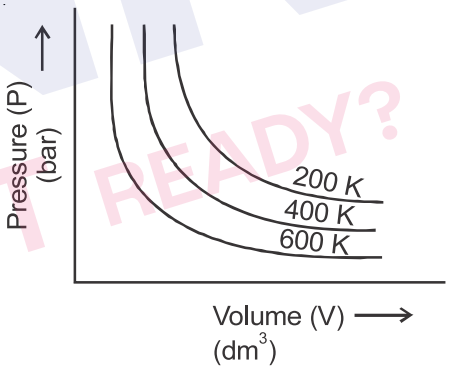


(3)



(4)



Answer (3)

Sol. According to Boyle's law

$$P \propto \frac{1}{V} \Rightarrow P = \frac{k}{V} \Rightarrow PV = k$$

where k is proportionality constant and equal to nRT.

$\therefore$ Graph between P vs. V should be rectangular hyperbola and product of PV increases with increase in temperature.

68. Right option for the number of tetrahedral and octahedral voids in hexagonal primitive unit cell are :

(1) 6, 12 (2) 2, 1

(3) 12, 6 (4) 8, 4

Answer (3)

Sol.
- Number of octahedral and tetrahedral voids formed by N closed packed atoms are N and 2N respectively.
- Each hexagonal unit cell contains 6 atoms therefore, number of tetrahedral and octahedral voids are 12 and 6 respectively.

69. Given below are two statements :

Statement I :

Aspirin and Paracetamol belong to the class of narcotic analgesics.

Statement II :

Morphine and Heroin are non-narcotic analgesics. In the light of the above statements, choose the correct answer from the options given below.

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

(2) **Statement I** is correct but **Statement II** is false

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

(4) Both **Statement I** and **Statement II** are true

Answer (1)

Sol.
- Aspirin and paracetamol belong to the class of non-narcotic analgesics
- Morphine and Heroin are Narcotic analgesics
- $\therefore$ Both statement I and statement II are false

70. Dihedral angle of least stable conformer of ethane is :

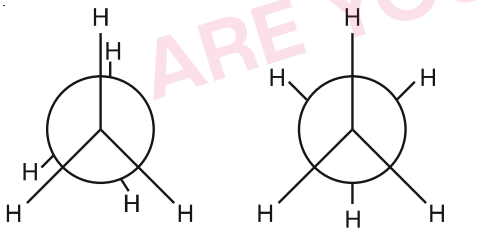
(1) 180° (2) 60°

(3) 0° (4) 120°

Answer (3)

Sol. Ethane has two conformers (i) Eclipsed
(ii) Staggered

Eclipsed conformer is least stable while staggered conformer is most stable. In eclipsed conformer the dihedral angle is 0°



Eclipsed
Dihedral angle = 0°

Staggered
Dihedral angle = 60°

71. Which one of the following methods can be used to obtain highly pure metal which is liquid at room temperature?

(1) Chromatography (2) Distillation

(3) Zone refining (4) Electrolysis

Answer (2)

Sol. Distillation method is generally used for the purification of metals having low boiling point such as Hg, Zn etc.

72. Match List-I with List-II.

List-I	List-II
(a) PCl_5	(i) Square pyramidal
(b) SF_6	(ii) Trigonal planar
(c) BrF_5	(iii) Octahedral
(d) BF_3	(iv) Trigonal bipyramidal

Choose the correct answer from the options given below.

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

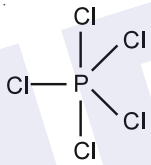
(2) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

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

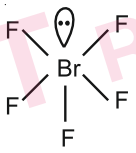
(4) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

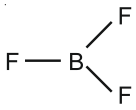
Answer (4)

Sol.

(a)  sp^3d hybridised and trigonal bipyramidal in shape

(b)  sp^3d^2 hybridised and octahedral in shape

(c)  sp^3d^2 hybridised and square pyramidal in shape

(d)  sp^2 hybridised and trigonal planar in shape

73. Tritium, a radioactive isotope of hydrogen, emits which of the following particles?

(1) Alpha (α) (2) Gamma (γ)

(3) Neutron (n) (4) Beta (β^-)

Answer (4)

Sol. Hydrogen has three isotopes : protium, ^1_1H deuterium, ^2_1H or D and tritium ^3_1H or T. Of these isotopes, only tritium is radioactive and emits low energy β^- particles ($t_{1/2}$, 12.33 years).

74. Which one of the following polymers is prepared by addition polymerisation?

(1) Nylon-66 (2) Novolac

(3) Dacron (4) Teflon

Answer (4)

Sol. Dacron, Nylon-66 and Novolac are prepared by condensation polymerisation.

Teflon is an addition polymer. Monomer of teflon is tetrafluoroethene.

$$nCF_2 = CF_2 \xrightarrow[\text{High pressure}]{\text{Catalyst}} \underset{\text{Teflon}}{-[CF_2 - CF_2]_n-}$$

Tetrafluoroethene

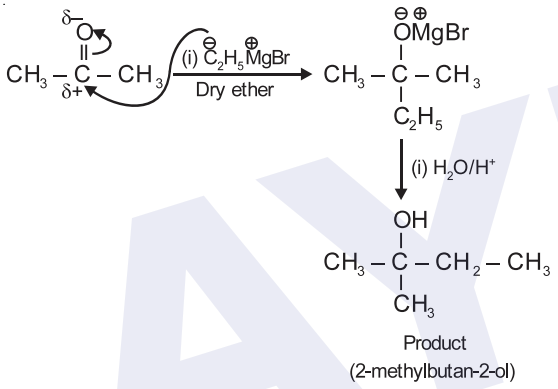
75. What is the IUPAC name of the organic compound formed in the following chemical reaction?

$$\text{Acetone} \xrightarrow[(ii)\ H_2O,\ H^+]{(i)\ C_2H_5MgBr,\ \text{dry Ether}} \text{Product}$$

(1) pentan-2-ol
(2) pentan-3-ol
(3) 2-methylbutan-2-ol
(4) 2-methylpropan-2-ol

Answer (3)

Sol.



Product
(2-methylbutan-2-ol)

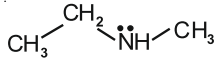
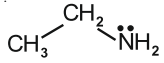
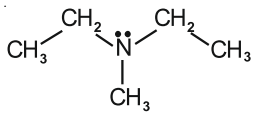
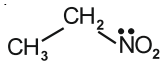
76. The RBC deficiency is deficiency disease of :

(1) Vitamin B_6 (2) Vitamin B_1
(3) Vitamin B_2 (4) Vitamin B_{12}

Answer (4)

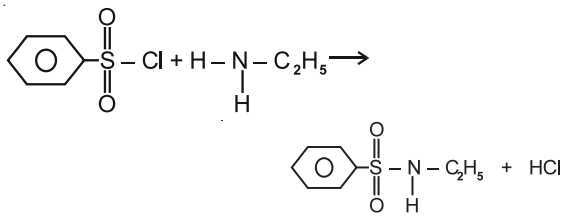
Sol.
- Deficiency of vitamin B_2 (Riboflavin) causes cheilosis, digestive disorders and burning sensation of the skin.
- Deficiency of vitamin B_{12} causes Pernicious anaemia which is RBC deficiency in haemoglobin.
- Deficiency of vitamin B_6 (Pyridoxine) causes Convulsions.
- Deficiency of vitamin B_1 (Thiamine) causes Beri-Beri (loss of appetite and retarded growth).

77. Identify the compound that will react with Hinsberg's reagent to give a solid which dissolves in alkali.

(1) 
(2) 
(3) 
(4) 

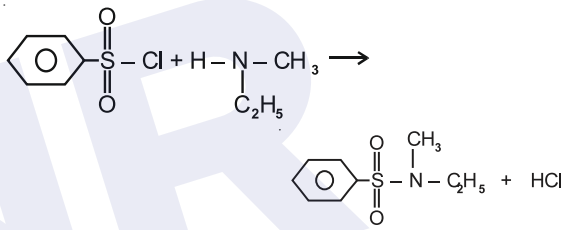
Answer (2)

Sol.
- Benzenesulphonyl chloride ($C_6H_5SO_2Cl$) is also known as Hinsberg's reagent.
- The reaction of Hinsberg's reagent ($C_6H_5SO_2Cl$) with primary amine ($CH_3CH_2NH_2$) yields N-ethylbenzene sulphonamide.



N-Ethylbenzene sulphonamide
(Soluble in alkali)

- The reaction of Hinsberg's reagent ($C_6H_5SO_2Cl$) with secondary amine ($C_2H_5NHCH_3$) gives, N-Ethyl-N-Methyl benzene sulphonamide



Insoluble in alkali due to absence of H-atom

- 3° amine do not react with Hinsberg reagent

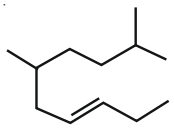
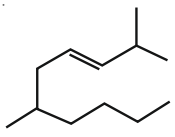
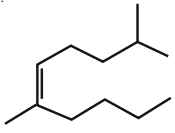
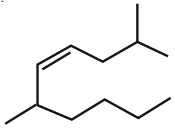
78. Among the following alkaline earth metal halides, one which is covalent and soluble in organic solvents is :

(1) Strontium chloride (2) Magnesium chloride
(3) Beryllium chloride (4) Calcium chloride

Answer (3)

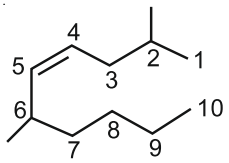
Sol.
- Except for beryllium chloride all other chloride of alkaline earth metals are ionic in nature.
- Due to small size of Be, Beryllium chloride is essentially covalent and soluble in organic solvents.

79. The correct structure of 2, 6-Dimethyl-dec-4-ene is

(1) 
(2) 
(3) 
(4) 

Answer (4)

Sol.



2, 6-Dimethyldec-4-ene

80. The correct option for the number of body centred unit cells in all 14 types of Bravais lattice unit cells is :

(1) 5 (2) 2

(3) 3 (4) 7

Answer (3)

Sol.
- In 14 types of Bravais lattices, body centred unit cell is present in cubic, tetragonal and orthorhombic crystal systems.
- Hence, body centred possible variation is present in three crystal systems.

81. The right option for the statement "Tyndall effect is exhibited by", is :

(1) Glucose solution

(2) Starch solution

(3) Urea solution

(4) NaCl solution

Answer (2)

Sol.
- Tyndall effect is exhibited by colloidal solution only.
- Among the given options, Urea, NaCl and Glucose solutions are true solutions, so cannot show Tyndall effect.
- Starch solution is a colloidal solution therefore can show Tyndall effect.

82. The pK_b of dimethylamine and pK_a of acetic acid are 3.27 and 4.77 respectively at T (K). The correct option for the pH of dimethylammonium acetate solution is :

(1) 5.50 (2) 7.75

(3) 6.25 (4) 8.50

Answer (2)

Sol. Dimethylammonium acetate is a salt of weak acid and weak base whose pH can be calculated as

$$pH = 7 + \frac{1}{2}(pK_a - pK_b)$$

$$= 7 + \frac{1}{2}(4.77 - 3.27)$$

$$= 7.75$$

83. BF_3 is planar and electron deficient compound. Hybridization and number of electrons around the central atom, respectively are :

(1) sp^3 and 6 (2) sp^2 and 6

(3) sp^2 and 8 (4) sp^3 and 4

Answer (2)

Sol.

- Number of electrons around boron atom is 6.
- Hybridization of B is sp^2.
- Shape is trigonal planar.

84. The maximum temperature that can be achieved in blast furnace is :

(1) Upto 2200 K (2) Upto 1900 K

(3) Upto 5000 K (4) Upto 1200 K

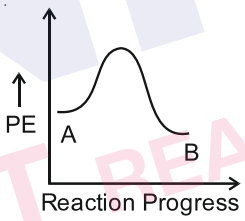
Answer (1)

Sol. Maximum temperature that can be achieved in blast furnace is upto 2200 K.

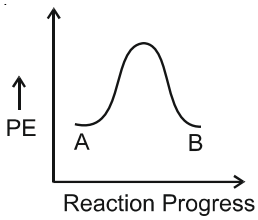
(As per NCERT text: 2170 K maximum temperature is given in the figure of blast furnace)

85. For a reaction A → B, enthalpy of reaction is –4.2 kJ mol^{-1} and enthalpy of activation is 9.6 kJ mol^{-1}. The correct potential energy profile for the reaction is shown in option.

(1)



(2)



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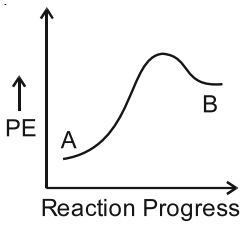

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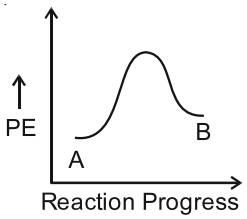


Answer (1)

Sol. • $\Delta H_{rxn} = (E_a)_f - (E_a)_b$

$-4.2 = (E_a)_f - (E_a)_b$

$-4.2 = 9.6 - (E_a)_b$

$(E_a)_b = 9.6 + 4.2 = 13.8 \text{ kJ mol}^{-1}$

- Since reaction is exothermic, so possible graph is (1) only.
- Also $(E_a)_f < (E_a)_b$, so answer is option (1).

SECTION - B

86. Match List-I with List-II.

	List-I		List-II
(a)	$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$	(i)	Acid rain
(b)	$HOCl(g) \xrightarrow{h\nu} \dot{O}H + \dot{C}l$	(ii)	Smog
(c)	$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$	(iii)	Ozone depletion
(d)	$NO_2(g) \xrightarrow{h\nu} NO(g) + O(g)$	(iv)	Tropospheric pollution

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

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

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

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

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

Answer (2)

Sol. • Tropospheric pollution: In the presence of pollutant, SO_2 cunverts into SO_3.

$$2SO_2 + O_2 \rightarrow 2SO_3$$

- In spring season, sunlight breaks HOCl and Cl_2 to give chlorine radicals.

$$HOCl \xrightarrow{h\nu} \dot{O}H(g) + \dot{C}l(g)$$

These chlorine radicals deplete ozone layer

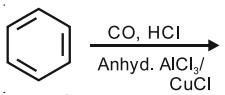
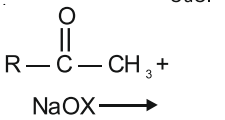
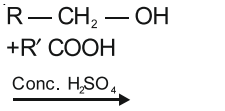
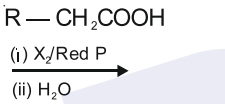
- High level of sulphur causes acid rain which reacts with marble and causes discolouring and disfiguring

$$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$$

- A chain reaction occurs from interaction of NO with sunlight in which NO is converted to NO_2 which absorb energy from sunlight and breaks into NO and O, which causes photochemical smong.

$$NO_2(g) \xrightarrow{h\nu} NO(g) + O(g)$$

87. Match List-I with List-II

	List-I		List-II
(a)		(i)	Hell-Volhard-Zelinsky reaction
(b)		(ii)	Gattermann-Koch reaction
(c)		(iii)	Haloform reaction
(d)		(iv)	Esterification

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

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

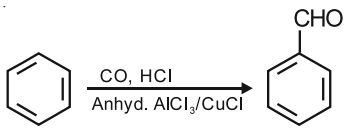
(2) (a) - (i), (b) - (iv), (c) - (iii), (d) - (ii)

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

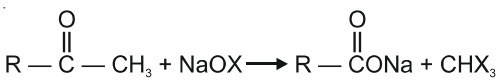
(4) (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii)

Answer (3)

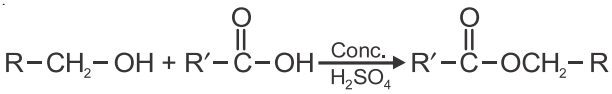
Sol. • Gattermann-Koch reaction:



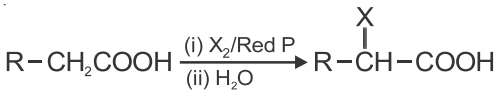
- Haloform reaction:



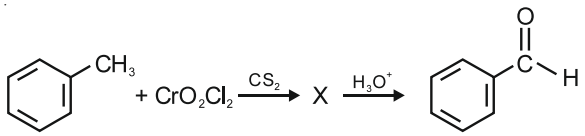
- Esterification:

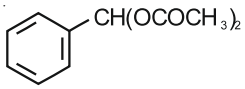


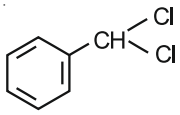
- Hell-Volhard-Zelinsky reaction:

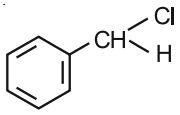


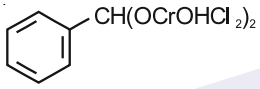
88. The intermediate compound 'X' in the following chemical reaction is:



(1) 

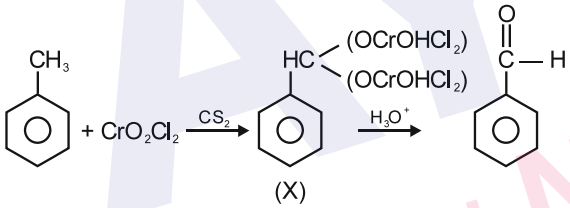
(2) 

(3) 

(4) 

Answer (4)

Sol. Etard's reaction

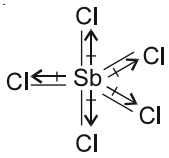


89. Which of the following molecules is non-polar in nature?

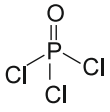
(1) CH_2O (2) $SbCl_5$

(3) NO_2 (4) $POCl_3$

Answer (2)

Sol. $SbCl_5$: 

Net vector summation of bond moments will be zero so $SbCl_5$ is a non-polar molecule.

- NO_2 :  ⇒ polar molecule.
- $POCl_3$:  ⇒ polar molecule.
- CH_2O :  ⇒ polar molecule.

90. $CH_3CH_2COO^-Na^+ \xrightarrow[\text{Heat}]{NaOH, +?} CH_3CH_3 + Na_2CO_3$.

Consider the above reaction and identify the missing reagent/chemical.

(1) Red Phosphorus (2) CaO

(3) DIBAL-H (4) B_2H_6

Answer (2)

Sol. Alkane is produced by heating sodium salt of carboxylic acid with sodalime (NaOH and CaO in the ratio of 3 : 1)

$$CH_3CH_2COO^-Na^+ \xrightarrow[\text{Heat}]{NaOH+CaO} CH_3CH_3 + Na_2CO_3$$

91. In which one of the following arrangements the given sequence is not strictly according to the properties indicated against it?

(1) $H_2O < H_2S < H_2Se < H_2Te$: Increasing pK_a values

(2) $NH_3 < PH_3 < AsH_3 < SbH_3$: Increasing acidic character

(3) $CO_2 < SiO_2 < SnO_2 < PbO_2$: Increasing oxidizing power

(4) HF < HCl < HBr < HI : Increasing acidic strength

Answer (1)

Sol. Stronger is the acid, lower is the value of pK_a. On moving down the group, bond dissociation enthalpy of hydrides of group 16 elements decreases hence acidity increases and pK_a value decreases. Correct order of pK_a value will be

$H_2O > H_2S > H_2Se > H_2Te$

92. From the following pairs of ions which one is not an iso-electronic pair?

(1) Na^+, Mg^{2+} (2) Mn^{2+}, Fe^{3+}

(3) Fe^{2+}, Mn^{2+} (4) O^{2-}, F^-

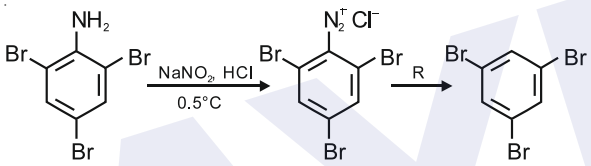
Answer (3)

Sol.

- Isoelectronic species have some number ofelectrons.
-

Species	Number of electrons
Fe^{2+}	26 – 2 = 24
Mn^{2+}	25 – 2 = 23
O^{2-}	8 + 2 = 10
F^-	9 + 1 = 10
Na^+	11 – 1 = 10
Mg^{2+}	12 – 2 = 10
Fe^{3+}	26 – 3 = 23

93. The reagent 'R' in the given sequence of chemical reaction is:

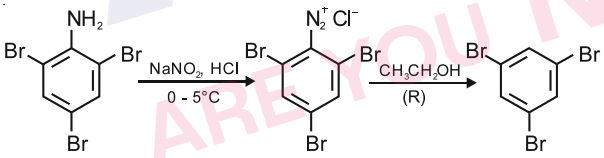


(1) CH_3CH_2OH (2) HI

(3) CuCN/KCN (4) H_2O

Answer (1)

Sol.



Reagent R is C_2H_5OH with diazonium salt.

94. Match List-I with List-II.

List-I	List-II
(a) $[Fe(CN)_6]^{3-}$	(i) 5.92 BM
(b) $[Fe(H_2O)_6]^{3+}$	(ii) 0 BM
(c) $[Fe(CN)_6]^{4-}$	(iii) 4.90 BM
(d) $[Fe(H_2O)_6]^{2+}$	(iv) 1.73 BM

Choose the correct answer from the options given below.

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

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

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

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

Answer (3)

Sol. Magnetic moment, $\mu = \sqrt{n(n+2)}$ BM (where n = number of unpaired electrons)

Complex	No. of unpaired electron(s)	μ(BM)
(a) $[Fe(CN)_6]^{3-}$	1	1.73
(b) $[Fe(H_2O)_6]^{3+}$	5	5.92
(c) $[Fe(CN)_6]^{4-}$	0	0
(d) $[Fe(H_2O)_6]^{2+}$	4	4.90

95. The correct option for the value of vapour pressure of a solution at 45°C with benzene to octane in molar ratio 3 : 2 is :

[At 45°C vapour pressure of benzene is 280 mm Hg and that of octane is 420 mm Hg. Assume Ideal gas]

(1) 168 mm of Hg (2) 336 mm of Hg

(3) 350 mm of Hg (4) 160 mm of Hg

Answer (2)

Sol. Given : $n_{C_6H_6} : n_{C_8H_{18}} = 3 : 2$

So, $\chi_{C_6H_6} = \frac{3}{5}, \chi_{C_8H_{18}} = \frac{2}{5}$

$$p_s = p^o_{C_6H_6}\chi_{C_6H_6} + p^o_{C_8H_{18}}\chi_{C_8H_{18}}$$

$$= 280\times\frac{3}{5} + 420\times\frac{2}{5}$$

$$= 168 + 168$$

= 336 mm of Hg

96. The slope of Arrhenius plot $\left(\ln k \text{ v/s } \frac{1}{T}\right)$ of first order reaction is -5×10^3K. The value of E_a of the reaction is. Choose the correct option for your answer.

[Given R = 8.314 $JK^{-1}mol^{-1}$]

(1) 83.0 kJ mol^{-1} (2) 166 kJ mol^{-1}

(3) –83 kJ mol^{-1} (4) 41.5 kJ mol^{-1}

Answer (4)

Sol. Arrhenius equation

$k = Ae^{-E_a/RT}$

$\ln k = \ln A + \ln e^{-E_a/RT}$

$\ln k = \ln A - \frac{E_a}{R}\left(\frac{1}{T}\right) \longrightarrow (1)$

Slope of $\ln k$ vs $\frac{1}{T}$ curve,

$m = -\frac{E_a}{R}$

$-5\times10^3 = -\frac{E_a}{R}$

$E_a = 5 \times 10^3 \times 8.314$ J/mol

$= 41.57 \times 10^3$ J/mol

$\simeq 41.5$ kJ/mol

97. For irreversible expansion of an ideal gas under isothermal condition, the correct option is:

(1) $\Delta U \neq 0$, $\Delta S_{total} \neq 0$ (2) $\Delta U = 0$, $\Delta S_{total} \neq 0$

(3) $\Delta U \neq 0$, $\Delta S_{total} = 0$ (4) $\Delta U = 0$, $\Delta S_{total} = 0$

Answer (2)

Sol.
- For a spontaneous process, $\Delta S_{total} > 0$ and since irreversible process is always spontaneous therefore $\Delta S_{total} > 0$.
- Since $\Delta U = nC_V\Delta T$ and $\Delta T = 0$ for isothermal process therefore $\Delta U = 0$.

98. Choose the **correct** option for the total pressure (in atm.) in a mixture of 4 g O_2 and 2 g H_2 confined in a total volume of one litre at 0°C is :

[Given R = 0.082 L atm $mol^{-1}K^{-1}$, T = 273 K]

(1) 2.602 (2) 25.18

(3) 26.02 (4) 2.518

Answer (2)

Sol. $n_{O_2} = \frac{4}{32} = \frac{1}{8}$

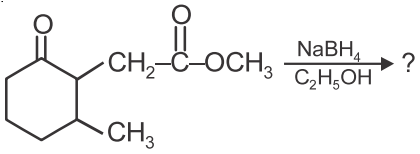
$n_{H_2} = \frac{2}{2} = 1$

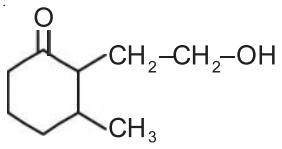
$n_t = \frac{1}{8} + 1 = \frac{9}{8}$

$P_tV = n_t RT$

$P_t = \frac{\frac{9}{8}\times0.082\times273}{1} = 25.18$ atm

99. The product formed in the following chemical reaction is:



(1)


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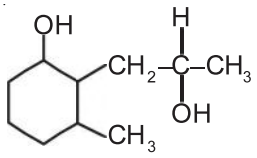
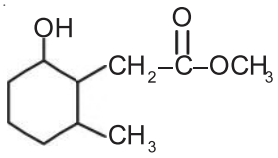
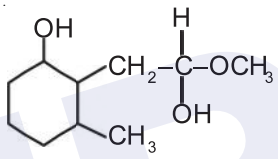
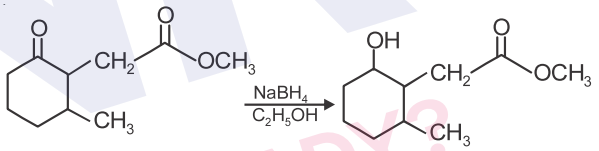


(3)


(4)


Answer (3)

Sol. $NaBH_4$ is a reducing agent. If reduces carbonyl group into alcohols but does not reduce esters.



100. The molar conductivity of 0.007 M acetic acid is 20 S cm^2 mol^{-1}. What is the dissociation constant of acetic acid? Choose the **correct** option.

$$\left[\begin{array}{l}\Lambda^\circ_{H^+} = 350 \text{ S cm}^2 \text{ mol}^{-1} \\ \Lambda^\circ_{CH_3COO^-} = 50 \text{ S cm}^2 \text{ mol}^{-1}\end{array}\right]$$

(1) 2.50×10^{-4} mol L^{-1} (2) 1.75×10^{-5} mol L^{-1}

(3) 2.50×10^{-5} mol L^{-1} (4) 1.75×10^{-4} mol L^{-1}

Answer (2)

Sol. $\Lambda_m = 20$ S cm^2 mol^{-1}

$\Lambda^o_{m\ CH_3COOH} = \Lambda^o_{CH_3COO^-} + \Lambda^o_{m\ H^+}$

$= 50 + 350 = 400$ S cm^2 mol^{-1}

$\alpha = \frac{\Lambda_m}{\Lambda^o_m} = \frac{20}{400} = \frac{1}{20}$

$K_a = \frac{C\alpha^2}{1-\alpha} \simeq C\alpha^2 = 7\times10^{-3}\times\left(\frac{1}{20}\right)^2$

$= 7\times10^{-3}\times\frac{1}{4}\times10^{-2}$

$= 1.75\times10^{-5}$ mol L^{-1}