CHEMISTRY

BOOKS - KVPY PREVIOUS YEAR

KVPY

Chemistry

1. The number of isomers of Co (diethylene triamine) Cl_3 is -

A. 2

B. 3

C. 4

D. 5

Answer: A

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2. Among the following, the π-acid ligand is-

A. F^-

B. NH_3

C. CN^-

D. I^-

Answer: C

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3. The bond order in O_2^{2-} is-

A. 2

B. 3

C. 1.5

D. 1

Answer: D

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4. The energy of a photon wavelength $k = 1$ meter is (Planck's constant $= 6.625 \times 10^{-34}$ Js, speed of light = $3 \times 10^{8} m / s$)

A. $1.988 \times 10^{-23} J$

B. $1.988 \times 10^{-28} J$

C. $1.988 \times 10^{-30} J$

D. $1.988 \times 10^{-25} J$

Answer: A

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5. The concentration of a substance undergoing a chemical reaction becomes one-half of its original value after time t regardless of the initial concentration. The reaction is an example of a -

A. zero order reaction

B. first order reaction

C. second order reaction

D. third order reaction

Answer: B

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6. The shape of the molecule ClF_3 is -

A. trigonal planar

B. pyramidal

C. T-shaped

D. Y-shaped

Answer: C

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7. Friedel-Crafts acylation is-

A. α-acylation of a carbonyl compound

B. acylation of phenols to generate esters

C. acylation of aliphatic olefins

D. acylation of aromatic nucleus

Answer: D

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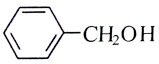
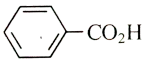
8. The order of acidity of compounds I-IV, is -



(I)



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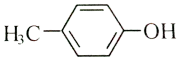

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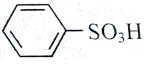

(IV)

A. $I < III < II < IV$

B. $IV < I < II < III$

C. $III < I < II < IV$

D. $II < IV < III < I$

Answer: A

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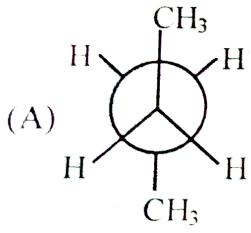
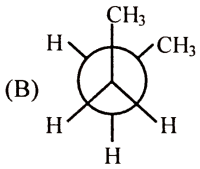
9. In the following the most stable conformation of n-butane is:

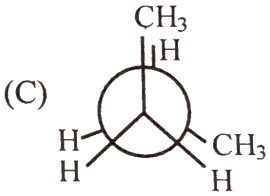
A.



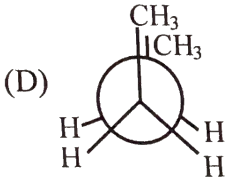
B.



C.



D.



Answer: A

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10. In the nuclear reaction ${}_{90}^{234}Th \rightarrow {}_{91}^{234}Pa + X$. X is -

A. ${}_{-1}^{0}e$

B. ${}_{1}^{0}e$

C. H

D. ${}_{1}^{2}H$

Answer: A

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11. A concentrated solution of copper sulphate, which is dark blue in colour, a mixed at room temperature with a dilute solution of copper sulphate, which is light blue. For this process-

A. Entropy change is positive, but enthalpy change is negative

B. Entropy and enthalpy changes are both positive

C. Entropy change is positive and enthalpy does not change

D. Entropy change is negative and enthalpy change is positive

Answer: C

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12. Increasing the temperature increases the rate of reaction but does not increase the-

A. number of collisions

B. activation energy

C. average energy of collisions

D. average velocity of the reactant molecules

Answer: B

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13. In metallic solids, the number of atoms for the face-centred and the body-centered cubic unit cells, are, respectively-

A. 2,4

B. 2,2

C. 4,2

D. 4,4

Answer: C

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14. From equation (i) and (ii),

$CO_2 \Leftrightarrow CO + \frac{1}{2}O_2 \left[K_{c1} = 9.0 \times 10^{-12} \text{ at } 1000^\circ C\right]$ (i)

$H_2O \Leftrightarrow H_2 + \frac{1}{2}O_2 \left[K_{c2} = 7.0 \times 10^{-12} \text{ at } 1000^\circ C\right]$ (ii)

the equilibrium for the reaction

$CO_2 + H_2 \Leftrightarrow CO + H_2O$

at the same temperature is

A. 0.78

B. 2.0

C. 16.2

D. 1.28

Answer: D

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15. For a first order reaction $R \rightarrow P$, the rate constant is k. if the initial concentration of R is $[R_0]$, the concentration of R at any time $'t'$ is given by the expression-

A. $[R_0]e^{kt}$

B. $[R_0]\left(1 - e^{-kt}\right)$

C. $[R_0]e^{-kt}$

D. $[R_0]\left(1 - e^{kt}\right)$

Answer: B

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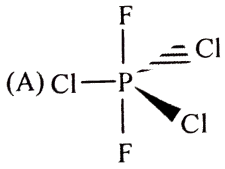
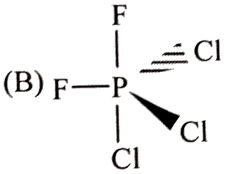
16. The correct structure of PCl_3F_2 is -

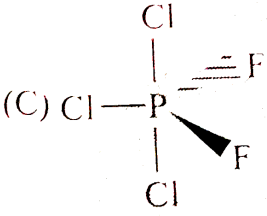
A.



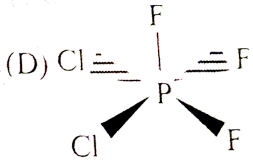
B.



C.



D.



Answer: A

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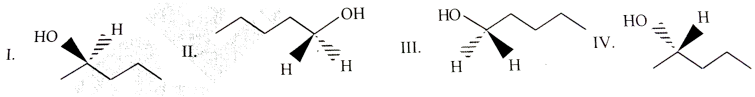
17. The enontiomeric pair among the following four structures -



A. I & II

B. I & IV

C. II & III

D. II & IV

Answer: B

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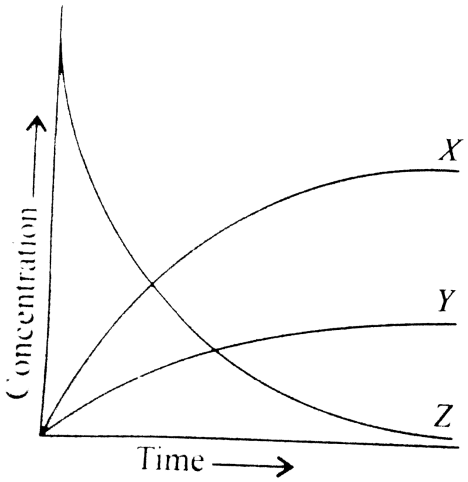
18. Consider the following reaction:

$2NO_2(g) \rightarrow 2NO(g) + O_2(g)$

In the figure below, identify the curves $X, Y,$ and Z associated with the

three species in the reaction



A. $X = NO, Y = O_2, Z = NO_2$

B. $X = O_2, Y = NO, Z = NO_2$

C. $X = NO_3, Y = NO, Z = O_2$

D. $X = O_2, Y = NO_2, Z = NO$

Answer: A

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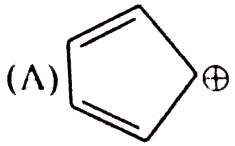
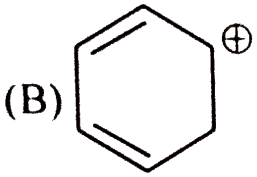
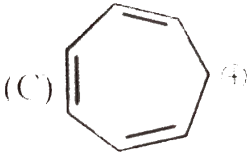
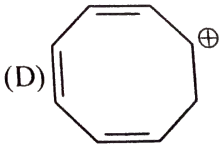
19. The aromatic carbocation among the following is -

A. 

B. 

C. 

D. 

Answer: C

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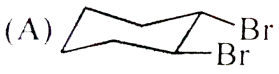
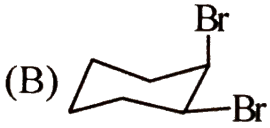
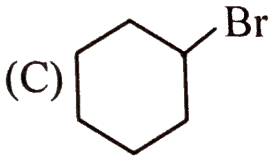
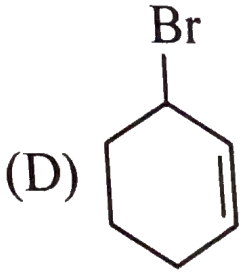
20. Cyclohexene is reacted with bromine in CCl_4 in the dark. The product of the reaction is -

A. 

B. 

C. 

D. 

Answer: A

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21. Two balloons A and B containing 0.2 mole and 0.1 mole of helium at room temperature and 2.0 atm, respectively, are connected. When equilibrium is established, the final pressure of He in the system is

A. 1.0atm

B. 1.5 atm

C. 0.5 atm

D. 2.0 atm

Answer: D

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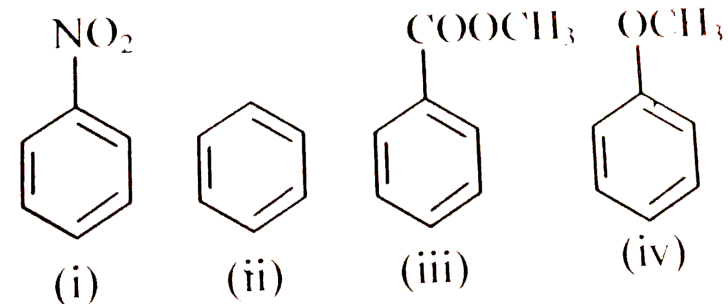
22. In the following set of aromatic compounds



the correct order of reactivity toward Friedel- Crafts alkylation is

A. $i > ii > iii > iv$

B. $ii > iv > iii > i$

C. $iv > ii > iii > i$

D. $iii > i > iv > ii$

Answer: C

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23. The set of principal (n), azimuthal (l) and magnetic (m_l) quantum number that is not allowed for the electron in H-atom is

A. n = 3, l = 1, $m_l = -1$

B. n = 3, l = 0, $m_l = 0$

C. n = 2, l = 1, $m_l = 0$

D. n = 2, l = 2, $m_l = -1$

Answer: D

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24. At 298 K, assuming ideal behaviour, the average kinetic energy of a deuterium molecule is

A. two times that of a hydrogen molecule

B. four times that of a hydrogen molecule

C. half of that of a hydrogen molecule

D. same as that of a hydrogen molecule

Answer: D

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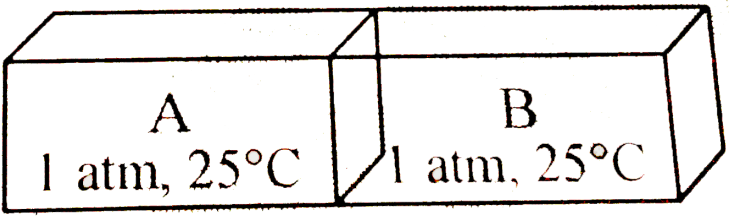
25. As isolated box, equally partitioned contains two ideal gases A and B as shown



What the partition is removed, the gases mix. The changes in enthalpy (ΔH) and entropy (ΔS) in the process, respectively, are

A. zero, positive

B. zero, negative

C. positive, zero

D. negative, zero

Answer: A

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26. The gas produced from thermal decomposition of $(NH_4)_2Cr_2O_7$ is

A. oxygen

B. nitric oxide

C. ammonia

D. nitrogen

Answer: D

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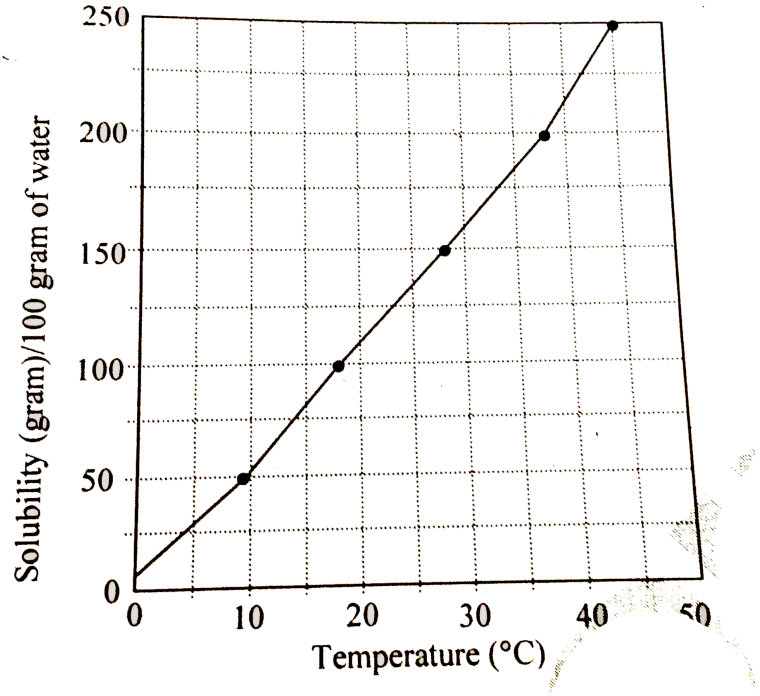
27. The solubility curve of KNO_3 in water is shown below.



The amount of KNO_3 that dissolves in 50 g of water at $40^\circ C$ is closest to

A. 100 g

B. 150 g

C. 200 g

D. 50 g

Answer: A

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28. A compound that shows positive iodoform test is

A. 2 - pentanone

B. 3 - pentanone

C. 3 - pentanol

D. 1 - pentanol

Answer: A

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29. After 2 hours the amount of a certain radioactive substance reduces to $1/16^{th}$ of the original amount (the decay process follows first-order kinetics). The half-life of the radioactive substance is

A. 15 min

B. 30 min

C. 45 min

D. 60 min

Answer: B

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30. In the conversion of zinc ore to zinc metal, the process of roasting involes

A. $ZnCO_3 \rightarrow ZnO$

B. $ZnO \rightarrow ZnSO_4$

C. $ZnS \rightarrow ZnO$

D. $ZnS \rightarrow ZnSO_4$

Answer: C

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31. The number of P - H bonds (s) in H_3PO_2, H_3PO_3 and H_3PO_4, respectively, is

A. 2, 0, 1

B. 1,1,1

C. 2, 0, 0

D. 2, 1, 0

Answer: D

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32. When chlorine gas is passed through an aqueous solution of KBr, the solution turns orange brown due to the formation of

A. KCl

B. HCl

C. HBr

D. Br_2

Answer: D

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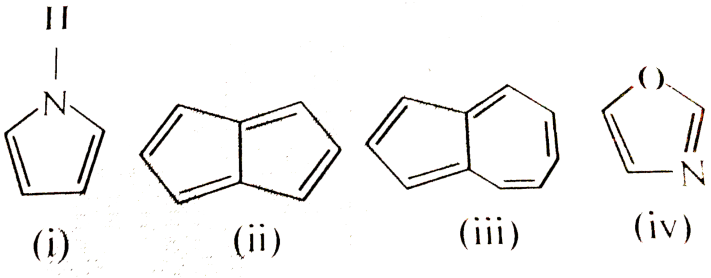
33.



the compound which is not aromatic is

A. i

B. ii

C. iii

D. iv

Answer: B

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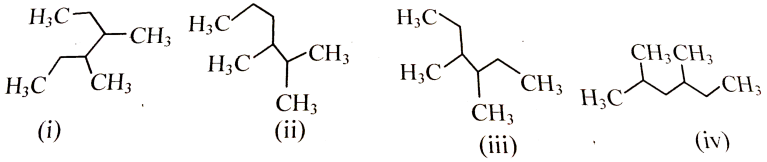
34. Among the following compounds



2, 3 - dimethylhexane is

A. i

B. ii

C. iii

D. iv

Answer: B

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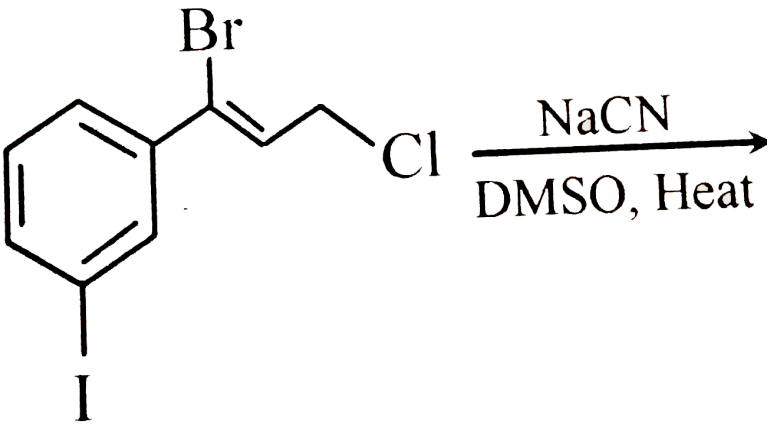
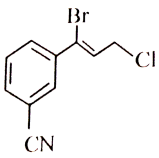
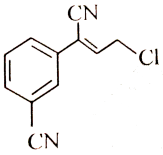
35. The major product formed in the reaction



is



(i)



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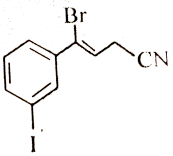

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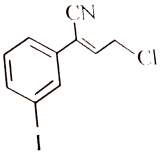

(iv)

A. i

B. ii

C. iii

D. iv

Answer: C

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36. $50mL$ of $0.1M$ solution of sodium acetate and $50mL$ of $0.01M$ acetic acid mixed. The pK_a of acetic acid is 4.76. The P^H of the buffer solution is

A. 4.26

B. 5.76

C. 3.76

D. 4.76

Answer: D

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37. The maximum number of structural isomers possible for the hydrocarbon having the molecular formula C_4H_6, is

A. 12

B. 3

C. 9

D. 5

Answer: C

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38. In the following reaction sequence, X and Y , respectively are

A. H_2O_2, $LiAlH_4$

B. $C_6H_5COOOH, \quad LiAlH_4$

C. $C_6H_5COOOH, Zn/Hg.\ HCl$

D. Alkaline $KMnO_4, LiAlH_4$

Answer: B

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39. Among

$(i)\left[Co(NH_3)_6\right]Cl_3, (ii)\left[Ni(NH_3)_6\right]Cl_2, (iii)\left[Cr(H_2O)_6\right]Cl_3, (iv)\left[Fe(H_2$

the complex which is diamagnetic is

A. i

B. ii

C. iii

D. iv

Answer: A

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40. At 783 K in the reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$, the molar concentrations $\left(\text{mol}^{-1}\right)$ of H_2, I_2 and HI at some instant of time are $0.1, 0.2$ and 0.4, respectively. If the equilibrium constant is 46 at the same temperature, then as the reaction proceeds

A. the amount of HI will increase

B. the amount of HI will decrease

C. the amount of H_2 and I_2 will increase

D. the amount of H_2 and I_2 will not change

Answer: A

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41. The hybridizations of $Ni(CO)_4$ and $Cr(H_2O)_6^{2+}$, respectively, are

A. sp^3 and d^3sp^2

B. dsp^2 and d^2sp^3

C. sp^3 and d^2sp^3

D. dsp^2 and sp^3d^2

Answer: C

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42. Extraction of silver is achieved by initial complexation of the ore (Argentite) with X followed by reduction with Y. X and Y respectively are

A. CN^- and Zn

B. CN^- and Cu

C. Cl^- and Zn

D. Br^- and Zn

Answer: A

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43. Assuming ideal behaviour, the enthalpy and volume of mixing of two liquids, respectively, are

A. zero and zero

B. $+ve$ and zero

C. $-ve$ and zero

D. $-ve$ and $-ve$

Answer: A

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44. At 298 K, the ratio of osmotic pressure of two solutions of a substance with concentrations of 0.01 M and 0.001 M, respectively, is

A. 1

B. 100

C. 10

D. 1000

Answer: C

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45. The rate of a chemical reaction generally increases rapidly even for small temperature increases because of a rapid increase in

A. the collision frequency increases with temperature

B. the fraction of molecules having energy in excess of the activation energy increases with temperature

C. the actiavtion energy decreases with temperature

D. the average kinetic energy of molecules increases with temperature

Answer: B

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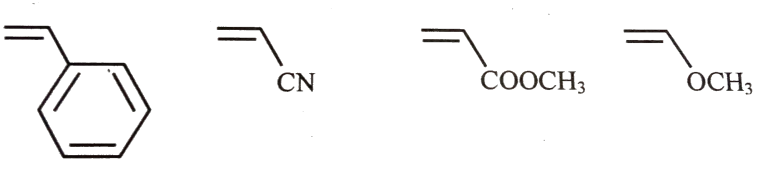
46. Among i-iv



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

the compound that does not undergo polymerization under radical initiation, is

A. i

B. ii

C. iii

D. iv

Answer: D

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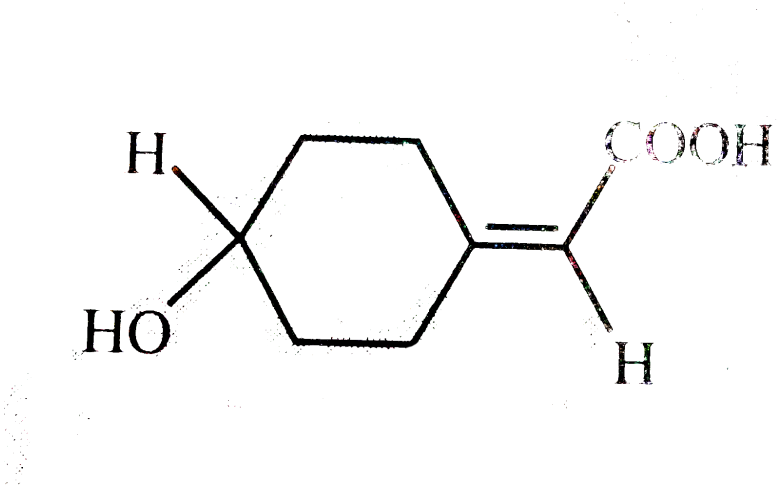
47. Two possible stereoisomers for



are

A. enantiomers

B. diasteromers

C. conformers

D. rotamers

Answer: A

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48. For a process to occurs spontaneously

A. Only the entropy of the system must increase

B. only the entropy of the surroundings must increase

C. either the entropy of the system or that of the surroundings must increase

D. the total entropy of the system and the surroundings must increase

Answer: D

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49. When the size of a spherical nanoparticle decreases from 30 nm to 10 nm, the ratio surface area/volume becomes

A. 1//3 of the original

B. 3 times the original

C. 1/9 of the original

D. 9 times the original

Answer: B

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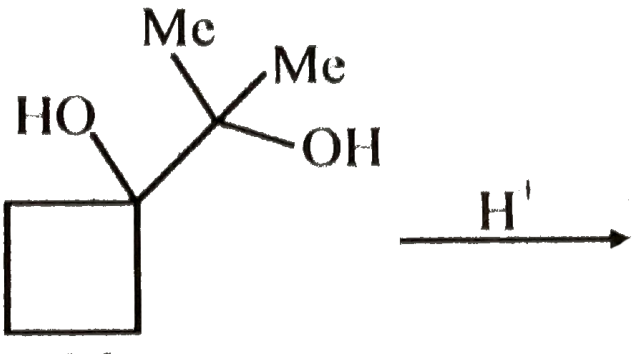
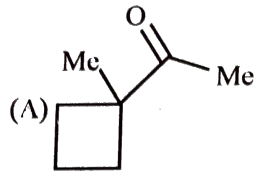
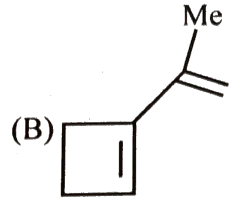
50. The major product of the following reaction is :



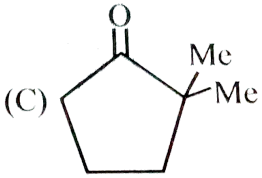
A.



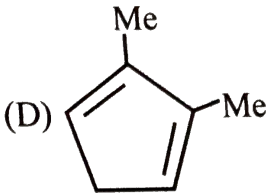
B.



C.



D.



Answer: C

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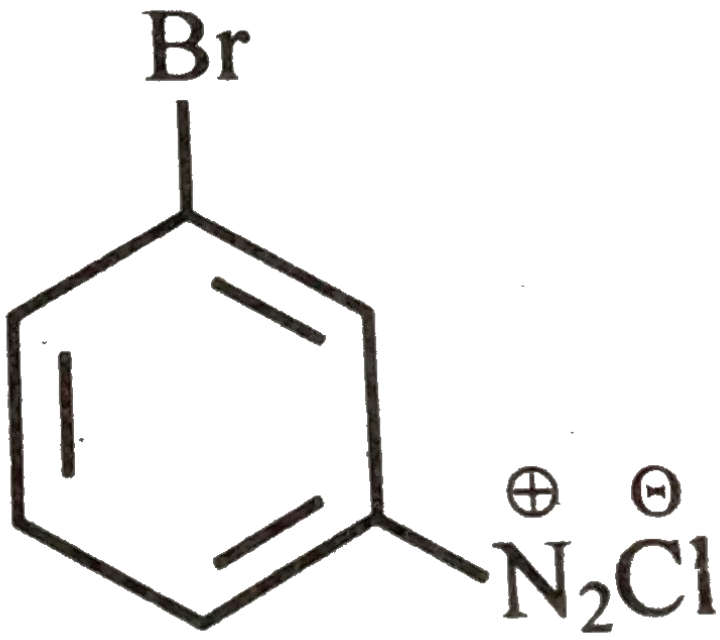
51. For the transformation



the reagent used is

A. $LiAlH_4$

B. H_3PO_2

C. H_3O^+

D. H_2 / Pt

Answer: B

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52. Molar conductivities (Λ_m°) at infinite dilution of $NaCl, HCl$ and CH_3COONa arc $126.4, 425.9$ and $91.0 Scm^2 mol^{-1}$ respectively. Λ_m° for CH_3COOH will be

A. 390.5

B. 299.5

C. 208.5

D. 217.4

Answer: A

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53. To obtain a diffraction peak, for a crystalline solid with interplane distance equal to the wavelength of incident X-ray radiation, the angle of incidence should be

A. 90°

B. 0°

C. 30°

D. 60°

Answer: C

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54. The standard Gibbs free energy change $\left(\Delta G^\circ \text{ in kJ mol}^{-1}\right)$, in a Daniel cell $\left(E^\circ_{\text{cell}} = 1.1V\right)$, when 2 moles of $Zn(s)$ is oxidized at 298 K, is closest to

A. -212.3

B. -106.2

C. -424.6

D. -53.1

Answer: C

Watch Video Solution

55. All the products formed in the oxidation of $NaBH_4$ by I_2 are

A. B_2H_6 and NaI

B. B_2H_6, H_2 and NaI

C. BI_3 and NaH

D. $NABI_4$ and HI

Answer: B

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56. The spin-only magnetic moments of $\left[Mn(CN)_6\right]^{4-}$ and $[MnBr_4]^{2-}$ in Bohr Magnetons, respectively, are

A. 5.92 and 5.92

B. 4.89 and 1.73

C. 1.73 and 5.92

D. 1.73 and 1.73

Answer: C

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57. In a zero-order reaction, if the initial concentration of the reactant is doubled, the time required for half the reactant to be consumed

A. increase two-fold

B. increases four-fold

C. decreases by half

D. does not change

Answer: A

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58. The adsorption isotherm for a gas is given by the relation $x = ap/(1 + bp)$ where x is mole of gas adsorbed per gram of the adsorbent, p is the pressure of the gas, and a and b are constants. Then x

A. increases with p

B. remains unchanged with p

C. decreases with p

D. increases with p at low pressures and then remains the same at high pressure

Answer: D

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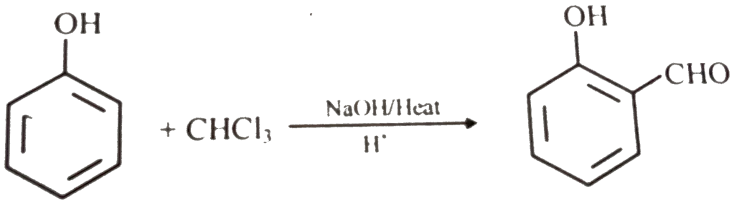
59. The reaction



is known as

A. Perkin reaction

B. Sandmeyer reaction

C. Reimer-Tiemann reaction

D. Cannizzaro reaction

Answer: C

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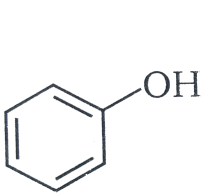
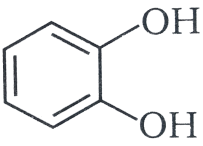
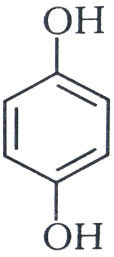
60. Among i-iii



(i)



(ii)



(iii)

the boiling point follows the order

A. $ii < i < iii$

B. $iii < ii < i$

C. $i < ii < iii$

D. $ii < iii < i$

Answer: C

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61. XeF_6 hydrolyses to give an oxide. The structure of XeF_6 and the oxide, respectively, are -

A. octahedral and tetrahedral

B. distorted octahedral and pyramidal

C. octahedral and pyramidal

D. distorted octahedral and tetrahedral

Answer: B

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62. MnO_4^- oxidizes (i) oxalate ion in acidic medium at 333 K and (ii) HCl. For balanced chemical equations, the rations $\left[MnO_4^- : C_2O_4^{2-}\right]$ in (i) and $\left[MnO_4^- : HCl\right]$ in (ii), respectively, are -

A. 1 : 5 and 2 : 5

B. 2 : 5 and 1 : 8

C. 2 : 3 and 1 : 5

D. 5 : 2 and 1 : 8

Answer: B

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63. If $E^{\circ}_{Fe^{2+}/Fe} = -0.440V$ and $E^{\circ}_{Fe^{3+}/Fe^{2+}} = 0.770V$, then $E^{\circ}_{Fe^{3+}/Fe}$ is -

A. 0.330 V

B. $-0.037V$

C. $-0.330V$

D. $-1.210V$

Answer: B

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64. The electron in hydrogen atom is in the first Bohr orbit $(n = 1)$. The ratio of transition energies, $E(n-1 \to n=3)$ to $E(n=1 \to n=2)$,

is-

A. 32/27

B. 16/27

C. 32/9

D. $8/9$

Answer: A

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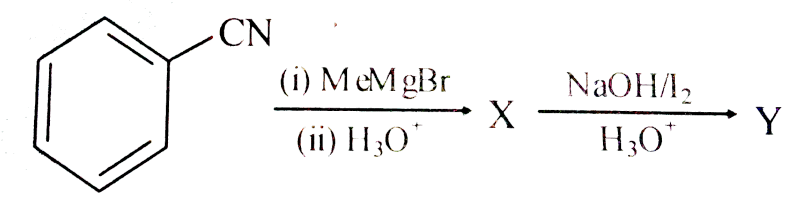
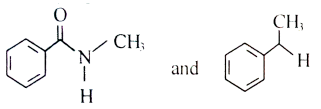
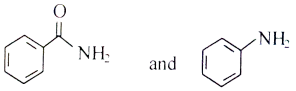
65. In the following conversion,



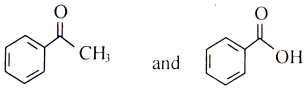
the major products X and Y, respectively, are -



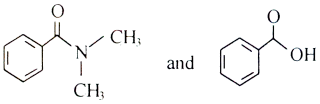
(i)



(ii)



(iii)



(iv)

A. i

B. ii

C. iii

D. iv

Answer: C

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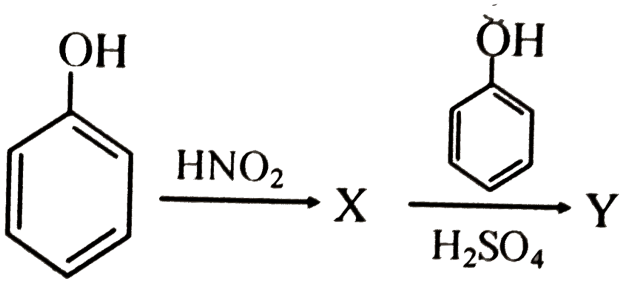
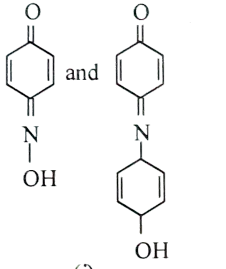
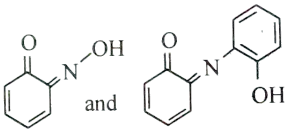
66. In the reaction sequence,



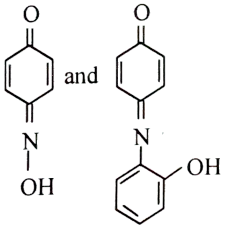
the major products X and Y, respectively, are -



(i)



(ii)



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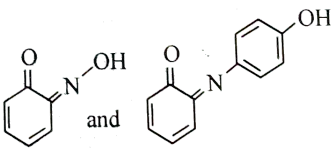

(iv)

A. i

B. ii

C. iii

D. iv

Answer: C

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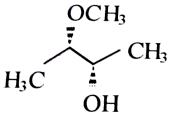
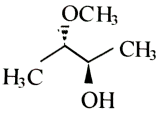
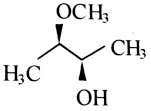
67. Optically active (S)-α-methoxyacetaldehyde on reaction with MeMgX gave a mixture of alcohols. The major diastereomer 'P' on treatment with MeI / K_2CO_3 gave an optically inactive compound. P is -



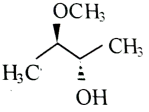
(i)



(ii)



(iii)



(iv)

A. i

B. ii

C. iii

D. iv

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68. At 300 K the vapour pressure of two pure liquids, A and B are 100 and 500 mm Hg, respectively. If in a mixture of a and B, the vapoure is 300 mm Hg, the mole fractions of a in the vapour phase, respectively, are -

A. 1/2 and 1/10

B. 1/4 and 1/6

C. 1/4 and 1/10

D. 1/2 and 1/6

Answer: D

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69. The crystal field stabilization energies (CFSE) of high spin and low spin d^6 metal complexes in terms of Δ_0, respectively, are -

A. -0.4 and -2.4

B. -2.4 and -0.4

C. -0.4 and 0.0

D. -2.4 and 0.0

Answer: A

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70. Emulsification of 10 ml of oil in water produces 2.4×10^{18} droplets. If the surface tension at the oil-water interface is $0.03 Jm^{-2}$ and the area of each droplet is $12.5 \times 10^{-16} m^2$, the energy spent in the formation of oil droplets is -

A. 90 J

B. 30 J

C. 900 J

D. 10 J

Answer: A

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71. Among the following, the species with the highest bond order is-

A. O_2

B. F_2

C. O_2^+

D. F_2

Answer: C

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72. The moecule with non-zero dipole moment is -

A. BCl_3

B. $BeCl_2$

C. CCl_4

D. NCl_3

Answer: D

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73. For a one-electron atom, the set of allowed quantum number is -

A. $n = 1, l = 0, m_l = 0, m_s = +1/2$

B. $n = 1, l = 1, m_l = 0, m_s = +1/2$

C. $n = 1, l = 0, m_l = -1, m_s = -1/2$

D. $n = 1, l = 1, m_l = 1, m_s = -1/2$

Answer: A

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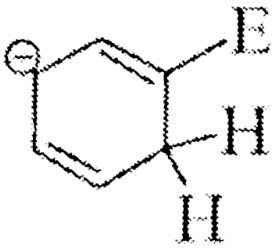
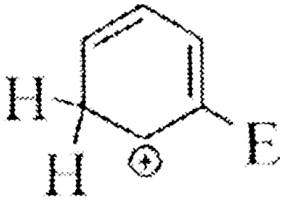
74. In the reaction benzene with an electrophile E^+, the structure of the intermediate $\sigma -$ complex can be represented as

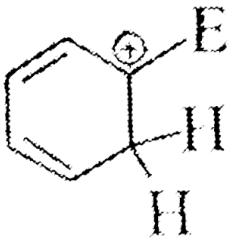
A.



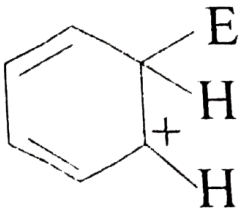
B.



C.



D.



Answer: D

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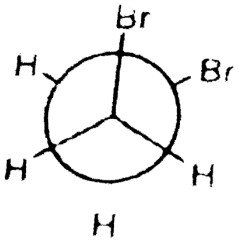
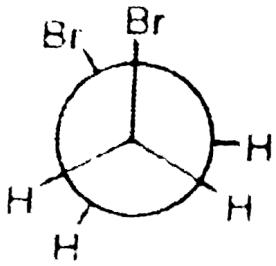
75. The most stable conformation of 2, 3-dibromobutane is -

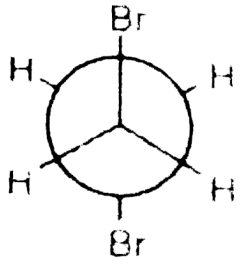
A.

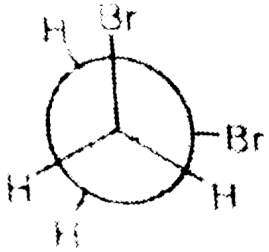


B.



C.



D. 

Answer: C

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76. Typical electronic energy gaps in molecules are about 1.0 eV. In terms of temperature, the gap is closed to -

A. $10^2 K$

B. $10^4 K$

C. $10^3 K$

D. $10^5 K$

Answer: D

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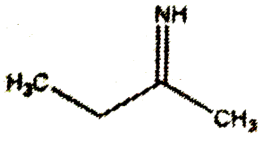
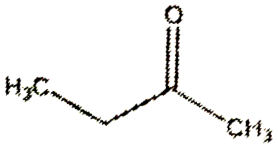
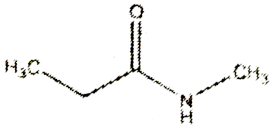
77. The major final product in the following reaction is -

$$CH_3CH_2CN \xrightarrow[2)H_3O^+]{1)CH_3MgBr}$$

A. 

B. 

C. 

D. 

Answer: C

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78. A zero-order reaction, $A \rightarrow$ Product, with an initial concentration $[A]_0$ has a half-life of 0.2 s. If one starts with the concentration $2[A]_0$, then the half-life is -

A. 0.1 s

B. 0.4 s

C. 0.2 s

D. 0.8 s

Answer: B

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79. The isoelectronic pair of ions is -

A. Sc^{2+} and V^{3+}

B. Mn^{2+} and Fe^{3+}

C. Mn^{3+} and Fe^{2+}

D. Ni^{3+} and Fe^{2+}

Answer: B

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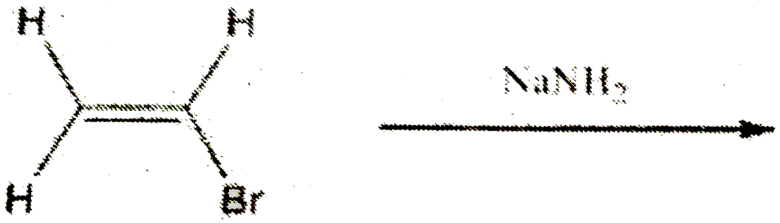
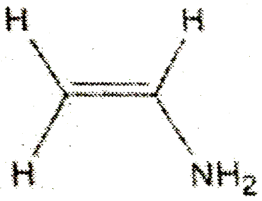
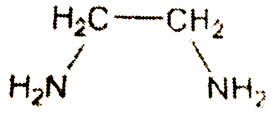
80. The major product in the following reaction is -



A. 

B. 

C. 

D. 

Answer: A

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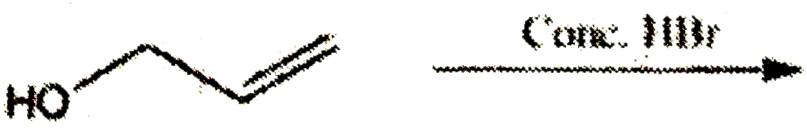
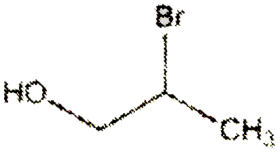
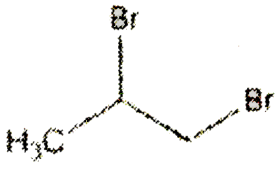
81. The major product of the following reaction is -



A. 

B. 

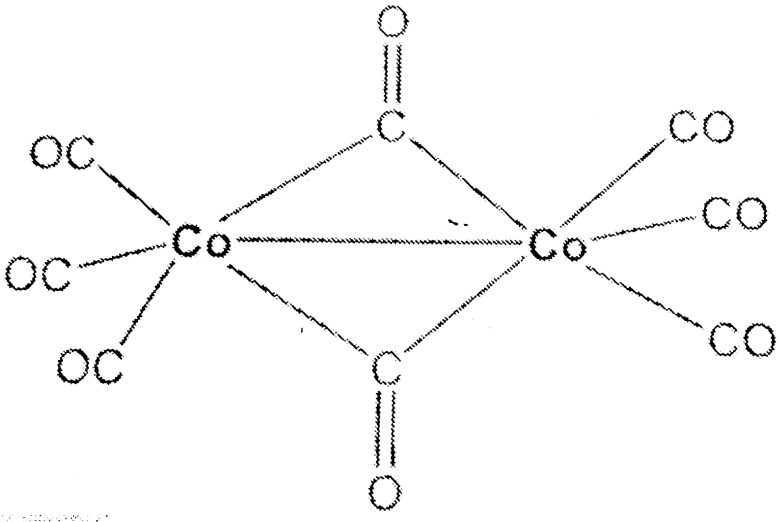
C. 

D. 

Answer: B

Watch Video Solution

82. The oxidation state of cobalt in the following molecule is -



A. 3

B. 1

C. 2

D. 0

Answer: D

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83. The PK_a of a weak acid is 5.85. The concentrations of the acid and its conjugate base are equal at a pH of -

A. 6.85

B. 5.85

C. 4.85

D. 7.85

Answer: B

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84. For a tetrahedral complex $[MCl_4]^{2-}$, the spin-only magnetic moment is 3.83 B.M. The element M is -

A. Co

B. Cu

C. Mn

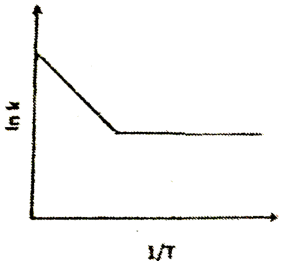
D. Fe

Answer: A

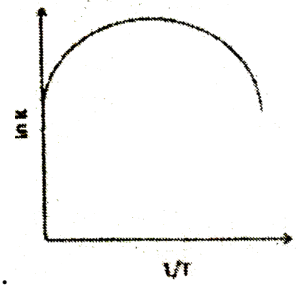
Watch Video Solution

85. Plots showing the variation of the rate constant (k) with temperature (T) are given below. The plot that follows the Arrhenius equation is

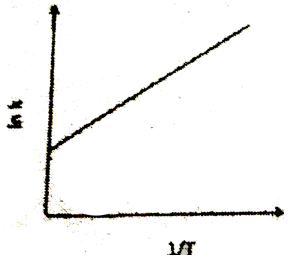
A.



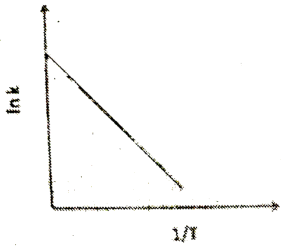
B.



C.



D.



Answer: D

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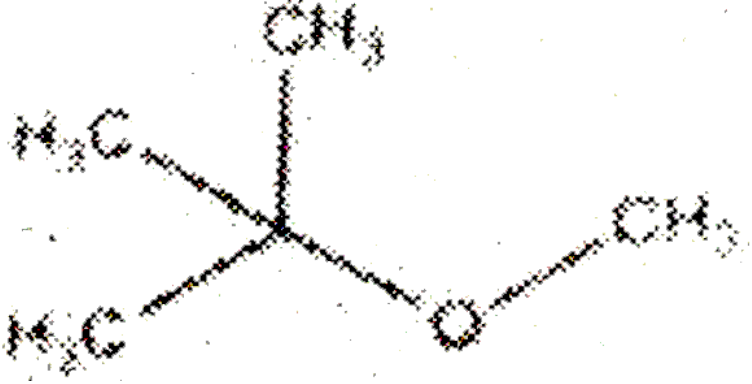
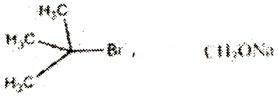
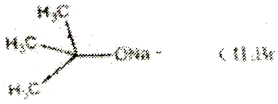
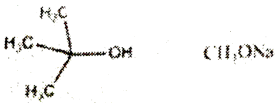
86. The reaction that gives the following molecule as the major product is

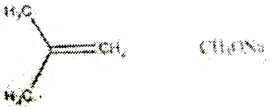
-



A. 

B. 

C. 

D. 

Answer: B

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87. The correct order of decreasing $C-O$ bond length of (1) CO, $(II)CO_3^{2-}$ $(III)CO_2$ is .

A. $CO < CO_2 < CO_3^{2-}$

B. $CO_2 < CO_3^{2-} < CO$

C. $CO > CO_2 > CO_3^{2-}$

D. $CO_3^{2-} < CO_2 < CO$

Answer: A

Watch Video Solution

88. The equilibrium constant for the following reactions are K_1 and K_2, respectively ,

$2P(g) + 3Cl_2(g) \Leftrightarrow 2PCl_3(g)$

$PCl_3(g) + Cl_2(g) \Leftrightarrow PCl_5(g)$

Then the equilibrium constant for the reaction

$2P(g) + 5Cl_2(g) \Leftrightarrow 2PCl_5(g)$ is -

A. K_1K_2

B. $K_1K_2^2$

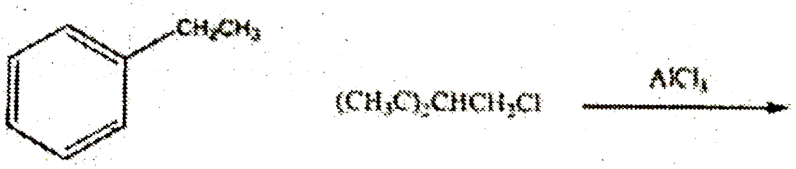
C. $K_1K_2^2$

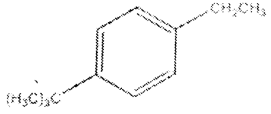
D. $K_1^2K_2$

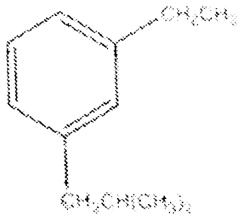
Answer: B

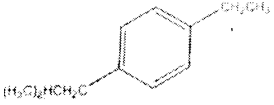
Watch Video Solution

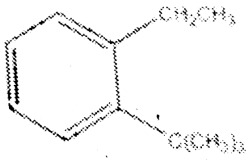
89. The major product of the following reaction is -



A. 

B. 

C. 

D. 

Answer: A

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90. Doping silicon with boron produces a -

A. n-type semiconductor

B. Metallic conductor

C. p-type semiconductor

D. Insulator

Answer: C

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91. the percentage of nitrogen by mass in ammonium sulphate is closed is (atomic Masses $H = 1, N = 14, O = 16, S = 32$)

A. 0.21

B. 0.24

C. 0.36

D. 0.16

Answer: A

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92. Mendeleev's periodic law states that the properties of element are periodic function of their

A. Reactivity of elements

B. atoms size

C. atomic mass

D. electronic configuration

Answer: C

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93. Maximum number of electrons that can be accommodated in the subshell with azimuthal quantum number l=4, is

A. 10

B. 8

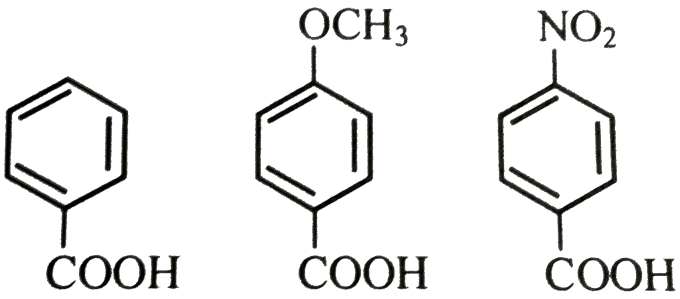
C. 16

D. 18

Answer: D

View Text Solution

94. the correct order of acidity of the following compounds is



A. $1 > 2 > 3$

B. $1 > 3 > 2$

C. $3 > 1 > 2$

D. $3 > 2 > 1$

Answer: C

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95. Reaction of 2- butene with acidic $KMnO_4$ gives

A. CH_3CHO

B. $HCOOH$

C. CH_3CH_2OH

D. CH_3COOH

Answer: D

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96. The gas released when baking soda is mixed with vinegar , is

A. CO

B. CO_2

C. CH_4

D. O_2

Answer: B

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97. The element which readily forms an ionic bond has the electronic configuration

A. $1s^2 2s^2 2p^3$

B. $1s^2 2s^2 2p^1$

C. $1s^2 2s^2 2p^2$

D. $1s^2 2s^2 2p^6 3s^1$

Answer: D

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98. The major products of the following reaction

$ZnS(s) + O_2(g) \xrightarrow{\text{heat}} are$

A. ZnO and SO_2

B. $ZnSO_4$ and SO_3

C. $ZnSO_4$ and SO_2

D. Zn and SO_2

Answer: A

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99. If Avogadro's number is A_0 the number of sulphur atoms present in 200mL of 1N H_2SO_4 is

A. $A_0/5$

B. $A_0/2$

C. $A_0/10$

D. A_0

Answer: C

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100. the functional group present in a molecule having the formula $C_{12}O_9$ is

A. carboxylic acid

B. anhydride

C. aldehyde

D. alcohol

Answer: B

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101. A sweet smelling compound formed by reacting acidic acid with ethanol in the presence of hydrochoric acid is

A. $CH_3COOC_2H_5$

B. C_2H_5COOH

C. $C_2H_5COOCH_3$

D. CH_3OH

Answer: A

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102. Among Mg , Cu ,fe ,Zn , the metal that does not produce hydrogen gas in reaction with hydrochloric acid is

A. Cu

B. Zn

C. Mg

D. Fe

Answer: A

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103. The number of ethers possible with the molecular formula $C_4H_{10}O$ is.

A. 2

B. 3

C. 4

D. 5

Answer: B

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104. the number fo electrons required to reduce chromium completely in $Cr_2O_7^{2-}$ to Cr_{3+} in acidic meddium , is

A. 5

B. 3

C. 6

D. 2

Answer: C

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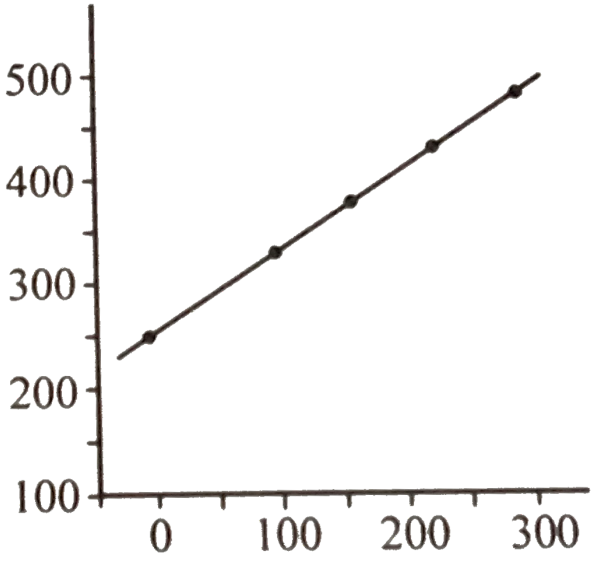
105. At constant pressure , the volume of a fixed mass of a gas varies as a function of temperarture as shown in the graph



the volume of the gas $300^\circ C$ is larger than at $0^\circ C$ by a factor of

A. 3

B. 4

C. 1

D. 2

Answer: D

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106. when 262 g of xenon (atomic mass = 131) reacted completely with 152 g flouride (atomic mass = 19) ,a mixture of XeF_2 and XeF_6 was produced , the molar $XeF_2 : XeF_6$ is

A. $1:2$

B. $1:4$

C. $1:1$

D. $1:3$

Answer: C

Watch Video Solution

107. Rection of ethanol with conc , sulphuric acid at $170^{\circ}C$ produces a gas which is then treated with bromine is carbon tetrachoride ,the major product obtained in this reaction is

A. 1.2 -dibromoethane

B. Ethylene glycol

C. Bromoethane

D. Ehtyl sulphate

Answer: A

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108. when 22.4 L of C_4H_8 at STP is burnt completely , 89.6 L of CO_2 gas at STP and 72 g water are Produced . The volume of the oxygen gas at STP consumed in the reaction is closest to

A. 89.6L

B. 112 L

C. 134.4L

D. 22.4L

Answer: C

Watch Video Solution

109. the Amonut of Ag (atomic mass =108) deposited at the cathode when a current of 0. amp is passed through a solution of $AgCO_3$ for 1 hour is closest to

A. 2g

B. 5g

C. 108g

D. 11g

Answer: A

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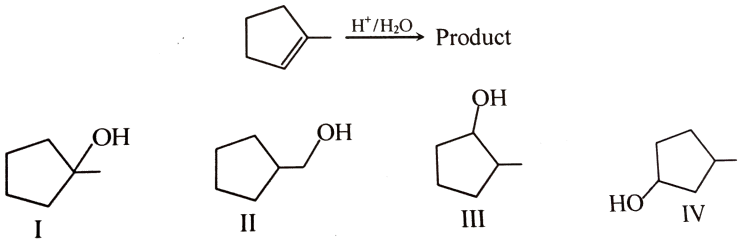
110. the major produced of the reaction Is -



A. I

B. II

C. III

D. IV

Answer: A

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111. The Lewis acid character of boron trihalides decreases as: $BBr_3 > BCl_3 > BF_3$. Explain ?

A. $BBr_3 < BCl_3 < BF_3$

B. $BCl_3 < BF_3 < BBr_3$

C. $BF_3 < BCl_3 < BBr_3$

D. $BBr_3 < BF_3 < BCl_3$

Answer: C

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112. O^{2-} is isoelectronic with

A. Zn^{2+}

B. Mg^{2+}

C. K^{+}

D. Ni^{2+}

Answer: B

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113. The H-C-H, H-N-H, and H-O-H bond angles (in degrees) in methane, ammonia and water are respectively, closed to

A. 109.5, 104.5, 107.1

B. 019.5, 107.1, 104.5

C. 104.5, 107.1, 109.5

D. 107.1, 104.5, 109.5

Answer: B

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114. In alkaline medium, the reaction of hydrogen peroxide with potassium permanganate produces a compound in which the oxidation

state of Mn is

A. 0

B. $+2$

C. $+3$

D. $+4$

Answer: D

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115. The rate constant of a chemical reaction at a very high temperature will approach

A. Arrhenius frequency factor divided by the ideal gas constant

B. activation energy

C. Arrhenius frequency factor

D. activation energy divided by ideal by the ideal gas constant

Answer: C

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116. The standard reduction potantials (in V) of a few metal ion/metal electrodes are given below.

$Cr^{3+}/Cr = -0.74, Cu^{2+}/Cu = +0.34, Pb^{2+}/Pb = -0.13, Ag^{+}/A$

.

The reducing strength of the metals follows the order

A. $Ag > Cu > Pb > Cr$

B. $Cr > Pb > Cu > Ag$

C. $Pb > Cr > Ag > Cu$

D. $Cr > Ag > Cu > Pb$

Answer: B

Watch Video Solution

117. Which of the following molecules can exhibit optical activity ?

A. 1-bromopropane

B. 2-bromobutane

C. 3-bromopentane

D. bromocyclohexane

Answer: B

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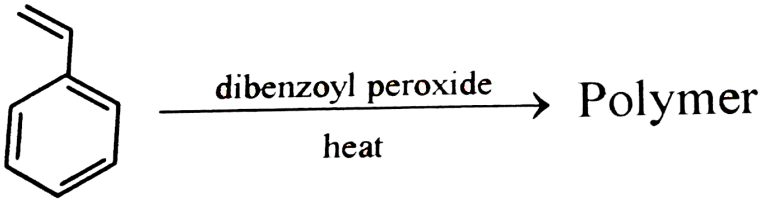
118. The structure of the obtained by the following reaction is



A. I

B. II

C. III

D. IV

Answer: A

Watch Video Solution

119. The major product of the reaction between CH_3CH_2ONa and $(CH_3)_3CCl$ in ethanol is

A. $CH_3CH_2OC(CH_3)_3$

B. $CH_2 = C(CH_3)_2$

C. $CH_3CH_2C(CH_3)_3$

D. $CH_3CH = CHCH_3$

Answer: B

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120. When H_2S gas is passed through a hot acidic aqueous solution containing Al^{3+}, Cu^{2+}, Pb^{2+} and Ni^{2+}, a precipitate is formed which consists of

A. Cus and Al_2S_3

B. PbS and NiS

C. CuS and NiS

D. PbS and Cus

Answer: D

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121. The electronic configuration of an element with the largest difference between the 1^{st} and 2^{nd} ionization energies is

A. $1s^2 2s^2 2p^6$

B. $1s^2 2s^2 2p^6 3s^1$

C. $1s^2 2s^2 2p^6 3s^2$

D. $1s^2 2s^2 2p^1$

Answer: B

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122. The order of electronegativity of carbon in sp, sp^2 and sp^3 hybridized states follows

A. $sp > sp^2 > sp^3$

B. $sp^3 > sp^2 > sp$

C. $sp > sp^3 > sp^2$

D. $sp^2 > sp > sp^3$

Answer: A

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123. The most abundant transition metal in human body is

A. copper

B. iron

C. zinc

D. manganese

Answer: B

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124. The molar conductivities of HCl, NaCl, CH_3COOH, and CH_3COONa at infinite dilution follow the order

A. $HCl > CH_3COOH > NaCl > CH_3COONa$

B. $CH_3COONa > HCl > NaCl > CH_3COOH$

C. $HCl > NaCl > CH_3COOH > CH_3COONa$

D. $CH_3COOH > CH_3COONa > HCl > NaCl$

Answer: A

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125. The spin only magnetic of $[ZCl_4]^{2-}$ is 3.87 BM where Z is

A. Mn

B. Ni

C. Co

D. Cu

Answer: C

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126. If $\alpha - D$-glucose is dissolved in water and kept for a few hours, the major constituent (s) present in the solution is (are)

A. $\alpha - D$-glucose

B. mixture of $\beta - D$-glucose and open chain D-glucose

C. open chain D-glocose

D. mixture of $\alpha - D$-glucose and $\beta - D$-glucose

Answer: D

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127. The pH of 1N aqueous solutions HCl, CH_3COOH and $HCOOH$ follows the order

A. $HCl > HCOOH > CH_3COOH$

B. $HCl = HCOOH > CH_3COOH$

C. $CH_3COOH > HCOOH > HCl$

D. $CH_3COOH = HCOOH > HCl$

Answer: C

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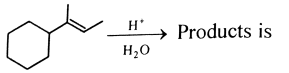
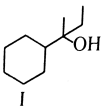
128. The major product of the reaction





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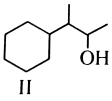

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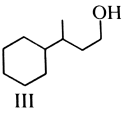
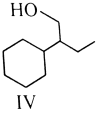


III



IV

A. I

B. II

C. III

D. IV

Answer: A

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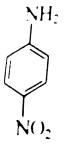
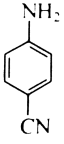
129. Raection of aniline with $NaNO_2$ + dil. HCl at $0^\circ C$ followed by reaction with CuCN yields



I



II

III

IV

A. I

B. II

C. III

D. IV

Answer: C

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130. Schottky defect in a crystal arises due to

A. creation of equal number of cation and anion vacancies

B. creation of unequal number of cation and vacancies

C. migration of cations to interstitial voids

D. migration of anions to interstitial voids

Answer: A

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131. For the reaction $N_2 + 3X_2 \rightarrow 2NX_3$ where X=F, Cl (the average bond energies are F-F = 155 kJ mol^{-1} N-F = 272 kJ mlo^{-1}, Cl-Cl = 242 kJ mol^{-1}, N-Cl= 200 kJ mol^{-1} and $N \equiv N = 941 kJ \mathrm{mol}^{-1}$), the heats of formation of NF_3 and NCl_3 in kJ mol^{-1}, respectively, are closest to

A. -226 and $+467$

B. $+226$ and -467

C. -151 and $+311$

D. $+151$ and -311

Answer: A

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132. The equilibrium constants for the reactions X = 2Y and Z=P+Q are K_1 and K_2, respectively. If the initial concentrations and the degree of dissociation of X and Z are the same, the ratio $K_1 / k_{92})$ is

A. 4

B. 1

C. 0.5

D. 2

Answer: A

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133. The geometry and the number of unpaired electron (s) of $[MnBr_4]^{2-}$, respectively, are

A. tetrahedral and 1

B. square planar and 1

C. tetrahedral and 5

D. square planar and 5

Answer: C

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134. The standard cell potential for $Zn|Zn^{2+}||Cu^{2+}|Cu$ is 1.10 V. When the cell is completely discharged, log $[Zn^{2+}]/[Cu^{2+}]$ is closest to

A. 37.3

B. 0.026

C. 18.7

D. 0.052

Answer: A

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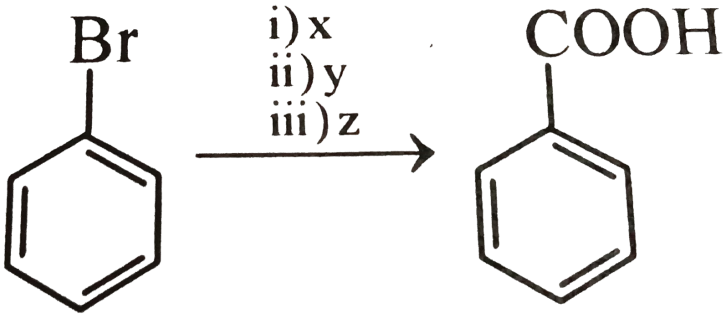
135. In the reaction



x,y and z are

A. $x = \text{Mg,dry ether, y} = CH_3Cl, z = H_2O$

B. $x = \text{Mg, dry methanol, y} = CO_2, z = \text{dil. HCl}$

C. $x = \text{Mg, dry ether, y} = CO_2, z = \text{dil. HCl}$

D. $x = \text{Mg, dry methanol, y} = CH_3Cl, z = H_2O$

Answer: C

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136. An organic compound having molecular formula C_2H_6O undergoes oxidation with $K_2Cr_2O_7 / H_2SO_4$ to produce X which contains $40\,\%$ carbon, $6.7\,\%$ hydrogen and $53.3\,\%$ oxygen. The molecular formula of the compound X is

A. CH_2O

B. $C_2H_4O_2$

C. C_2H_4O

D. $C_2H_6O_2$

Answer: B

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137. The maximum number of cyclic isomers (positional and optical) of a compound having molecular formula $C_3H_2Cl_2$ is

A. 2

B. 3

C. 4

D. 5

Answer: C

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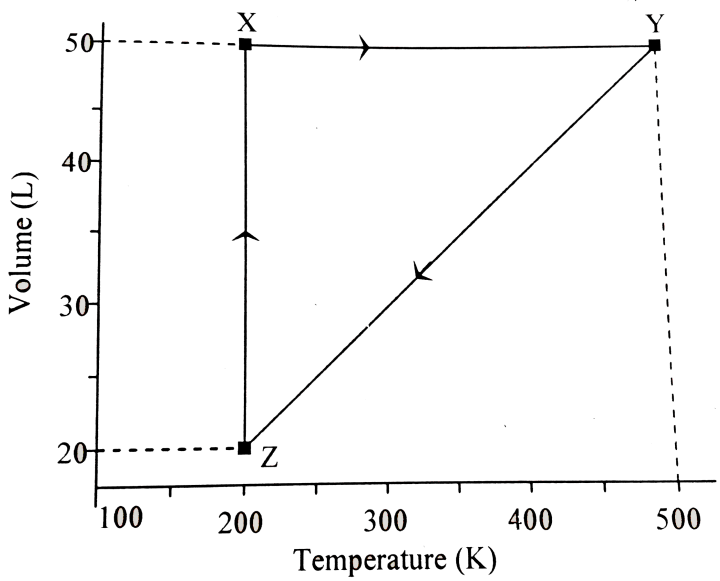
138. The volume vs. temperature graph of 1 mole of an ideal gas is given below



The pressure of the gas (in atm) at X, Y and Z, respectively, are

A. $0.328, 0.820, 0.820$

B. $3.28, 8.20, 3.28$

C. $0.238, 0.280, 0.280$

D. $32.8, 0.280, 82.0$

Answer: A

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139. MnO_2 when fused with KOH and oxidized in air gives a dark green compound X. In acidic solution, X undergoes disproportionation to give an intense purple compound Y and MnO_2. compounds X and Y, respectively, are

A. K_2MnO_4 and $KMnO_4$

B. Mn_2O_7 and $KMnO_4$

C. K_2MnO_4 and Mn_2O_7

D. $KMnO_4$ and K_2MnO_4

Answer: A

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140. A metal (X) dissolves both in HCl and dilute NaOH to liberate H_2. Addition of NH_4Cl and excess NH_4OH to HCl solution of X produces Y as a precipitate. Y is also produced by addding NH_4Cl to the NaOH solution of X. The Species X and Y, respectively, are

A. Zn and $Zn(OH)_2$

B. Al and $Al(OH)_3$

C. Zn and Na_2ZnO_2

D. Al and $NaAlO_2$

Answer: B

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141. One mole of one of sodium salt listed below, having carbon content close to 14.3% produces 1 mole of carbon dioxide upon heating (atomic mass Na=23, C=12,O=16). The salt is

A. C_2H_5COONa

B. $NaHCO_3$

C. HCOONa

D. CH_3COONa

Answer: b

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142. Among formic acid,acetic acid, propanoic acid and phenol the strongest acid in water is

A. formic acid

B. acetic acid

C. propanoic acid

D. phenol

Answer: a

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143. Accoding to Graham's Law, the rate of diffusioon of CO, O_2, N_2 and CO_2 follows the order.

A. $CO = N_2 > O_2 > CO_2$

B. $CO = N_2 > CO_2 > O_2$

C. $O_2 > CO = N_2 > CO_2$

D. $CO_2 > O_2 > CO = N_2$

Answer: a

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144. The major product formed when 2-butene is reacted with O_3 followed by treatment with Zn / H_2O is

A. CH_3COOH

B. CH_3CHO

C. CH_3CH_2OH

D. $CH_2 = CH_2$

Answer: b

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145. The IUPAC name for the following compound is

$$CH_3 - CH_2 - CH_2 - CH_2 - \underset{\underset{CH_2}{||}}{C} - CH_2 - CH_3$$

A. 2-propylhex -1-ene

B. 2-butylpent-1-ene

C. 2-propyl-2-butylethene

D. propyl-1-butylethene

Answer: a

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146. the major product obtained in the reaction of oxalic acid with conc, H_2SO_4 upon heating are

A. CO, CO_2, H_2O

B. CO, SO_2, H_2O

C. H_2S, CO, H_2O

D. $HCOOH, H_2S, CO$

Answer: a

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147. LiOH reacts with CO_2 to form Li_2CO_3 (atomic mass of Li=7) the amount of CO_2 (in g) consumed by 1g of LiOH is closet to

A. 0.916

B. 1.832

C. 0.544

D. 1.088

Answer: a

$2Lion + CO_2 \rightarrow Li_2CO_3 + H_2O$

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148. The oxdidation number of sulphur is +4 is

A. H_2S

B. CS_2

C. Na_2SO_4

D. Na_2SO_3

Answer: d

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149. Al_2O_3 reacts with

A. only water

B. only acids

C. only alkalis

D. both acids and alkalis

Answer: d

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150. The major product formed in the oxidation of acetylene with alkaline $KMnO_4$ is

A. ethanol

B. acetic acid

C. formic acid

D. oxalic acid

Answer: d

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151. In a closed vessel an ideal gas at 1 atm is heated from $27^\circ C \text{to} 327^\circ C$. The pressure of gas will approximately be

A. 3 atm

B. 0.5 atm

C. 2 atm

D. 12 atm

Answer: c

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152. Among the elements Li, N ,C and Be one with the largest atomic radius id

A. Li

B. N

C. C

D. Be

Answer: a

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153. A redox reaction among the following is

A. $CdCl_2 + 2KOH \rightarrow Cd(OH)_2 + 2KCl$

B. $BaCl_2 + K_2SO_4 \rightarrow BaSO_4 + 2KCl$

C. $CaCO_3 \rightarrow CaO + CO_2$

D. $2Ca + O_2 \rightarrow 2CaO$

Answer: d

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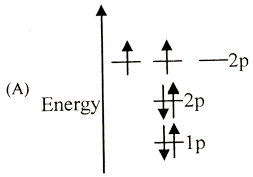
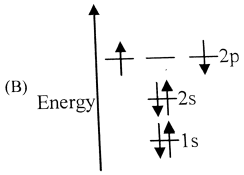
154. The eleectronic cofiguration which obeys Hund's rule for the ground state of carbon atom is

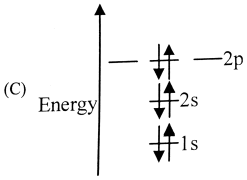
A.



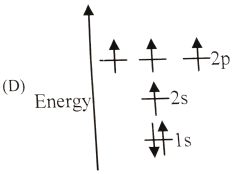
B.



C.



D.



Answer: a

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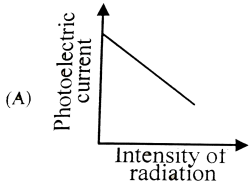
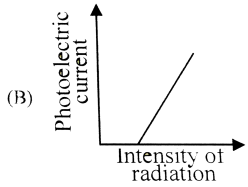
155. The graph that depicts Einstein photoelectric effect for a monochromatic source of frequency above that theshold frequency is

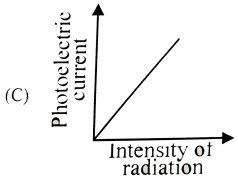
A.



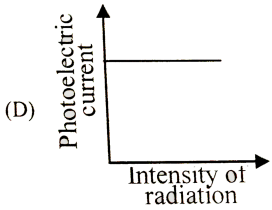
B.



C.



D.



Answer: c

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156. 2,3 - dibromobutane can be converted to 2-butene in two - step reaction using

A. (i) HCl and (ii) NaH

B. (i) alcoholic KOH and (ii) $NaNH_2$

C. (i) Na and (ii) NaOH

D. $(i)Br_2$ and $(ii)NaH$

Answer: b

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157. given $NO(g) + O_3(g) \rightarrow NO_2(g) + O_2(g) \quad \Delta H = 198.9kJ/mol$

$O_3(g) \rightarrow 3/2O_2(g) \quad \Delta H = -142.3kj/mol$

$O_2(g) \rightarrow 2O(g) \quad \Delta H = +495.0kj/mol$

The entalpy change (ΔH) for the following reaction is

$NO(g) + O(g) \rightarrow NO_2(g)$

A. $-304.1kJ/mol$

B. $+304.1kJ/mol$

C. $-403.1kJ/mol$

D. $+403.1kJ/mol$

Answer: a

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158. A 1.85 g sample of an arsenic- containing pesticide was chemically converted to AsO_4^{3-} (atomic mas of As= 74.9) and titrated with Pb^{2+} to form $Pb^3(AsO_4)_2$ mL. of 0.1 M Pb^{2+} is required to reach the equivalence point, the mass percentages fo arsenic in the pesticide sample is closest to

A. 8.1

B. 2.3

C. 5.4

D. 3.6

Answer: c

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159. When traded with conc, HCl_2MnO_2 yields gas (X) which further reacts with $Ca(OH)_2$ to generate a white solid (Y) reacts with dil. HCl to produces the same gas X. the solid Y is

A. CaO

B. $CaCl_2$

C. Ca(OCl)Cl

D. $CaCO_3$

Answer: c

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160. The boiling points of 0.01 M aqueous solution of sucrose, NaCl and $CaCl_2$ would be -

A. The same

B. highest for sucrose solution

C. highest for NaCl solution

D. highest for $CaCl_2$ solution

Answer: D

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161. The correct electronic configuration for the ground state of silicon (atomic number 14) is -

A. $1s^2 2s^2 2p^6 3s^2 3p^2$

B. $1s^2 2s^2 2p^4 3s^2 3p^4$

C. $1s^2 2s^2 2p^6 3s^2 3p^4$

D. $1s^2 2s^2 2p^6 3s^1 3p^2$

Answer: A

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162. The molar mass of $CaCO_3$ is 100 g. The maximum amount of carbon dioxide that can be liberated on heating 25 g of $CaCO_3$ is -

A. 11 g

B. 55 g

C. 22 g

D. 2.2 g

Answer: A

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163. The atomic radii of the elements across the second period of the periodic table -

A. decrease due to increase in atomic number

B. decrease due to increase in effective nuclear charge

C. decrease due to increase in atomic weights

D. decrease due to increase in effective nuclear charge

Answer: B

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164. Among NH_3, BCl_3, Cl_2 and N_2 the compound that does not satisfy the octet rule is -

A. NH_3

B. BCl_3

C. Cl_2

D. N_2

Answer: B

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165. The gas produced on heating MnO_2 with conc. HCl is -

A. Cl_2

B. H_2

C. O_2

D. O_3

Answer: A

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166. The number of covalent bonds in $C_4H_7Br_2$ is -

A. 12

B. 10

C. 13

D. 11

Answer: A

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167. An aqueous solution of HCl has a pH of 2.0 When water is added to increase the pH to 5.0 the hydrogen ion concentration -

A. remains the same

B. decrease three-fold

C. increases three-fold

D. decreases thousand-fold

Answer: D

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168. Consider two sealed jars of equal volume. One contains 2 g of hydrogen at 200 K and the other contains 28 g of nitrogen at 400 K. The gases in the two jars will have -

A. the same pressure

B. the same average kinetic energy

C. the same number of molecules

D. the same average molecular speed

Answer: C

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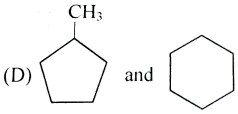
169. Indentify the stereoisomer pair from the following choice -

A. $CH_3CH_2CH_2OH$ and $CH_3CH_2OCH_3$

B. $CH_3CH_2CH_2Cl$ and $CH_3CHClCH_3$

C. $CH_3 - \underset{\underset{H}{|}}{C} = \underset{\underset{H}{|}}{C} - CH_3$ and $CH_3 - \underset{\underset{H}{|}}{C} = \overset{\overset{H}{|}}{C} - CH_3$

D. 

Answer: C

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170. Copper in an alloy is estimated by dissolving in conc. Nitric acid . In this process copper is converted to cupric nitrate with the evolution of nitric oxide (NO) . The mixture when treated with potassium iodide forms cupric iodide. Which is unstable and decomposes to cuprous iodide and iodine.The amount of copper in the alloy is estimated by librating the librated iodine with sodium thiosulphate. The reactions are

a $Cu + bHNO_3 \rightarrow cCu(NO_3)_2 + dNO + eH_2O$

f $CuI_2 \rightarrow gCu_2I_2 + hI_2$

i $Na_2S_2O_3 + \hat{j}I_2 \rightarrow kNa_2S_4O_6 + lNaI$

(fill up the blanks)

(a) The coefficients are : a = _____ . b = _____ , c = _____ , d = _____ and e =_____ .

(b) The coefficients are : f = _____ , g = _____ and h = _____.

(c) The coefficients are : i = _____ , j = _____ , k = and l = _____.

(d) If 2.54 g of I_2 is evolved from a 2.0 g sample of the alloy, what is the percentage of copper in the alloy ?

(atomic, weight of iodine and coper are 127 and 63.5, respectively)

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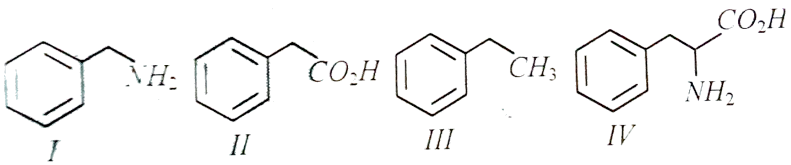
171. You have been given four bottles marked A, B, C and D each containing one of the organic compounds given below



The following observation were made.

(i) The compound in the bottle A did not dissolve in either 1 N NaOH or 1 N HCl.

(ii) The compound in the bottle B dissolved in 1 N NaOH but not in 1 N HCl.

(iii) The compound in the bottle C dissolved in both 1 N NaOH and 1 N HCl.

j(iv) The compound in the bottle D did not dissolved in 1 N NaOH but dissolved in 1 N HCl.

(a) Indicate hte compounds in : bottle A : _____, bottle B : _____, bottle C = _____ and bottle D = _____.

(b) The compound with the highest solubility in distilled water is _____.

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172. Assume that a human body requires 2500 kcal of energy each day for metabolic activity and sucrose is the only source of energy, as per the equation

$C_{12}H_{22}O_{11}(S) + 12O_2(g) \rightarrow 12CO_2(g) + 11H_2O(l), \Delta H = -5.6 \times 10^6 J$

.

(Fill up the blanks)

(a) The energy requirement of the human body per day is _____ kJ.

(b) The mass of sucrose required to provide this energy is _____ g and the volume of CO_2 (at STP) produced is _____ litres .

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Mathematics

1. $2.52g$ of oxalic acid dehydrate was dissolved in 100 ml of water, 10 mL of this solution was diluted to 500 mL. The normality of the final solution and the amount of oxalic acid (mg/mL) in the solution are respectively-

A. $0.16N, 5.04$

B. $0.08N, 3.60$

C. $0.04N, 3.60$

D. $0.02N, 10.08$

Answer: C

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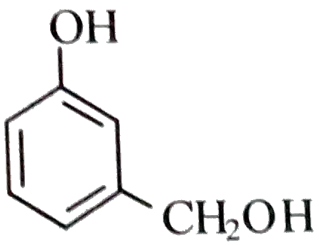
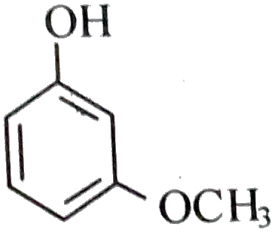
2. Two isomeric compounds I and II are heated with HBr-

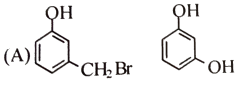


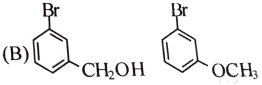
(I)

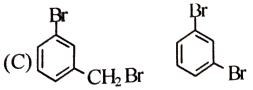


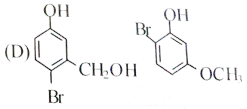
(II)

The products obtained are

A. 

B. 

C. 

D. 

Answer: A

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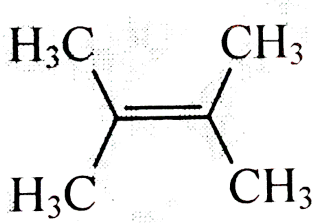
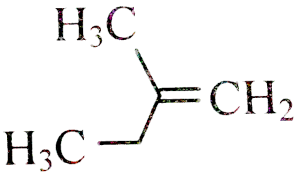
3. The number of possible enatiomeric pair(s) produced from the bromination of I and II, respectively, are



I



II

A. 0,1

B. 1,0

C. 0,2

D. 1,1

Answer: A

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4. For the reaction $A \rightarrow B$, $\Delta H^{\circ} = 7.5 mol^{-1}$ and $\Delta S^{\circ} = 2.5 J mol^{-1}$. The value of ΔG° and the temperature at which the reaction reaches

equilibrium are, respectively.

A. $0kJmol^{-1}$ and $400K$

B. $-2.5kJmol^{-1}$ and $400K$

C. $2.5kJmol^{-1}$ and $200K$

D. $0kJmol^{-1}$ and $300K$

Answer: D

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5. The solubility product of $Mg(OH)_2$ is 1.0×10^{-12}. Concentrated aqueous $NaOH$ solution is added to a $0.01M$ aqueous solution of $MgCl_2$. The pH at which precipitation occur is -

A. 7.2

B. 7.8

C. 8.0

D. 9.0

Answer: D

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6. A metal with an atomic radius of 141.4 pm crystallizes in the face centered cubic structure. The volume of the unit cell in pm is -

A. 2.74×10^7

B. 2.19×10^7

C. 6.40×10^7

D. 9.20×10^7

Answer: C

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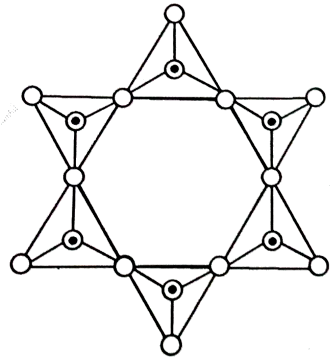
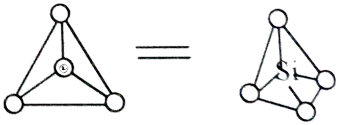
7. Identify the cyclic silicate ion given in the figure below



where



• = Si
O = O

A. $[Si_4O_{25}]^{24-}$

B. $[Si_6O_{18}]^{18-}$

C. $[Si_4O_{12}]^{12}$

D. $[Si_6O_{24}]^{12-}$

Answer: B

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8. Diborane is formed the element as shown in equation (1)

$2B(s) + 3H_2(g) \rightarrow 3B_2H_6(g) \ldots\ldots\ldots (1)$

Given that

$$H_2O(l) \rightarrow H_2O(g) \qquad \Delta H_{1^\circ} = 44kJ$$
$$2B(s) + 3/2O_2(s) \rightarrow B_2O_3(s) \qquad \Delta H_{2^\circ} = -1273kJ$$
$$B_2H_6(g) + 3O_2(g) \rightarrow B_2O_3(s) + 3H_2O(g) \qquad \Delta H_{3^\circ} = -2035kJ$$
$$H_2(g) + 1/2O_2(g) \rightarrow H_2O(l) \qquad \Delta H_{4^\circ} = -286kJ$$

the ΔH° for the reaction (1)` is -

A. $36kJ$

B. $509kJ$

C. $520kJ$

D. $-3550kJ$

Answer: A

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9. The Crystal Field Stabilization Energy (CFSE) and the spin-only magnetic moment in Bohr Magneton (BM) for the complex $K_3\left[Fe(CN)_6\right]$ are, respectively-

A. $0.0\Delta_s$ and $\sqrt{35}BM$

B. $+2.0\Delta_s$ and $\sqrt{3}BM$

C. $-0.4\Delta_s$ and $\sqrt{24}BM$

D. $-2.4\Delta_s$ and $0BM$

Answer: B

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10. A solution containing $8.0g$ of nicotine in $92g$ of water-frezes 0.925 degrees below the normal freezing point of water. If the freezing point depression constant $K_f = -1.85^\circ Cmol^{-1}$ then the molar mass of nicotine is -

A. 16

B. 80

C. 320

D. 160

Answer: D

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PART-I CHEMISTRY

1. The weight of calcium oxide formed by burning 20 g of calcium in excess oxygen is-

A. 36g

B. 56g

C. 28g

D. 72g

Answer: A::B::C::D

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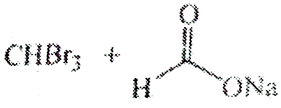
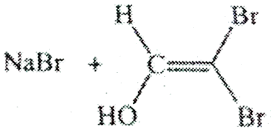
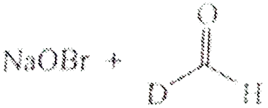
2. The major products in the reaction

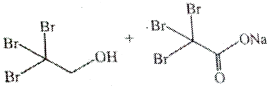
$Br_3CCHO \xrightarrow{NaOH}$

are-

A. 

B. 

C. 

D. 

Answer: A

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3. The number of electrons plus neutrons in ${}^{40}_{19}K^+$ is-

A. 38

B. 59

C. 39

D. 40

Answer: C

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4. Among the following, the most basic oxide is-

A. Al_2O_3

B. SiO_2

C. P_2O_5

D. Na_2O

Answer: D

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5. By dissolving 0.35 mole of sodium chloride in water, 1.30L of salt solution is obtained. The molarity of the resulting solution should be reported as-

A. 0.3

B. 0.269

C. 0.27

D. 0.2692

Answer: B

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6. Among the quantities, density (p), temperature (T), heat capacity (C_p), volume (V) and pressure (P), a set of intensive variables are-

A. (p, T, H)

B. (H, T, V)

C. (V,T,C_p)

D. (p, T, P)

Answer: D

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7. The value of 'X' in $KAl(SO_4)x.12H_2O$ is-

A. 1

B. 2

C. 3

D. 4

Answer: B

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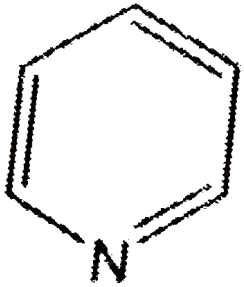
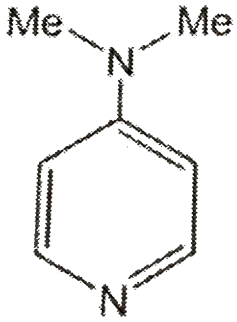
8. Among the following substituted pyridines, the most basic compound is-

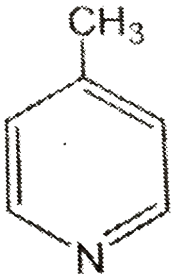
A.

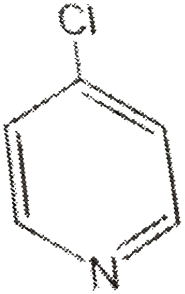


B.



C.





D.

Answer: C

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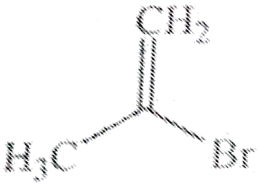
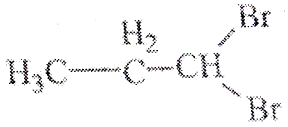
9. The major product in the following reaction is-

$$H_3C - C \equiv C - H + 2HBr(excess)$$

A. 

B. $H_3C - \overset{\overset{Br}{|}}{\underset{\underset{Br}{|}}{C}} - CH_3$

C. $H_3C - \overset{\overset{H}{|}}{\underset{\underset{Br}{|}}{C}} - \underset{\underset{Br}{|}}{CH_2}$

D. 

Answer: B

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10. The major product in the following reaction at $25^\circ C$ is-

$$CH_3 - COOH \xrightarrow{CH_3CH_2NH_2}$$

A. $CH_3CONHCH_2CH_3$

B. $CH_3CH = NCH_2CH_3$

C. $NH_3^+CH_2CH_2COO^-$

D. $CH_3CON = CHCH_3$

Answer: A

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11. A reaction with reaction quotient Qc and equilibrium constant K_c, will proceed in the direction of the products when-

A. Qc=Kc

B. $Qc < Kc$

C. $Qc > Kc$

D. Qc=0

Answer: B

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12. Acetylsalicylic acid is a pain killer and is commonly known as-

A. Paracetamol

B. ibuprofen

C. aspirin

D. penicillin

Answer: B

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13. The molecule which does not exhibits strong hydrgoen bonding is-

A. methyl amine

B. diethyl ether

C. acetic acid

D. glucose

Answer: C

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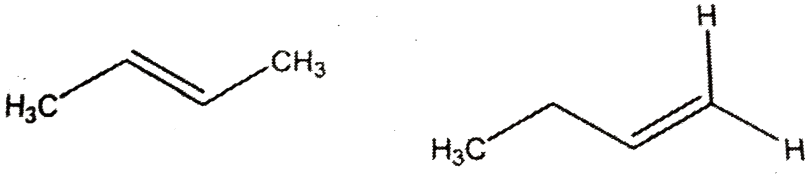
14. The following two compounds are-



A. geometrical isomers

B. positional isomers

C. functional group isomers

D. optical isomers

Answer: B

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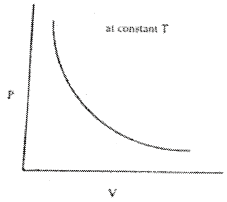
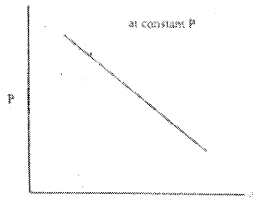
15. The graph that does not repersent the behaviour of an ideal gas is-

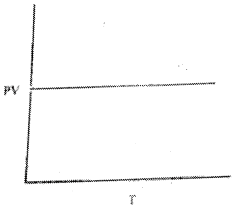
A.



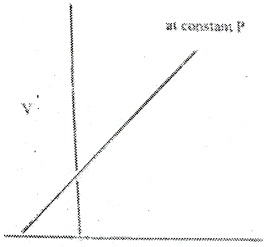
B.



C.



D.



Answer: A::B::C::D

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16. When $1.88g$ of AgBr(s) is added to a 10^{-3} M aqueous solution of KBr, the concentrationof Ag is 5×10^{-10}M. If the same amout of AgBr(s) is

added to a 10^{-2} M aqueous solution of $AgNO_3$, the concentration of Br^- is

A. $9.4 \times 10^{-9} M$

B. $5 \times 10^{-10} M$

C. $1 \times 10^{-11} M$

D. $5 \times 10^{-11} M$

Answer: D

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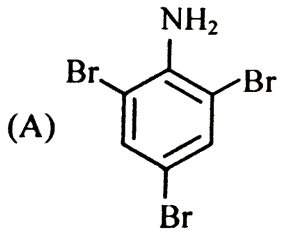
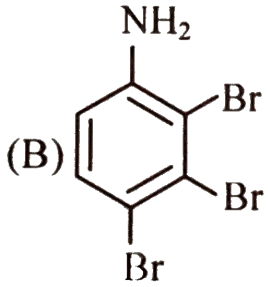
17. Aniline reacts with excess Br_2 / H_2O to give the major product

A.

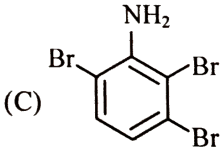


(A)

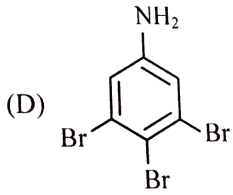
B.



C.



D.



Answer: A

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18. The metal with the highest oxidation state presnt in K_2CrO_4, $NbCl_5$ and MnO_2 is -

A. Nb

B. Mn

C. K

D. Cr

Answer: D

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19. The number of geometrical isomers of $\left[CrCl_2(en)(NH_3)_2\right]$, where en= ethylene diamine, is -

A. 2

B. 3

C. 4

D. 1

Answer: B

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20. The element that combines with oxygen to give an amphoteric oxide is-

A. Nb

B. P

C. Al

D. Na

Answer: C

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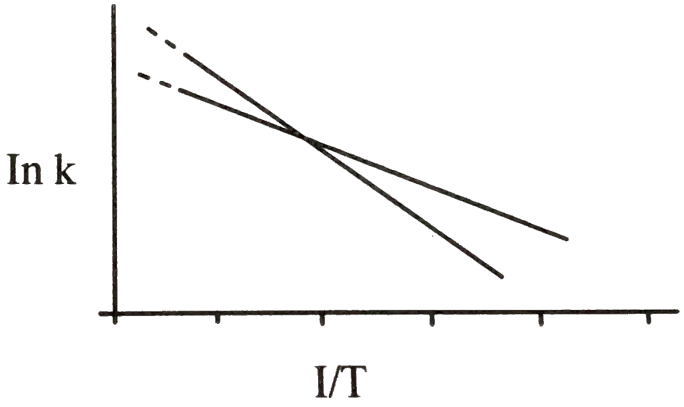
21. The Arrhenius plots of two reactions, I and II are shown graphically-



The graph suggest that-

A. $E_I > E_{II}$ and $A_I > A_{II}$

B. $E_{II} > E_I$ and $A_{II} > A_I$

C. $E_I > E_{II}$ and $A_{II} > A_I$

D. $E_{II} > E_1$ and $A_I > A_{II}$

Answer: A

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22. $Ni(CO)_4$ is

A. tetrahedral and parmagnetic

B. square planar and diamagnetic

C. tetrahedral and diamagnetic

D. square planar and paramegnetic

Answer: C

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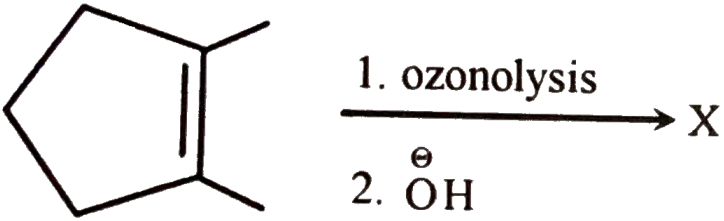
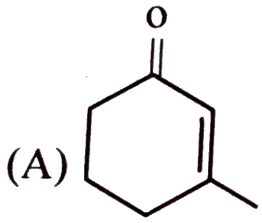
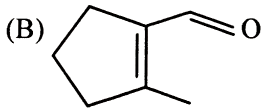
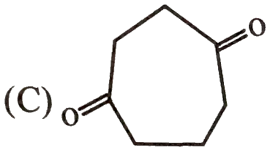
23. In the following reaction

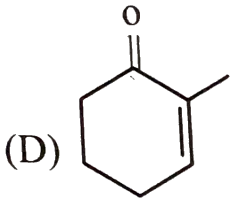


the major product X is -

A. 

B. 

C. 

D. 

Answer: A

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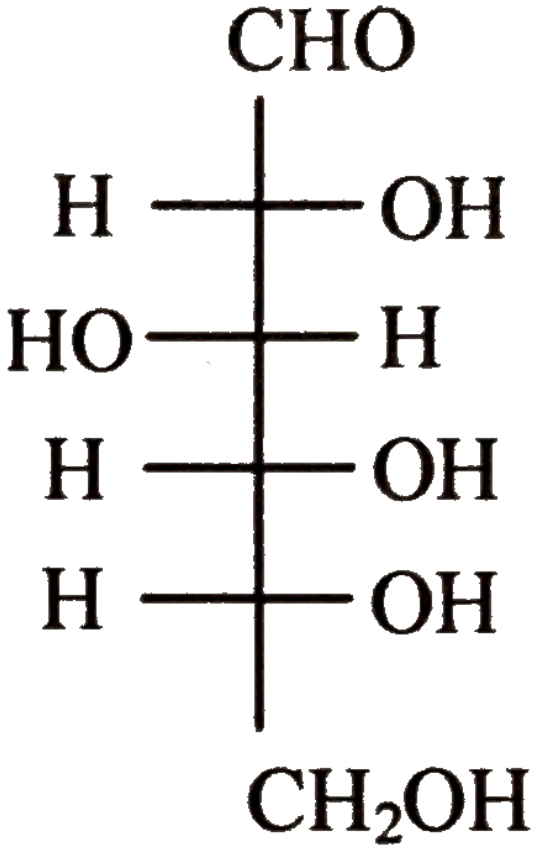
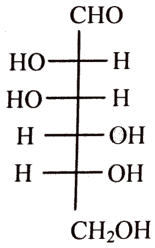
24. Given the structure of D-(+)- glucose as

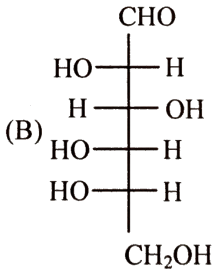


The structure of L-(-)-glucose is

A. (A)

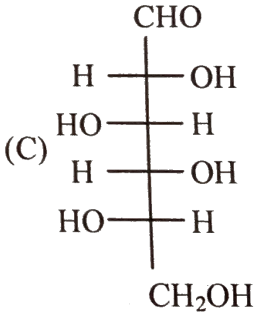


B.



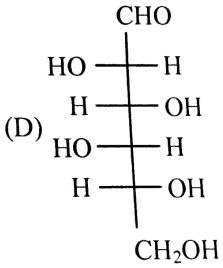
(B)

C.



(C)

D.



(D)

Answer: B

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25. In a cubic close packed structure, fractional contributions of an atom at the corner and at the face in the unit cell are, respectively-

A. 1/8 and 1/2

B. 1/2 and 1/4

C. 1/4 and 1/2

D. 1/4 and 1/8

Answer: A

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26. The equilibirum constant K_c of the reaction, $2A \Leftrightarrow B + Cis0.5at25^\circ C$ and 1 atm. The reaction will proceed in the backward direction when concentrations [A], [B] and [C] are respectively-

A. $10^{-3}, 10^{-2}$ and $10^{-2}M$

B. $10^{-1}, 10^{-2}$ and $10^{-2}M$

C. $10^{-2}, 10^{-2}$ and $10^{-3}M$

D. $10^{-2}, 10^{-3}$ and $10^{-3}M$

Answer: A

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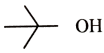
27. Major products formed in the reaction of t-butyl methyl ether with HI are-

A. (A) H_3C-I and  OH

B. (B)  and H_3C-OH

C. (C) H_3C-OH and  I

D. (D)  and H_3C-OH

Answer: C

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28. If the molar conductivities $\left(\text{in} S cm^2 \text{mol}^{-1}\right)$ of NaCl,KCl and NaOH at infinite dilution are 126, 150 and 250 respectively, the molar conductivity of KOH $\left(\text{in} S \text{cm}^2 \text{mol}^{-1}\right)$ is -

A. 256

B. 226

C. 26

D. 274

Answer: D

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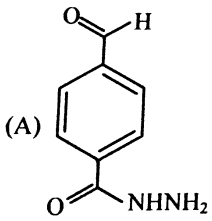
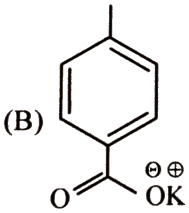
29. 4-Formyl benzoic acid on treatment with one equivalent of hydrazine following by heating with alcoholic KOH gives the major product-

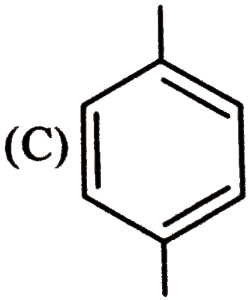
A.



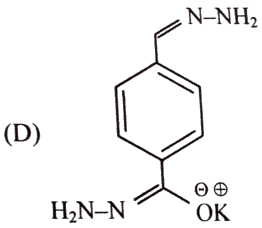
B.



C.



D.



Answer: B

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30. Two elements, Xand Y, have atomic numbers 33 and 17 , rspectively. The molecular formula of a stable compound formed between them is-

A. XY

B. XY_2

C. XY_3

D. XY_4

Answer: C

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31. The number of moles of $KMnO_4$ required to oxidize one equivalent of Kl is the presence of sulfuric acid is-

A. 5

B. 2

C. $1/2$

D. $1/5$

Answer: D

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32. Three successive measurements in an experiment gave the values 10.9, 11.4042 and 11.42. The correct way of reporting the average value is -

A. 11.208

B. 11.21

C. 11.2

D. 11

Answer: C

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33. The latent heat of melting of ice at $0^{\circ}C$ is 6 kJ mol^{-1} . The entropy change during the melting in $JK^{-1}\mathrm{mol}^{-1}$ is closest to-

A. 22

B. 11

C. -11

D. -22

Answer: A

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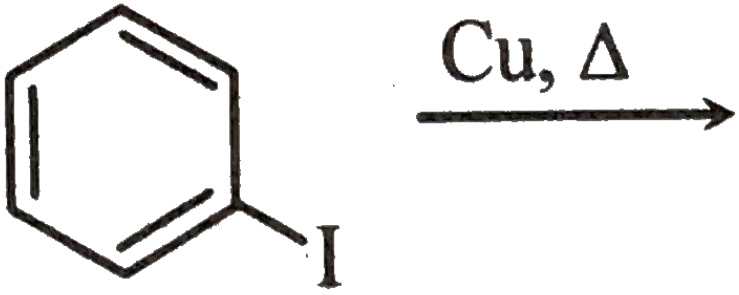
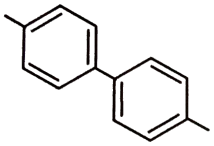
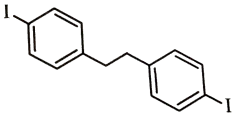
34. The major product of the following reaction



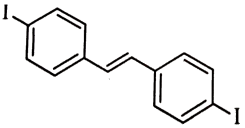
A. (A)



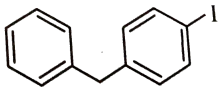
B. (B)



C. (C)



D. (D)



Answer: A

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35. The energies of d_{xy} and d_z^2 orbits in octahedral and tetrahedral transition metal complexes are such that-

A. $E(d_{xy}) > E(d_z^2)$ in both tetrahedral and octahedral complexes

B. $E(d_{xy}) < E(d_z^2)$ in both tetrahedral and octahedral complexes

C. $E(d_{xy}) > E(d_z^2)$ in tetrahedral bt $E(d_{xy}) < E(d_z^2)$ in octahedral complexes

D. $E(d_{xy}) < E(d_z^2)$ in tetrahedral bt $E(d_{xy}) > E(d_z^2)$ in octahedral complexes

Answer: C

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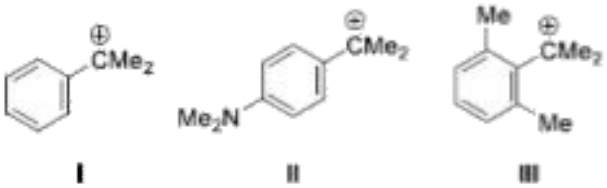
36. The stability of



I II III

follows the order :

A. $I > II > III$

B. $II > I > III$

C. $II > III > I$

D. $III > II > I$

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37. Among the following, the biodegradable polymer is :

A. polylactic acid

B. polyvinyl chloride

C. bakelite

D. teflon

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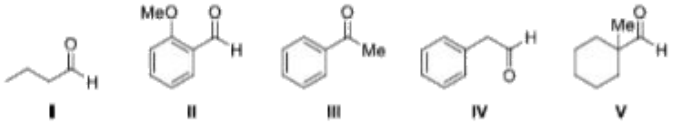
38. Among the following,



the compounds which can be reduced with formaldehyde and conc.aq. KOH, are :

A. only II and V

B. only I and V

C. only II and III

D. only I, II and IV

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39. An organic compound that is commonly used for sanitizing surfaces is :

A. acetylsalicylic acid

B. chloramphenicol

C. aspartame

D. cetyltrimethyl ammonium bromide

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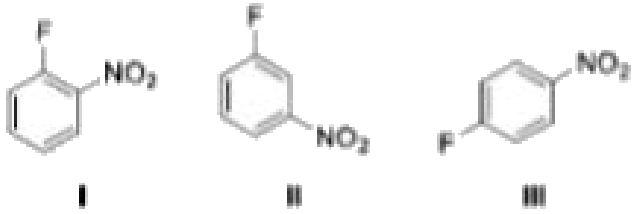
40. The rates of reaction of NaOH with

The rates of reaction of NaOH with



I II III

follow the order:

follow the order :

A. $II > I > III$

B. $II > III > I$

C. $I > III > II$

D. $III > II > I$

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41. The best reagent for converting, 2-phenylpropanamide into 1-phenylethanamine is....

A. $H_2, Pd/C$

B. $Br_2, NaOH$

C. $LiAlH_4, Et_2O$

D. $NaBH_4, MeOH$

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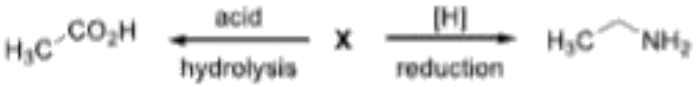
42. The compound X in the following reaction scheme



is :

A. acetonitrile

B. methyl isocyanide

C. acetaldehyde

D. nitromethane

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43. A nucleus X captures a β particle and then emits a neutron and γ ray to form Y.

A. isomorphs

B. isotopes

C. isobars

D. isotones

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44. The boiling point (in $^{\circ}C$) of 0.1 molal aqueous solution of $CuSO_4.5H_2O$ at 1 bar is closest to :

[Given : Ebullioscopic (molal boiling point elevation) constant of water, $K_b = 0.512 K Kg mol^{-1}$]

A. 100.36

B. 99.64

C. 100.1

D. 99.9

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45. A weak acid is titrated with a weak base. Consider the following statmenets regarding the pH of the solution at the equivalence point :

(i) pH depends on the concentration of acid and base.

(ii) pH is independent of the concentration of acid and base.

(iii) pH depends on the pK_a of acid and pK_b of base.

(iv) pH is independent of the pK_a of acid and pK_b of base.

The correct statments are :

A. only (i) and (iii)

B. only (i) and (iv)

C. only (ii) and (iii)

D. only (ii) and (iv)

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46. Products are favored in a chemical reaction taking place at a constant temperature and pressure. Consider the following statements :

(i) The change in Gibbs energy for the reaction is negative.

(ii) the total change in Gibbs energy for the reaction and the surroundings is negative.

(iii) The change in entropy for the reaction is positive.

(iv) The total change in entropy for the reaction and the surrounding is

positive.

The statments which are ALWAYS true are :

A. only (i) and (iii)

B. only (i) and (iv)

C. only (ii) and (iv)

D. only (ii) and (iii)

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47. A mixture of toluene and benzene forms a nearly ideal solution. Assume P_B° and P_T° to be the vapor pressures of pure benzene and toluene, respectively. The slope of the line obtained by plotting the total vapor pressure to the mole fraction of benzene is :

A. $P_B^\circ - P_T^\circ$

B. $P_T^\circ - P_B^\circ$

C. $P_B^\circ + P_T^\circ$

D. $\left(P_B^\circ + P_T^\circ\right)/2$

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48. Upon dipping a copper rod, the aqueous solution of the salt that can turn blue is:

A. $Ca(NO_3)_2$

B. $Mg(NO_3)_2$

C. $Zn(NO_3)_2$

D. $AgNO_3$

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49. Treatment of alkaline $KMnO_4$ solution with KI solution oxidizes iodide to:

A. I_2

B. IO_4^-

C. IO_3^-

D. IO_2^-

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50. If an extra electron is added to the hypothetical molecule C_2 this extra electron will occupy the molecular orbital:

A. π_{2p}^*

B. π_{2p}

C. σ_{2p}^*

D. σ_{2p}

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51. Among the following the square planar geometry is exhibited by:

A. $CdCl_4^{2-}$

B. $Zn(CN)_4^{2-}$

C. $PdCl_4^{2-}$

D. $Cu(CN)_4^{3-}$

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52. The correct pair of orbitals involved in t-bonding between metal and CO in metal carbonyl complexes is:

A. metal d_{xy} and carbonyl π_x^*

B. metal d_{xy} and carbonyl π_t

C. metal $d_{x^2-y^2}$ and carbonyl π_x^*

D. metal $d_{x^2-y^2}$ and carbonyl π_x

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53. The magnetic moment (in μ_B) of [Ni(dimethylglyxoimate)$_2$] complex is closest to:

A. 5.37

B. 0.00

C. 1.73

D. 2.25

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54. A compound is formed by two elements M and N. Element N forms hexagonal closed pack array with 2/3 of the octahedral holes occupied by M. The formula of the compound is:

A. M_4N_3

B. M_3N_3

C. M_3N_2

D. M_3N_4

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55. If the velocity of the revolving electron of He^+ in the first orbit (n= 1) is v. the velocity of the electron in the second orbit is:

A. v

B. $0.5V$

C. $2v$

D. $0.25v$

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PART-I BIOLOGY

1. The pH of $10^{-8}M$ solution of HCl in water is

A. 8

B. close to 7

C. 1

D. 0

Answer: B

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PART-2 CHEMISTRY

1. Upon fully dissolving 2.0 g of a metal in sulfuric acid, 6.8 g of the metal sulfate is formed. The equivalent weigth of the metal is-

A. $13.6g$

B. $20.0g$

C. $4.0g$

D. $10.0g$

Answer: B

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2. Upon mixing equal volumes of aqueous solutions of 0.1 M HCl and 0.2 M H_2SO_4, the concentration of H^+ in the resulting solution is-

A. $0.30mol/L$

B. $0.25 mol / L$

C. $0.15 mol / L$

D. $0.10 mol / L$

Answer: A::B::C::D

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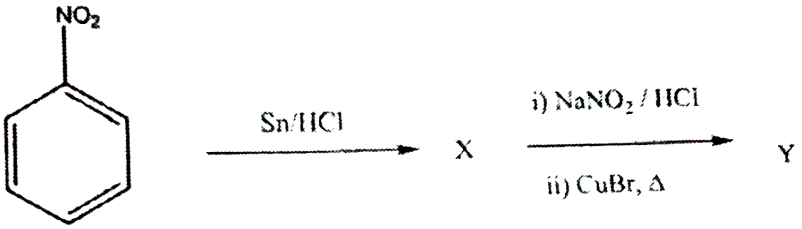
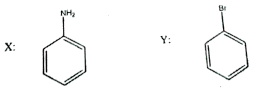
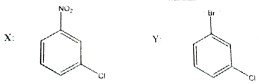
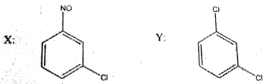
3. The products X and Y in the following reaction sequence are-



A. 

B. 

C. 

D. 

Answer: B

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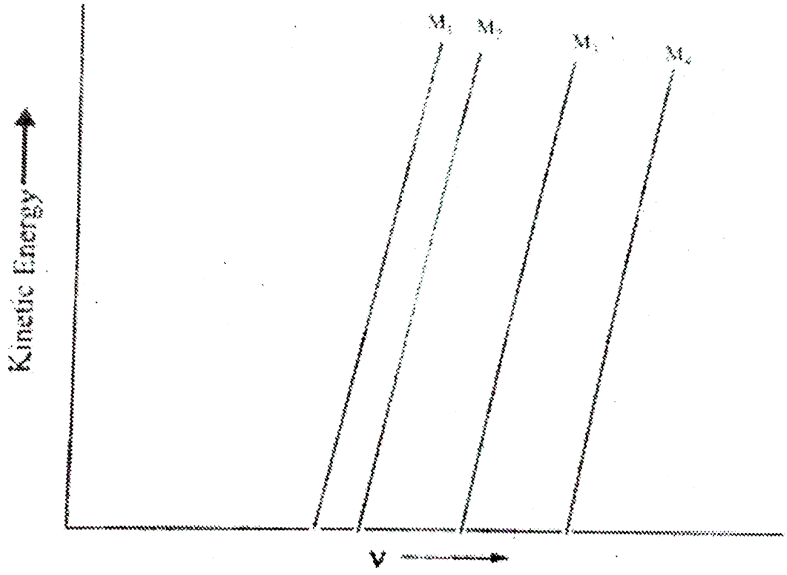
4. A pot of the kinetic energy $(1/2mv^2)$ of ejected electrons as a functionof the frequency (v) of incident radiation for four alkali metals (M_1, M_2, M_3, M_4) is shown below.

The alkali metals M_1, M_2, M_3 and M_4 are, respectively-



A. Li, Na, K, and Rb

B. Rb, K, Na, and Li

C. Na, K, Li and Rb

D. Rb, Li, Na, and K

Answer: B

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5. The number of moles of Br_2 produced when two moles of potassium permanganate are treated with excess potassium bromide in aqueous acid medium is-

A. 1

B. 3

C. 2

D. 4

Answer: B

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6. For the electrochemical cell show below

$Pt \mid H_2(P = 1atm|H^+(aq.\ , xM)||Cu^{2+}(aq, 0M)|Cu(s)$

the potential is 0.49 V at 298 K. The pH of the solution is closest to

[Given: Standard reduction potential E° for Cu^{2+}/Cu is 0.34 V gas constant , R is $8.31JK^{-1}mol^{-1}$ Farady constant , F is $9.65 \times 104JV^{-1}mol^{-1}]$

A. 1.2

B. 8.3

C. 2.5

D. 3.2

Answer: C

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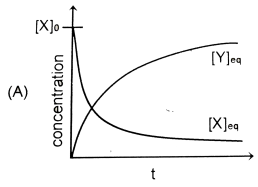
7. Consider the following reversible first - order reaction of X at an initial concentration $[X]_0$. The values of the rate constants are $k_f = 2s^{-1}$ and $k_b = 1s^{-1}$

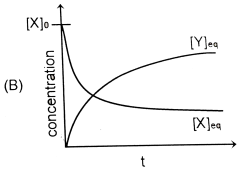
$$X \underset{k_b}{\overset{k_r}{\rightleftharpoons}} y$$

A plot of concentration of X and Y as function of time is

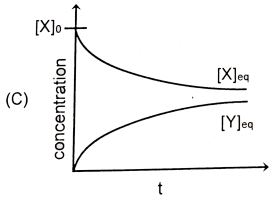
A.



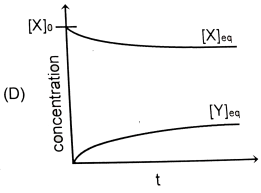
B.



C.



D.



Answer: B

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8. Nitroglycerine (MW =227.1) denotes according to the following equation

:

$$2C_3H_5(NO_3)_3I \rightarrow 3N_2(g) + 1/2O_2(g) + 6CO_2(g) + 5H_2O(g)$$

The standard molar enthalpies of formation, ΔH_f° for the compounds are given bellow:

$$\Delta H_f^\circ \left[C_3H_5(NO_3)_3\right] = -364kJ/mol$$

$$\Delta H_f^\circ \left[CO_2(g)\right] = -395.5kJ/mol$$

$$\Delta H_f^\circ \left[H_2O(g)\right] = -241.8kJ/mol$$

$$\Delta H_f^\circ \left[N_2(g)\right] = 0kJ/mol$$

$$\Delta H_f^\circ \left[O_2(g)\right] = 0kJ/mol$$

The enthalpy change when 10g of nitroglycerine is detonated is

A. $-100.5kJ$

B. $-62.5kJ$

C. $-80.3kJ$

D. $-74.9kJ$

Answer: B

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9. The heating of $(NH_4)_2Cr_2O_7$ produces another chromium compound along with N_2 gas. The change of oxidation state of Cr in the reaction is

A. $+6 \text{ to } +2$

B. $+7 \text{ to } +4$

C. $+8 \text{ to } +4$

D. $+6 \text{ to } +3$

Answer: D

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10. The complex having the highest spin-only magnetic moment is

A. $\left[Fe(CN)_6\right]^{3-}$

B. $\left[Fe(H_2O)_6\right]^{2+}$

C. $[MnF_6]^{4-}$

D. $[NiCl_4]^{2-}$

Answer: C

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11. Among $Ce\left(4f^15d^16s^2\right)$, $Nd\left(4f^46s^2\right)$, $Eu\left(4f^76s^2\right)$ and $Dy\left(4f^{10}6s^2\right)$, the element having highest and lowest 3rd ionization energies, respectively are

A. Nd and Ce

B. Eu and Ce

C. Cu and Dy

D. Dy and Nd

Answer: B

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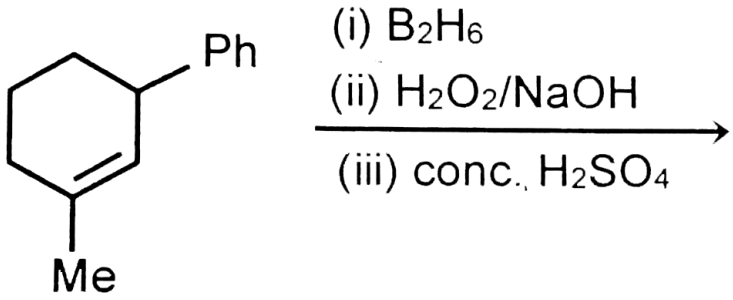
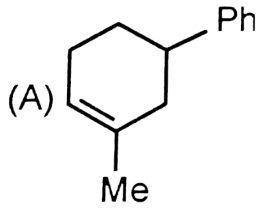
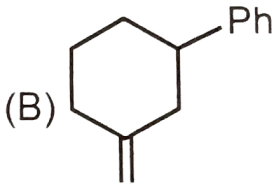
12. The major product of the following reaction

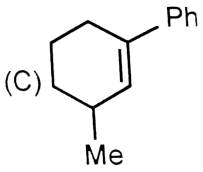


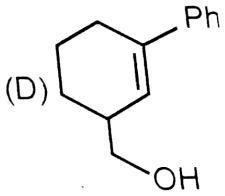
is

A.



B. 

C. 

D. 

Answer: C

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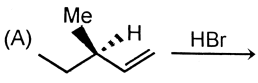
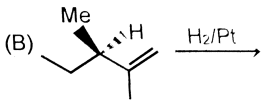
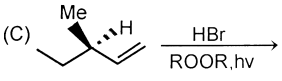
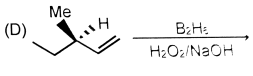
13. Among the following reactions ,a mixture of diastereomers is produced form

A. 

B. 

C. 

D. 

Answer: A

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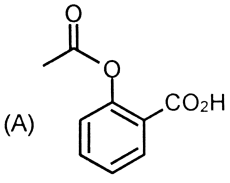
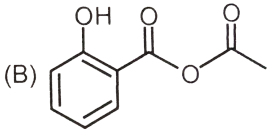
14. Reaction of phenol with NaOH followed by heating with CO_2 under high pressure , and subsequent acidification gives compounds X as the major product , which can be purified by steam distillation . When reacted with acetic anhydride in the presence of a trace amount of conc. H_2SO_4 compound X produces Y as the major product .

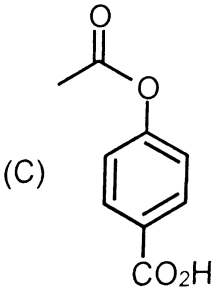
Compound Y is

A. 

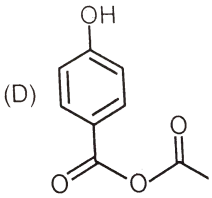
B.



C.



D.



Answer: A

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15. Tetrapeptide is made of naturally occuring alanine , serine, glycine and valine . If the C-terminal amino acid is alanine and the N-terminal amino acid is chiral , the number of possible sequences of the tetrapeptide is

A. 12

B. 8

C. 6

D. 4

Answer: D

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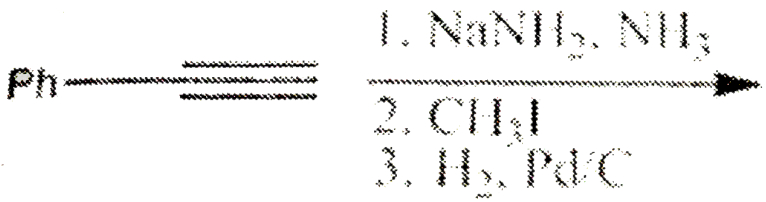
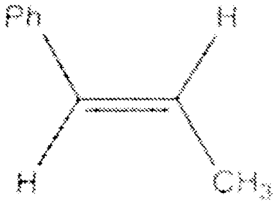
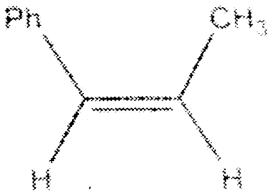
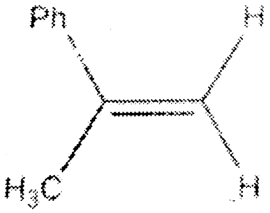
PART-2 (CHEMISTRY)

1. The final major product obtained in the following sequence of reactons is -



A. 

B. 

C. 

D. 

Answer: B

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2. In the DNA of E. Coli the mole ratio of adenine to cytosine is 0.7. If the number of moles of adenine in the DNA is 350000, the number of moles of guanine is equal to -

A. 350000

B. 500000

C. 225000

D. 700000

Answer: B

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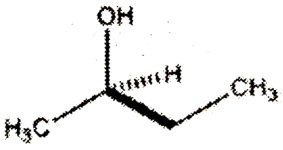
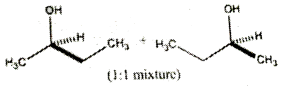
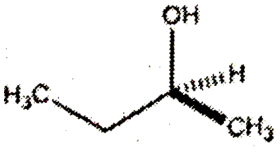
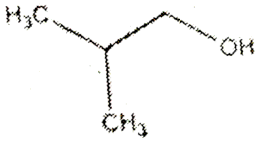
3. (R)-2-bromobutane upon treatment with aq. NaOH gives -

A. 

B. 

C. 

D. 

Answer: B

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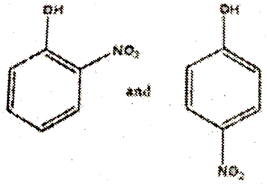
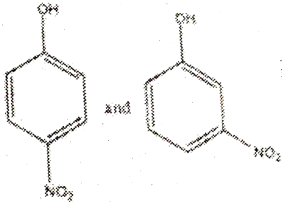
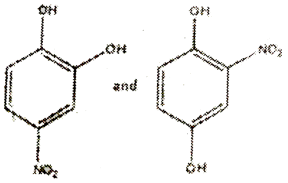
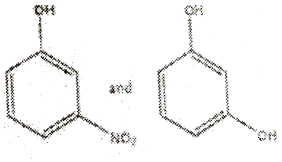
4. Phenol on treatment with dil. HNO_3 gives two products P and Q. P is steam volatile but Q is not , P and Q are respectively-

A. 

B. 

C. 

D. 

Answer: A

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5. A metal is irradiated with light of wavelength 660 nm. Given that the work function of the metal is $1.0eV$, the de Broglie wavelength of the ejected electron is close to-

A. $6.6 \times 10^{-7}m$

B. $8.9 \times 10^{-11}m$

C. $1.3 \times 10^{-9}m$

D. $6.6 \times 10^{-13}m$

Answer: C

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6. The inter-planar spacing between the (2 2 1) planes of a cubic lattice of length 450 pm is -

A. 50 pm

B. 150 pm

C. 300 pm

D. 450 pm

Answer: B

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7. The ΔH for vaporization of a liquid is 20kJ/mol. Assuming ideal behaviour, the change in internal energy for the vaporization of 1 mol of the liquid at $60^{\circ}C$ and 1 bar is close to -

A. $13.2kJ/mol$

B. $17.2kJ/mol$

C. $19.5kJ/mol$

D. $20.0kJ/mol$

Answer: B

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8. Among the following, the species that is both tetrahedral and diamagnetic is-

A. $[NiCl_4]^{2-}$

B. $\left[Ni(CN)_4\right]^{2-}$

C. $Ni(CO)_4$

D. $\left[Ni(H_2O)_6\right]^{2+}$

Answer: C

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9. Three moles of an ideal gas expands reversibly under isothermal condition form 2 L to 20 L at 300 K. The amount of heat-change (in kJ/mol) in the process is -

A. 0

B. 7.2

C. 10.2

D. 17.2

Answer: D

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10. The following data are obtained for a reaction, $X + Y \rightarrow \text{Products}.$

Expt.	$[X_0]/\text{mol}$	$[Y_0]/\text{mol}$	$\text{rate/mol L}^{-1}s^{-1}$
1	0.25	0.25	1.0×10^{-6}
2	0.50	0.25	4.0×10^{-6}
3	0.25	0.50	8.0×10^{-6}

The overall of the reaction is

A. 2

B. 4

C. 3

D. 5

Answer: D

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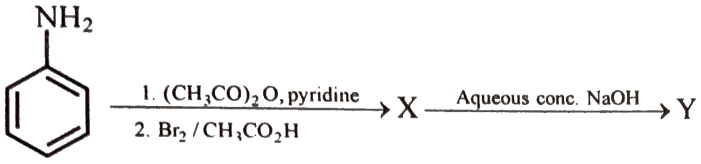
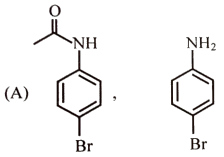
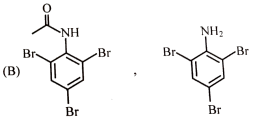
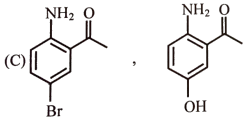
PART II CHEMISTRY

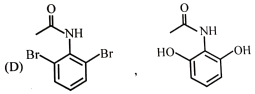
1. In the reaction sequence



A. 

B. 

C. 

D. 

Answer: A

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2. The density of acetic acid vapour at 300 K and 1 atm is 5 mg cm^{-1}. The number of acetic acid molecules in the cluster that is formed in the gas phase is closest to

A. 5

B. 2

C. 3

D. 4

Answer: B

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3. The molar enthalpy change for $H_2O(l) \Leftrightarrow H_2O(g)$ at 373 K and 1 atm is 41 kJ/mol. Assume ideal behaviour, the internal energy change for vaporization of 1 mol of water at 373 K and 1 atm in KJ mol^{-1} is :

A. 30.2

B. 41.0

C. 48.1

D. 37.9

Answer: D

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4. The equilibirum constant (K_c) of two reactions $H_2 + I_2 \Leftrightarrow 2HI$ and $N_2 + 3H_2 \Leftrightarrow 2NH_3$ are 50 and 1000, respectively. The equilibirum constant of the raction $N_2 + 6HI \rightarrow 2NH_3 + 3I_2$ is closeest to :

A. 50000

B. 20

C. 0.008

D. 0.005

Answer: C

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5. Given that the food energies of : $N \equiv N$ is 946kJ mol^{-1} , H-H is 435 kJ mol^{-1}, $N - N$ is 159 kJ mol^{-1}, and N-H is 389 kJ mol^{-1} , the heat of formation of hydrazine in the phase in kJ mol^{-1} is :

A. 833

B. 101

C. 334

D. 1268

Answer: B

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6. The radius of K^+ is 133 pm and that of Cl^- is 181 pm. The volume of the unit cell of KCI expressed in $10^{-22}cm^3$ is :

A. 0.31

B. 1.21

C. 2.48

D. 6.28

Answer: C

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7. The raction ,

$K_2Cr_2O_7 + mFeSO_4 \rightarrow nH_2SO_4 \rightarrow Cr_2(SO_4)_3 + pFe_2(SO_4)_3 + qH_2O$

when balanced, m,n,p and q are respectively :

A. 6,14,3,14

B. 6,7,3,7

C. 3,7,2,7

D. 4,14,2,14

Answer: B

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8. The standard free energy change (in J) for the reaction $3Fe^{2+}(aq) + 2Cr(s) \rightarrow 2Cr^3 + 3Fe(s)$ given $E^0_{Fe^{2+}/Fe} = -0.454V$ and $E^0_{Cr^{3+}/Cr} = -0.74Vis(F = 96500C)$

A. 57900

B. $-57,900$

C. 173700

D. 173700

Answer: C

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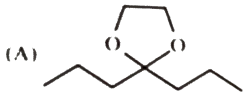
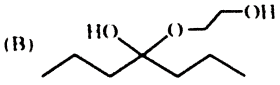
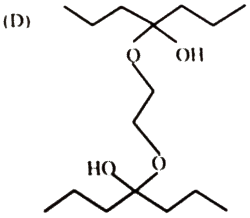
9. Calcium butanoate on heating followed by treatment with 1,2-ethandiol in the presence of catalytic amount of an acid, produces a major product which is :

A. 

B. 

C. 

(D)



D.

Answer: A

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10. XeF_6 on complete hydrolysis yeild 'X' . The molecular of X and its geometry, respectively, are :

A. XeO_2 and linear

B. XeO_3 and trigonal planar

C. XeO_3 and pyramidal

D. XeO_4 and tetrahedral

Answer: C

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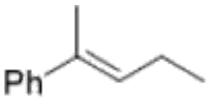
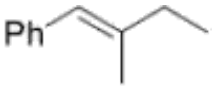
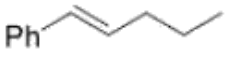
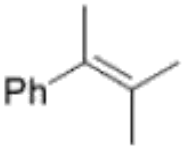
11. An organic compound X with molecular formula $C_{11}H_{14}$ gives an optically active compound on hydrogenation. Upon ozonolysis, X produces a mixture of compunds - P and Q, Compund P gives a yellow precipitate when treated with I_2 and NaOH bu does no reduce Tollens' reagent. Compound Q does not gives any yellow precipitate with I_2 and NaOH but gives Fehling 's test. The compund X Q does not give any yellow precipitate with I_2 and NaOH but gives Fehling 's test . The compund X is

A. 

B. 

C. 

D. 

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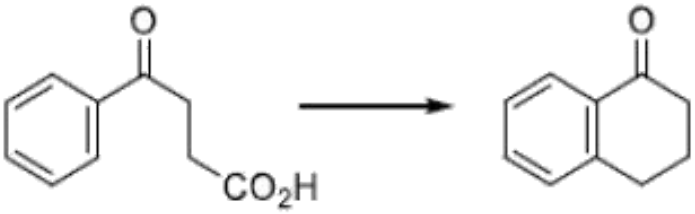
12. The following transformation



can be carried out in three sptes. The reagents required for these three steps in their correct order. Are :

A. $(i) NaBH_4, (ii) PCl_5, (iii) anh.\ AlCl_3$

B. $(i) SOCl_2, (ii) anh.\ AlCl_3, (iii) Zn(Hg)/HCl$

C. $(i) Zn(Hg)/HCl, (ii) SOCl_2, (iii) anh.\ AlCl_3$

D. $(i) conc.\ H_2SO_4, (ii) H_2N - NH_2.\ H_2O, (iii) KOH,$ ethylene glycol, Δ

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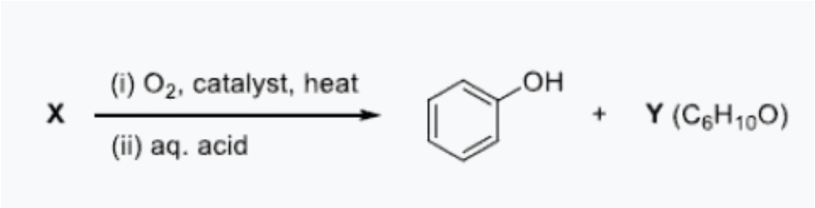
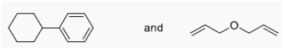
13. 

X and Y, respectively, are :

A. 

B. 

C. 

D. 

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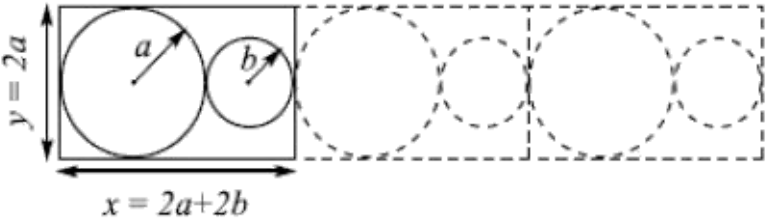
14. A two- dimensional solid is made by alternating circles with radius a and b such that the sides of the circles touch. The packing fraction is defined as the ratio of the are under the circles to the area under the rectangle with sides of the length x and y.



The ratio r = b/a for which the packing fraction is minimized is closed to :

A. 0.41

B. 1

C. 0.5

D. 0.32

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15. Consider a reaction that is first order in both direction

$$A \underset{k_b}{\overset{k_f}{\Longleftrightarrow}} B$$

Initially only A is present , and its concentration is A_0. Assume A_t and A_{eq} are the concentrations of A at time 't' and at equilibrium, respectively. The time 't at which $A_t = (A_0 + A_{eq})/2is$,

A. $t = \dfrac{\ln\left(\frac{3}{2}\right)}{(kf + kb)}$

B. $t = \dfrac{\ln\left(\frac{3}{2}\right)}{\left(k_f - k_b\right)}$

C. $t = \dfrac{\ln 2}{\left(k_f + k_b\right)}$

D. $t = \dfrac{\ln 2}{\left(k_f + k_b\right)}$

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16. The reaction

$CaCO_3 \Leftrightarrow CaO(s) + CO_2(g)$

is in equilibrium in a closed vessel at 298 K . The partial pressure (in atm) of CO_2 (g) in the reaction vessel is closest to :

[Given : the change in Gibbs energies of formation at 298 K and 1 bar for

$CaO(s) = -603.501 kJmol^{-1}$

$CO_2(g) = -394.389 kJmol^{-1}$

$CaCO_3(s) = -1128.79 kJmol^{-1}$

Gas constant $R = 8.314 JK^{-1}mol^{-1}$]

A. 1.13×1^{-23}

B. 0.95

C. 1.05

D. 8.79×10^{23}

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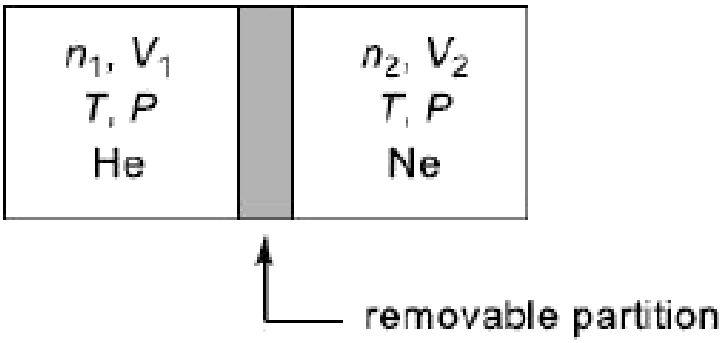
17. A container is divided into two compartments by a removable partition as shown below :



In the first compartment n_1 moles of ideal gas He is present in a volume V_1 . In the second compartment, n_2 moles of ideal gas Ne is present in a

volume V_2. The temperature and pressure in both the compartments are T and P repectively. Assuming R is the gas constant. the total change is entropy upon removing the partition when the gases mix irreversibly is :

A. $n_1 R\ln\frac{v_1}{v_1+v_2} + n_2 R\ln\frac{v_2}{v_1+v_2}$

B. $n_1 R\ln\frac{v_1+v_2}{v_1} + n_2 R\ln\frac{v_1+v_2}{v_2}$

C. $(n_1+n_2)R\ln\ \frac{n_1 v_1}{n_2 v_2}$

D. $(n_1+n_2)R\ln\frac{n_2 v_2}{n_1 v_1}$

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18. Number of stereoisomers possible for the octahedral complexes $\left[Co(NH_3)_3Cl_3\right]$ and $\left[Ni(en)_2Cl_2\right]$,respectively, are : [en = 1,2-ethylenediamine]

A. 2 and 4

B. 4 and 3

C. 3 and 2

D. 2 and 3

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19. When a mixture of NaCl, $K_2Cr_2O_7$ and conc. H_2SO_4 is heated in a dry test tube, a red vapour (X) is evolved. This vapour (X) turns an aqueous solution of NaOH yellow due to the formation of Y. X and Y. respectively. are:

A. $CrCl_3$ and $Na_2Cr_2O_7$

B. $CrCl_3$ and Na_2CrO_4

C. CrO_2Cl_2 and Na_2CrO_4

D. $Cr_2(SO_4)_3$ and $Na_2Cr_2O_7$

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20. Sodium borohydride upon treatment with iodine produces a Lewis acid (X), which on heating with ammonia produces a cyclic compoud (Y) and a colorless gas (Z). X, Y and Z are:

A. $X = BH_3, Y = BH_3NH_3, Z = N_2$

B. $X = B_2H_6, Y = B_3N_3H_6, Z = H_2$

C. $X = B_2H_6, Y = B_6H_6, Z = H_2$

D. $X = B_2H_6, Y = B_3N_3H_6, Z = N_2$

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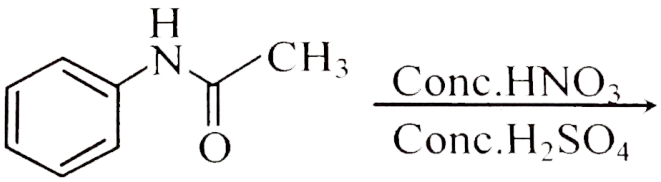
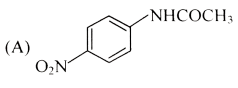
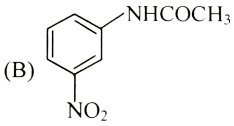
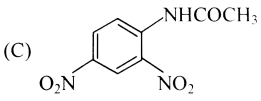
Part A - Chemistry

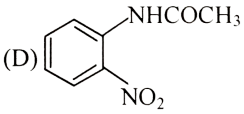
1. The major product formed in the following reaction is



A. 

B. 

C. 

D. 

Answer: A

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2. Among the α-amino acid -threonine, tyrosine, methionine, arginine and tryptophan, those which contain an aromatic group in their side chain are

A. theronine and Arginine

B. tyrosine and tryptophan

C. methionine and tyrosine

D. arginine and tryptophan

Answer: B

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3. The number of stereoisomers possible for a compound of the molecular formula $CH_3 - CH = CH - CH(OH) - Me$ is

A. 1

B. 2

C. 3

D. 4

Answer: D

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4. In electrophilic aromatic substitution reactions of chlorobenzene, the ortho/para-directing ability of chloride is due to its

A. positive inductive effects (+I)

B. negative inductive effect (-I)

C. positive resonance effect (+R)

D. negative resonance effect (-R)

Answer: C

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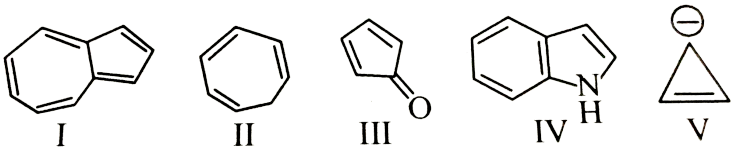
5. Among the following,



the antiaromatic compounds are

A. I and IV

B. III and V

C. II and V

D. I and III

Answer: B

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6. Upon reaction with CH_3MgBr followed by protonation, the compound that produces ethanol is

A. CH_3CHO

B. $HCOOH$

C. $HCHO$

D. $(CHO)_2$

Answer: C

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7. Which of the following is NOT an oxidation reduction reaction ?

A. $H_2 + Br_2 \rightarrow 2HBr$

B. $NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl$

C. $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$

D. $Cl_2 + H_2O \rightarrow HCl + HOCl$

Answer: B

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8. The thermal stability of alkaline earth metal carbonates $-MgCO_3, CaCO_3, SrCO_3$ and $BaCO_3$, follows order

A. $BaCO_3 > SeCO_3 > CaCO_3 > MgCO_3$

B. $CaCO_3 > SrCO_3 > BaCO_3 > MgCO_3$

C. $MgCO_3 > CaCO_3 > SrCO_3 > BaCO_3$

D. $SrCO_3 > CaCO_3 > MgCO_3 > BaCO_3$

Answer: A

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9. When a mixture of diborane and ammonia is heated, the final product is `

A. BH_3

B. NH_4BH_4

C. NH_2NH_2

D. $B_3N_3H_6$

Answer: D

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10. Among the following metals, the strongest reducing agent is

A. Ni

B. Cu

C. Zn

D. Fe

Answer: C

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11. The molecule which is NOT hydrolysed by water at $25^\circ C$ is

A. $AlCl_3$

B. $SiCl_4$

C. BF_3

D. SF_6

Answer: D

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12. Among the following compounds, the one which does NOT produce nitrogen gas upon heating is

A. $(NH_4)_2Cr_2O_7$

B. NaN_3

C. NH_4NO_2

D. $(NH_4)_2(C_2O_4)$

Answer: D

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13. Chlorine has two naturally occuring isotopes, ^{35}Cl and ^{37}Cl. If the atomi mass of Cl is 35.45, the ratio of natural abundance of ^{35}Cl and ^{37}Cl is closest to

A. $3.5:1$

B. $3:1$

C. $2.5:1$

D. $4:1$

Answer: B

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14. The reaction $C_2H_6(g) \Leftrightarrow C_2H_4(g) + H_2(g)$ is at equilibrium in a closed vessel at 1000 K. The enthalpy change (ΔH) for the reaction is

137.0kJ mol^{-1}. Which one of the following actions would shift the equilibrium to the right ?

A. Decreasing the volume of the closed reaction vessel

B. Decreasing the temperature at which the reaction is performed

C. Adding an inert gas to the closed reaction vessel.

D. Increasing the volume of the closed reaction vessel.

Answer: D

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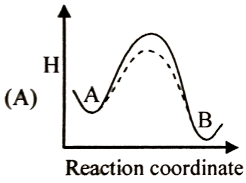
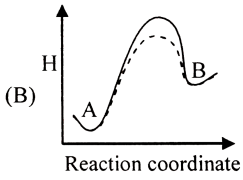
15. The enthalpy (H) of an elementary exothermic reaction $A \Leftrightarrow B$ is schematically plotted against the reaction coordinate. The plots in the presence and absence of a catalyst are shown in dashed and solid lines, respectively. Identify the correct plot for the reaction.

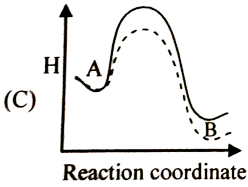
A.



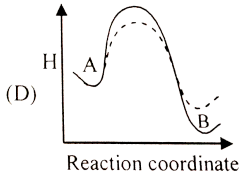
B.



C.



D.



Answer: A

Watch Video Solution

16. $Mg(OH)_2$ is precipitated when NaOH is added to a solution of Mg^{2+} . If the final concentration of Mg^{2+} is 10^{-10} .M, the concetration of

OH^- (M) is the solution is b

[Solubility product for $Mg(OH)_2 = 5.6 \times 10^{-12}$]

A. 0.056

B. 0.12

C. 0.24

D. 0.025

Answer: C

Watch Video Solution

17. A constant current (0.5 amp) is passed for 1 hour through (i) aqueous $AgNO_3$ (ii) aqueous $CuSO_4$ and (iii) molten AlF_3 separately . The ratio of the mass of the metals deposited on the cathod is

$[M_{Ag}, M_{Cu}, M_{Al}$ are molar masses of the respectively metals]

A. $M_{Ag} : 2M_{Cu} : 3M_{Al}$

B. $M_{Ag} : M_{Cu} : M_{Al}$

C. $6M_{Ag} : 3M_{Cu} : 2M_{Al}$

D. $3M_{Ag} : 2M_{Cu} : 2M_{Al}$

Answer: C

Watch Video Solution

18. A reaction has an activation energy of 209 KJ mol^{-1} . The rate increase 10-fold when the temperature is increased from $27^{\circ}C$ to $X^{\circ}C$. The temperature X is closed to

[Gas constant, R =$8.314 J \mathrm{mol}^{-1} K^{-1}$]

A. 35

B. 40

C. 30

D. 45

Answer: A

Watch Video Solution

19. A mineral consists of a cubic close-packed structure formed by O^{2-} ions where half the octahedral voids are occupied by Al^{3+} and one eighth of the tetrahedral voids are occupied by Mn^{2+}. The chemical formula of the mineral is

A. $Mn_3Al_2O_6$

B. $MnAl_2O_4$

C. $MnAl_4O_7$

D. $Mn_2Al_2O_5$

Answer: B

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20. For a 4p orbital, the number of radial and angular nodes, respectively , are

A. 3,2

B. 1,2

C. 2,4

D. 2,1

Answer: D

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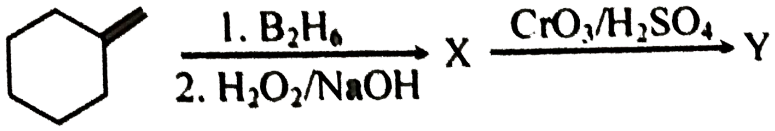
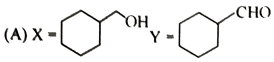
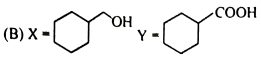
Part B- Chemistry

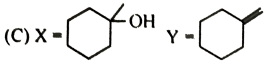
1. In the following reaction squence

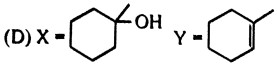


X and Y are

A. 

B. 

C. 

D. 

Answer: B

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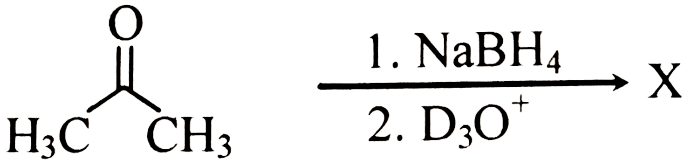
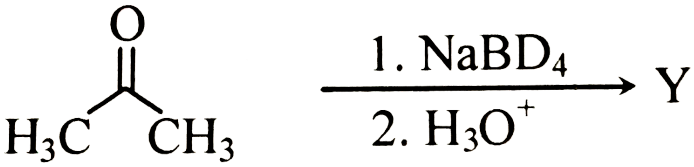
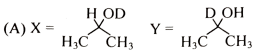
2. In the following reactions

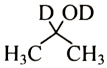


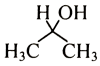


X and Y are

A. 

B. (B) X =  Y = 

C. (C) X = Y = 

D. (D) X = Y = 

Answer: A

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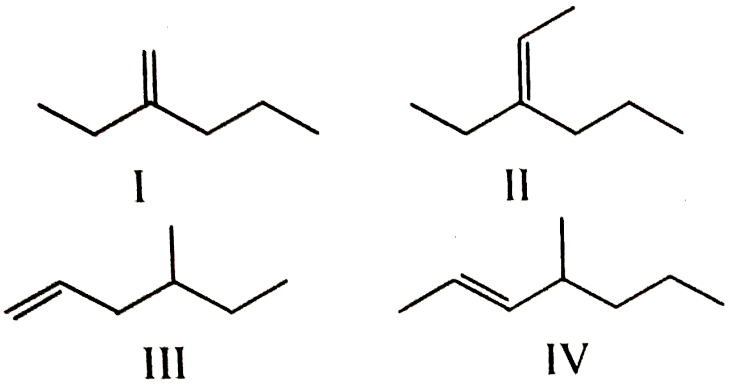
3. Which of the following alkenes can generate optically active compounds upon hydrogenation ?



A. I,III and IV

B. II and III

C. I and III

D. II and IV

Answer: C

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4. When heated in air, brown copper powder turns black. This black powder would turn brown again when heated with

A. CO

B. O_2

C. H_2

D. NH_3

Answer: C

Watch Video Solution

5. The geometry and magnetic property of $[NiCl_4]^{2-}$, respectively are,

A. tetrahedral, paramagnetic

B. tetrahedral, diamagnetic

C. square planar, paramagnetic

D. square planar, diamagnetic

Answer: A

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6. Among (i) $[Cr(en)_3]^{3+}$, (ii) trans - $[Cr(en)_2Cl_2]^+$, (iii) Cis - $[Cr(en)_2Cl_2]^+$ (iv) $[Co(NH_3)_4Cl_2]^+$ the optically active complexes are

A. i and ii

B. i and iii

C. ii and iii

D. ii and iv

Answer: B

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7. ^{227}Ac has a half-life of 22 years with respect to radioactive decay. The decay follows two prallel paths : $^{227}Ac \rightarrow {}^{227}Th$ and $^{227}Ac \rightarrow {}^{223}Fr$. If the percentage of the two daughter nuclides are 2.0 and 98.0, respectively, the decay constant (in year^{-1}) for $^{227}Ac \rightarrow {}^{227}Th$ path is closest to

A. 6.3×10^{-2}

B. 6.3×10^{-3}

C. 6.3×10^{-1}

D. 6.3×10^{-4}

Answer: D

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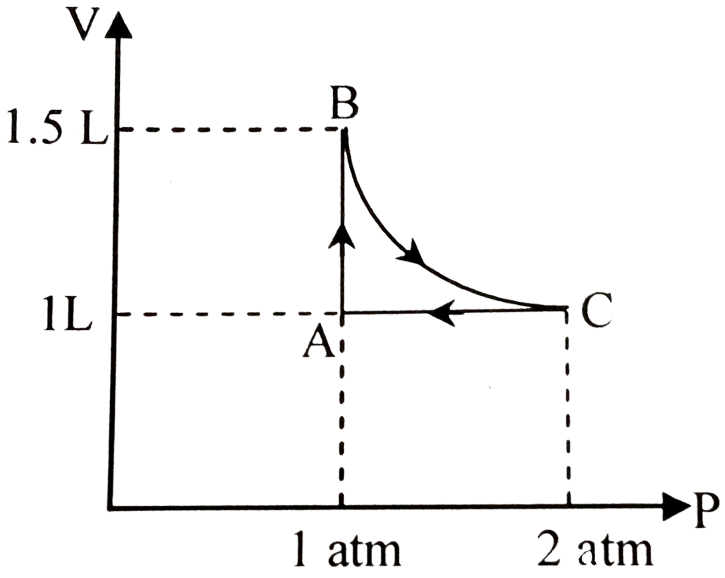
8. A system consisting of 1 mol of an ideal gas undergoes a reversible process, $A \to B \to C \to A$ (schematically indicated in the figure below). If the temperature at the starting point A is 300 K and the work done in the process $B \to C$ is 1 L atm, the heat exchanged in the entire process is L atm is



A. 1.0

B. 0.0

C. 1.5

D. 0.5

Answer: C

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9. A mixture of toluene and benzene boils at $100^{\circ}C$. Assuming ideal behaviour, the mole fraction of toluene in the mixture is closest to [Vapour presure of pure toluene and pure benzene at $100^{\circ}C$ are 0.742 and 1.800 bar respectively. 1 atm = 1.013 bar]

A. 0.824

B. 0.744

C. 0.544

D. 0.624

Answer: B

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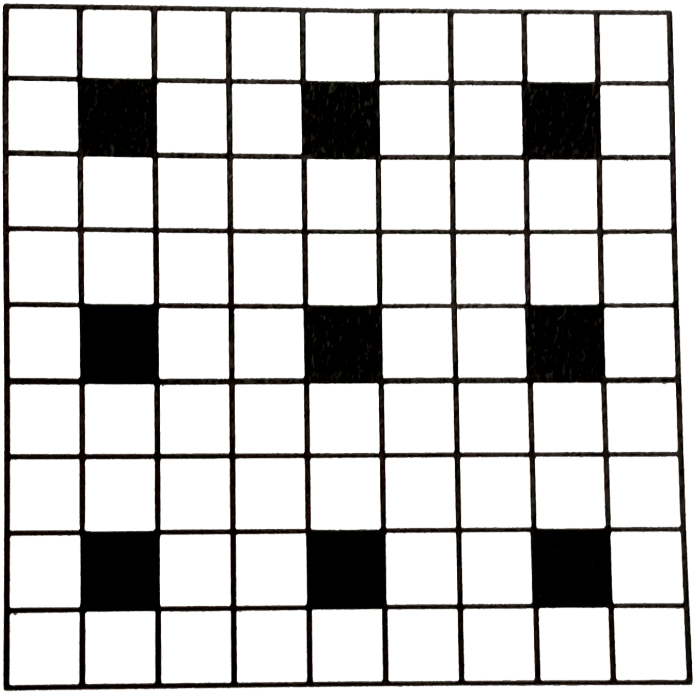
10. A two-dimensional solid pattern formed by two different atoms X and Y is shown below. The black and white squares represent atoms X and Y, respectively. The simplest formula for the compound based on the unit cell from the pattern is



A. XY_8

B. X_4Y_9

C. XY_2

D. XY_4

Answer: A

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Part 1 Chemistry

1. The number of water molecules in 250 mL of water is closest to

[Given: Density of water is $1.0g \quad mL^{-1}$, Acogadro's number $= 6.023 \times 10^{23}$]

A. 83.6×10^{23}

B. 13.9×10^{23}

C. 1.5×10^{23}

D. 33.6×10^{23}

Answer: A

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2. Among the following, the correct statements is

A. pH decreases when solid ammonium chloride is added toa a dilute aqueous soplution of NH_3

B. pH decreases when solid sodium acetate is added to a dilute aqueous solution of acetic acid.

C. pH decreases when solid NaCl is added to a dilute aqueous solution of NaOH

D. pH decreases when solid sodium oxalate is added to a dilute aqueous solution of oxalic acid

Answer: A

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3. The solubility of $BaSO_4$ in pure water (in g L^{-1}) is closest to

[Given: K_{sp} for $BaSO_4$ is 1.0×10^{-10} at $25^{\circ}C$. Molecular weight of $BaSO_4$ is $233 gmol^{-1}$]

A. 1.0×10^{-5}

B. 1.0×10^{-3}

C. $2.3 \times^{-5}$

D. 2.3×10^{-3}

Answer: D

Watch Video Solution

4. Among the following, the INCORRECT statement is

A. No two electrons in an atom can have same have the same set of four quantum numbers.

B. The maximum number of electron in the shell with principal quantum numbers is n

C. Electrons in an orbital must have opposite spin.

D. In the ground state, atomic orbitals are filled in the order of their increasing energies.

Answer: B

Watch Video Solution

5. A container of volume 2.24 L can withstand a maximum pressure of 2 atm K before exploding. The maximum amount of nitrogen (in g) that can be safely put in this container at this temperature is closest to

A. 2.8

B. 5.6

C. 1.4

D. 4.2

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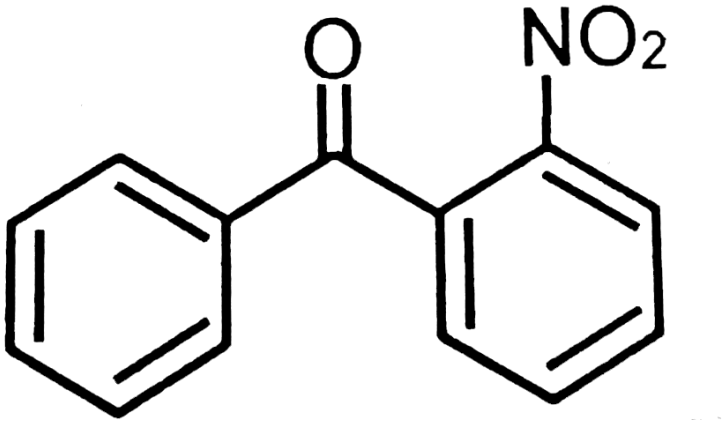
6. The compound shows below



can be readily prepared by Friedel-Crafts reaction between

A. benzene and 2-nitrobenzoyl chloride

B. benzyl chloride and nitrobenzene

C. nitrobenzene and benzoyl chloride

D. benzene and 2-nitrobenzyl chloride

Answer: A

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7. The correct statement about the following compound

X

Y

is

A. both are chiral

B. Both are achiral

C. X is chiral and Y is achiral

D. X is achiral and Y is chiral

Answer: C

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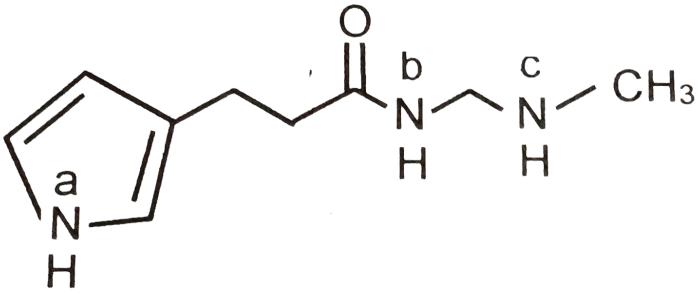
8. The most acidic proton and the strongent nucleophilic nitrogen in the following compound



respectively are

A. $N^a - H, N^b$

B. $N^b - H, N^c$

C. $N^a - H, N^c$

D. $N^c - H, N^a$

Answer: B

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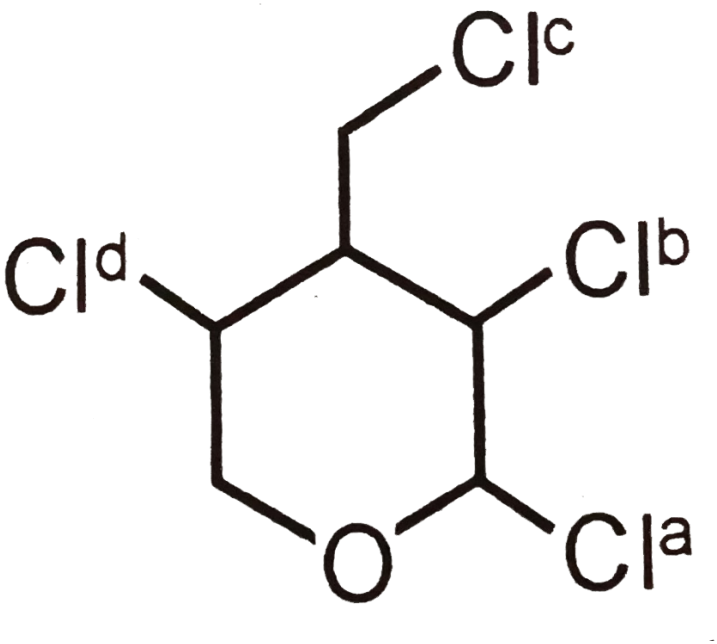
9. The chlorine atom of the following compound



that reacts most readily with $AgNO_3$ to give a precipitate is

A. Cl^a

B. Cl^b

C. Cl^c

D. Cl^d

Answer: A

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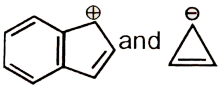
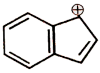
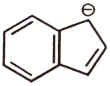
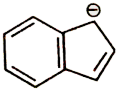
10. Among the following sets, the most stable ionic species are

A. (A)  and

B. (B)  and 

C. (C)  and 

D. (D)  and 

Answer: D

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11. The correct order of energy of 2s orbitals in H,Li,Na and K, is

A. $K < Na < Li < H$

B. $Na < Li < K < H$

C. $Na < K < H < Li$

D. $H < Na < Li < K$

Answer: A

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12. The hybridisation of xenon atom XeF_4 is

A. sp^3

B. dsp^2

C. sp^3d^2

D. d^2sp^3

Answer: C

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13. The formal oxidation of Cr and Cl in the ions $Cr_2O_7^{2-}$ and ClO_3^-, respectively, are

A. $+6$ and $+7$

B. $+7$ and $+5$

C. $+6$ and $+5$

D. $+8$ and $+7$

Answer: C

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14. A filter paper soaked in salt X turns brown when exposed to HNO_3 vapour. The salt X is

A. KCl

B. KBr

C. KI

D. K_2SO_4

Answer: C

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15. The role of haemoglobin is to

A. store oxygen in muscles

B. transport oxygen to different parts of the body

C. convert CO to CO_2

D. convert CO_2 into carbonic acid

Answer: B

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16. Consider the following statements :

(I)n All isotopes of an elements have the same number of neutrons.

(II) only one isotope of an element can be stable and non-radioactive.

(III) All elements have isotopes

(IV) All isotopes of Carbon can form chemical compounds with Oxygen - 16

A. III and IV only

B. II ,III and IV only

C. I, II and III only

D. I,III and IV only

Answer: A

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17. The isoelectronic pairs is :

A. CO, N_2

B. O_2, NO

C. C_2, HF

D. F_2, HCl

Answer: A

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18. The numbers of lone pair and bond pairs in hydrazine are, respectively :

A. 2 and 4

B. 2 and 6

C. 2 and 5

D. 1 and 5

Answer: C

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19. The volume of oxygen at STP required to burn 2.4 g of carbon completely is :

A. 1.12 L

B. 8.96 L

C. 2.24 L

D. 4.48 L

Answer: D

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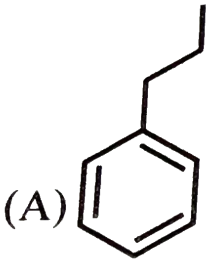
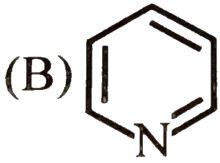
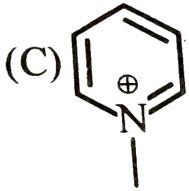
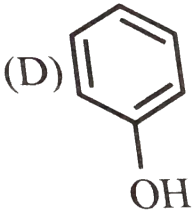
20. The species that exhibits the highest R_f valume in a thin layer chromatogram using a nonpolar solvent on a silica gel plate is :

A. 

B. 

C. 

D. 

Answer: A

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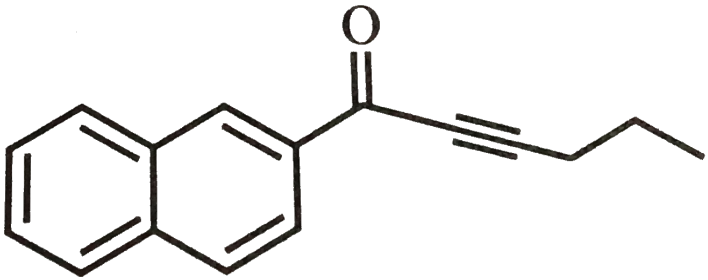
21. The number of C - C sigma bonds in the compound



A. 16

B. 17

C. 18

D. 11

Answer: B

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22. If the radius of the drogen atom is 53 pm, the radius of the He^{+} ion is closest to :

A. 108 pm

B. 81 pm

C. 27 pm

D. 13 pm

Answer: C

Watch Video Solution

23. The diamagenetic species is :

A. NO

B. NO_2

C. O_2

D. CO_2

Answer: D

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24. The pH of 1.0 aqueous solution of $NaCL, CH_3COONa$ and NH_4Cl will follow the order :

A. $NaCl < CH_3COONa < NH_4Cl$

B. $NH_4Cl < NaCl < CH_3COONa$

C. $NH_4Cl < CH_3COONa < NaCl$

D. $NaCl < NH_4Cl < CH_3COONa$

Answer: B

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25. At room themperature, the average speed of Helium is Helium is higher than of Oxygen by a factor of :

A. $2\sqrt{2}$

B. $6\sqrt{2}$

C. 8

D. 6

Answer: A

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26. Ammonia is NOT produced in the reaction of :

A. NH_4Cl with KOH

B. AIN with water

C. NH_4Cl with $NaNO_2$

D. NH_4Cl with $Ca(OH)_2$

Answer: C

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27. The number of isomers which are ethers and having the molecular formula $C_4H_{10}O$, is :

A. 2

B. 3

C. 4

D. 5

Answer: B

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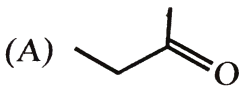
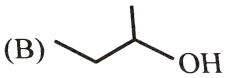
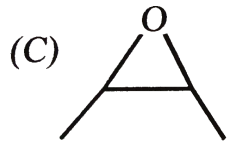
28. The major product of the reaction of 2-butene with cold alkaline $KMnO_4$, is

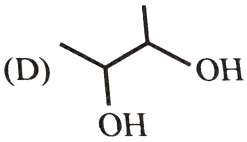
A. 

B. 

C.



D.



Answer: D

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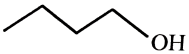
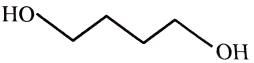
29. Among the compound I-IV, the compound having the lowest boining point is :



(I)



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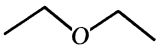

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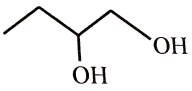

(IV)

A. I

B. II

C. III

D. IV

Answer: C

Watch Video Solution

30. Of the following reactions

(i) $A \Rightarrow B, \Delta G^{\circ} = 250 kjmol^{-1}$

(ii) $D \Rightarrow E, \Delta G^{2} = -100 kjmol^{-1}$

(iii) $\mathfrak{A}rrG, \Delta^{\circ} = -150 kjmol^{-1}$

(iv) $M \Rightarrow N, \Delta G^{\circ} = 150 kjmol^{-1}$

reaction with the largest equilibrium constant is

A. I

B. II

C. III

D. IV

Answer: C

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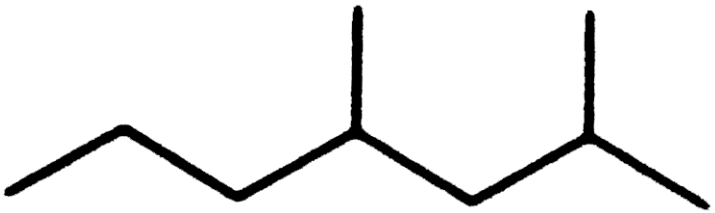
31. The IUPAC name for the following compound is



A. 4,6-dimethylheptane

B. 1,3,5-trimethylhexane

C. 2,4-dimethylheptane

D. 2,4,6-trimethylhexane

Answer: C

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32. The stability of carbocations

$(CH_3)_3C^{\oplus}$ (I) $(CH_3)_2\overset{\oplus}{C}(OCH_3)$ (II) $CH_3CH_2CH_2\overset{\oplus}{C}H_2$ (III) $CH_3\overset{\oplus}{C}HCH_2$ (IV)

follows the order

A. $III < IV < II < I$

B. $III < IV < II < I$

C. $IV < III < II < I$

D. $IV < III < I < II$

Answer: B

Watch Video Solution

33. The acidity of compounds I-IV in water

I. Ethanol

II. Acetic Acid

III. Phenol

IV. Acetonitrile follows the order

A. $IV < I < III < II$

B. $I < II < III < IV$

C. $IV < I < II < III$

D. $IV < III < I < II$

Answer: A

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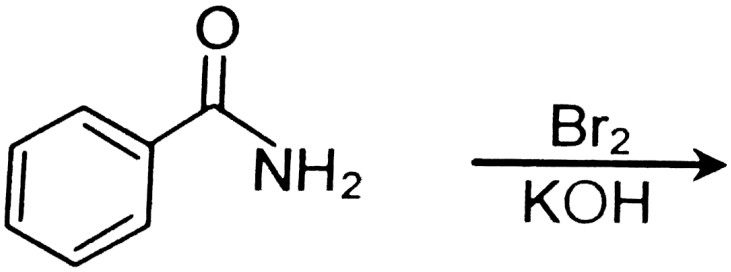
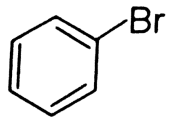
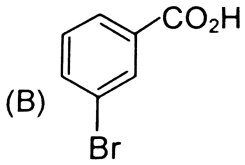
34. In the following reaction



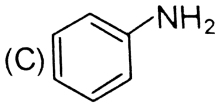
A.

(A) 

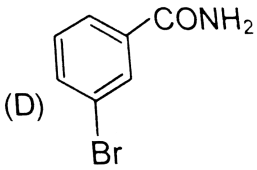
B.



C.



D.



Answer: C

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35. The reddish brown precipitate formed in the Fehling test for aldehydes (RCHO) is due to the formation of

A. Cu

B. Cu_2O

C. CuO

D. $(RCOO)_2Cu$

Answer: B

Watch Video Solution

36. The reducing ability of the metals K, Au, Zn and Pb follows the order

A. $K > Pb > Au > Zn$

B. $Pb > K > Zn > Au$

C. $Zn > Au > K > Pb$

D. $K > Zn > Pb > Au$

Answer: D

Watch Video Solution

37. White phosphorous catches fire in air to produce dense white fumes. This is due to the formation of

A. P_4O_{10}

B. PH_3

C. H_3PO_3

D. H_3PO_2

Answer: A

Watch Video Solution

38. The maximum number of electrons that can be filled in the shell with the principal quantum number n = 4 is

A. 64

B. 26

C. 18

D. 32

Answer: D

Watch Video Solution

39. At a constant pressure P, the plot of volume (V) as a function of temperature (T) for 2 moles of an ideal gas gives a straight line with a slope 0.328 L K^{-1}. The value of P (in atm) is closest to [Gas constant, R = 0.0821 L atm mol^{-1} K^{-1}]

A. 0.25

B. 0.5

C. 1.0

D. 2.0

Answer: B

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40. Which of the following transformations can be carried out by using HI as a reducing agent, under acidic conditions ?

$\left[\text{Given: } I_2(S) \rightarrow 2I^- \; E^\theta = 0.54 \text{ V}\right]$

(i) $Cu^+ \rightarrow Cu(S) \quad E^\theta = 0.52 \text{ V}$

(ii) $Cr^{3+} \rightarrow Cr^{2+} \quad E^\theta = -0.41 \text{ V}$

(iii) $Fe^{3+} \rightarrow Fe^{2+} \quad E^\theta = -0.77 \text{ V}$

(iv) $Fe^{2+} \rightarrow Fe(s) \quad E^\theta = -0.44 \text{ V}$

A. (i) and (iii)

B. (ii) and (iv)

C. only (iii)

D. only (ii)

Answer: C

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41. C_{60} emerging from a source at a speed (v) has a de Broglie wavelength of 11.0 Ã.... The value of v (in m s^{-1}) is closest to [Plancks constant $h = 6.626 \times 10^{-34}$ J s]

A. 0.5

B. 2.5

C. 5.0

D. 30

Answer: A

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42. The lattice energies of NaCl, NaF, KCl and RbCl follow the order

A. $KCl < RbCl < NaCl < NaF$

B. $NaF < NaCl < KCl < RbCl$

C. $RbCl < KCl < NaCl < NaF$

D. $NaCl < RbCl < NaF < KCl$

Answer: C

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43. The oxidation states of P atom in $POCl_3$, H_2PO_3 and $H_4P_2O_6$, respectively, are

A. +5, +4, +4

B. +5, +5, +4

C. +4, +4, +5

D. +3, +4, +5

Answer: A

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44. A solution (5 mL) of an acid X is completely neutralized by y mL of 1M NaOH. The same volume (y ML) of 1M NaOH is required to neutralize 10 mL of 0.6 M of H_2SO_4 completely. The normality (N) of the acid X is

A. 1.2

B. 2.4

C. 4.8

D. 0.6

Answer: B

Watch Video Solution

45. 1.25 g of a metal (M) reacts with oxygen completely to produce 1.68 g of metal oxide. The empirical formula of the metal oxide is

[molar mass of M and O are 69.7 g mol^{-1} and $16.0\,\text{g}\ mol^{-1}$, respectively]

A. M_2O

B. M_2O_3

C. MO_2

D. M_3O_4

Answer: B

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Part 2 Chemistry

1. Among the following, the species with identical bond order are

A. CO and O_2^{2-}

B. O_2^- and CO

C. O_2^{2-} and B_2

D. CO and N_2^+

Answer: C

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2. The quantity of heat (in J) required to raise temperature of 1.0 kg of ethanol from 293.45 K to the boiling point and then change the liquid to vapor at that temperature is closest to

[Given , Boiling point of ethanol 351.45K]

Specific heat capacity of liquid ethanol $2.44Jg^{-1}K^{-1}$

latent heat of vaporization of ethanol $855Jg^{-1}K^{-1}$

A. 1.42×10^2

B. 9.97×10^2

C. 1.42×1^5

D. 9.97×10^5

Answer: D

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3. A solution of 20.2 g of 1,2-dibromopropane in MeOH upon heating with excess Zn produces 3.58 g of an unsaturated X. The yield (%) is closest to [Atomic weight of Br is 80]

A. 18

B. 85

C. 89

D. 30

Answer: B

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4. The lowest stability of ethyl anion compared to methyl anion and the higher stability of ethyl radical compared to methyl radical, respecticely, are due to

A. $+I$effect of the methyl group in ethyl anion and $\sigma \rightarrow$ p-orbital conjugation in ethyl radical.

B. $-I$ effect of the methy group in ethyl anion and $\sigma \rightarrow \sigma \cdot$ conjugation in ethyl radical.

C. $+I$ effect of the methyl group in both cases

D. $+I$ effect of the methyl group in ethyl anion and $\sigma \rightarrow \sigma \cdot$ conjugation in ethyl radical.

Answer: A

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5. The F-B -F bond angels in BrF_5 and $Cl-P-Cl$ bond angls in PCl_5, respectively, are

A. identical inBrF_5 but non-identical in PCl_5

B. identical inBrF_5 and identical in PCl_5

C. non-identical in BrF_5 but identical in PCl_5

D. non-identical in BrF_5 and non- identical in PCl_5

Answer: D

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6. 10 moles of a mixture of hydrogen and oxygen gases at a pressure of 1 atm at a constant volume and temperature, react to form 3.6 g of liquid pressure of the resulting mixture will be closest to :

A. 1.07 atm

B. 0.97 atm

C. 1.02 atm

D. 0.92 atm

Answer: B

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7. The ammonia evolved from 2 g of a compound in Kjeldahl's estimation of nitrogen neutralizes 10 mL of 2 M H_2SO_4 solution. The weight percentage of nitrogen in the compound is :

A. 28

B. 14

C. 56

D. 7

Answer: A

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8. Compelete reaction of 2.0 g calcium (at wt. = 40) with excess HCl produces 1.125 L of H_2 gas. Complete reaction of the same wuantity of another metal "M" with excess HCl produces 1.85 L of H_2 gas under identical conditions . The equivalent weight of "M" is closest to :

A. 23

B. 9

C. 7

D. 12

Answer: D

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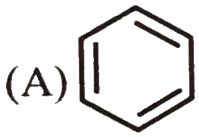
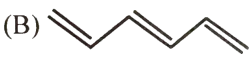
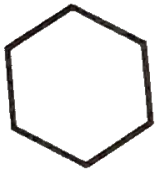
9. A compound X formed after heating coke with lime react with water to give Y which on passing over redhot iron at 873 produces Z. The compound Z is

A. 

B. 

(C) 

C.

(D) 

D.

Answer: A

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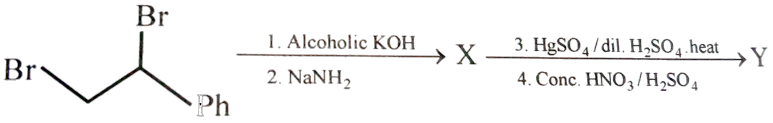
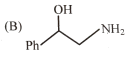
10. In the following reaction sequence

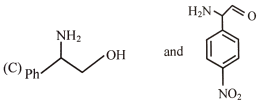


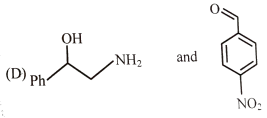
X and Y are, respectively

A. (A) Ph—≡ and 

B. (B) 

and 

C. 

D. 

Answer: A

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11. Among the following compouds, E/Z isomerism is possible for

A. 2-methylbut-2-ene

B. 2-methylbut-1-ene

C. 3-methylpent-1-ene

D. 3-methylpent-2-ene

Answer: D

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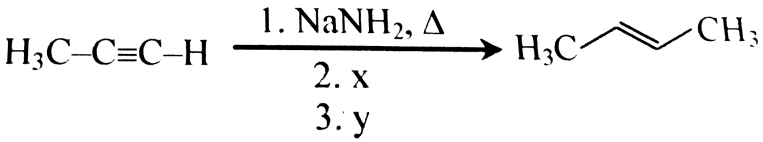
12. In the reaction



x and y, respectively, are

A. $x = CH_3OH, y = Pd/BaSO_4,$ quinoline, H_2

B. $x = CH_3I, y = Pd/BaSO_4,$ quinoline, H_2

C. $x = CH_3I, y =$ Na in liq. NH_3

D. $x = CH_3OH, y =$ Na in liq. NH_3

Answer: C

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13. Among the following molecules, the one with the largest bond angle at the central atom is

A. ClF_3

B. $POCl_3$

C. BCl_3

D. SO_3

Answer: A

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14. A compound has the following composition by weight , $Na = 18.60\,\%$, $S = 25.80\,\%$, $H = 4.02\,\%$ and $O = 51.58\,\%$ Assuming that all the hydrogen atoms in the compound are part of water of crystallization, the correct molecular formula of the compound is

A. $Na_2S_2O_3.3H_2O$

B. $Na_2SO_4.5H_2O$

C. $Na_2SO_4.10H_2O$

D. $Na_2S_2O_3.5H_2O$

Answer: D

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15. X g of ice at 0 .$^\circ C$ is added to 340 g of water at $20^\circ C$. The final tempeature of the resultant mixture is 5 .$^\circ C$. The value of X (in g) is closest to

[Heat of fusion of ice $= 333 J/g$, Specific heat of water $= 4.184 J/g.K$]

A. 80.4

B. 52.8

C. 120.6

D. 60.3

Answer: D

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PART-1 CHEMISTRY

1. The amount (in mol) of bromoform $(CHBr_3)$ produced when 1.0 mol of acetone reacts completely with 1.0 mol of bromine in the presence of aqueous NaOH is

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. 1

D. 2

Answer: A

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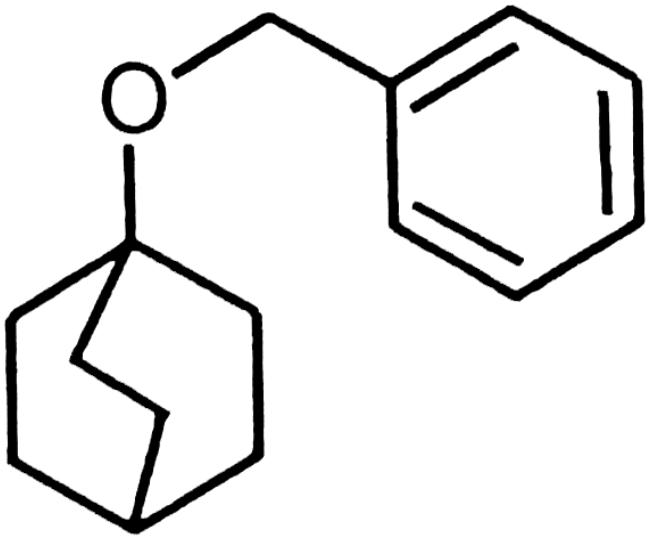
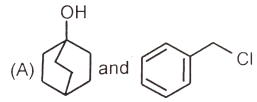
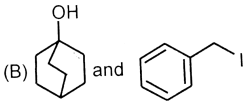
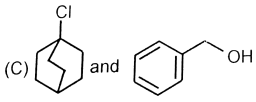
2. The following compound

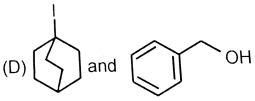


can readily be prepared by Williamson ether synthesis by reaction between

A. 

B. 

C. 

D. 

Answer: B

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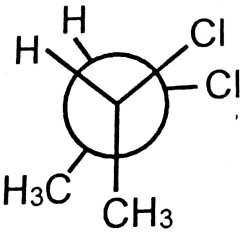
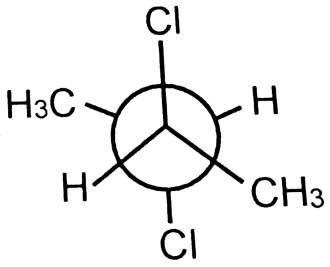
3. X and Y



X



Y

are

A. enantiomers

B. diastereomers

C. constitutional isomers

D. conformers

Answer: D

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4. The hyperconjugative stabilities of tert-butyl cation and 2-butene, respectively, are due to

A. $\sigma \rightarrow \pi$ and $\sigma \rightarrow \pi^*$

B. $\sigma \rightarrow$ vacant p and $\pi \rightarrow \pi^*$

C. $\sigma \rightarrow \sigma^*$ and $\sigma \rightarrow \pi$

D. $\sigma \rightarrow$ vacant p and $\sigma \rightarrow \pi^*$

Answer: D

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5. Benzaldehyde can be converted to benzyl alcohol in concentrated aqueous NaOH solution using

A. acetone

B. acetaldehyde

C. formic acid

D. formaldehyde

Answer: D

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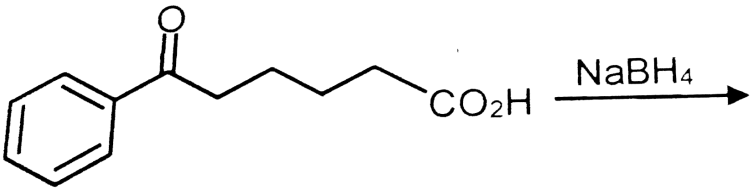
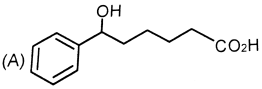
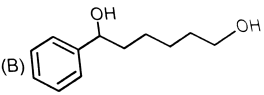
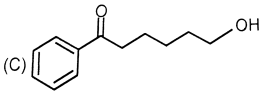
6. The major product of the following reaction

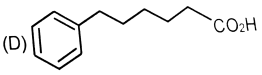


is

A. 

B. 

C. 

D. 

Answer: A

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7. Among the following species, the H-X-H angle (X=B,N or P) follows the order

A. $PH_3 < NH_3 < NH_4^+ < BF_3$

B. $NH_3 < PH_3 < NH_4^+ < BF_3$

C. $BF_3 < PH_3 < NH_4^+ < NH_3$

D. $BF_3 < NH_4^+ < NH_3 < PH_3$

Answer: A

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8. The ionic radii of Na^+, F^-, O^{2-}, N^{3-} follow the order

A. $O^{2-} > F^{-} > Na^{+} > N^{3-}$

B. $N^{3-} > Na^{+} > F^{-} > O^{2-}$

C. $N^{3-} > O^{2-} > F^{-} > Na^{+}$

D. $Na^{+} > F^{-} > O^{2-} > N^{3-}$

Answer: C

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9. The oxoacid of phosphorus having the strongest reducing property is

A. H_3PO_3

B. H_3PO_2

C. H_3PO_4

D. $H_4P_2O_7$

Answer: B

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10. Among C, S and P the element (s) that produces (s) SO_2 on reaction with hot conc. H_2SO_4 is /are

A. only S

B. only C and S

C. only S and P

D. C, S and P

Answer: D

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11. The complex that can exhibit linkage isomerism is

A. $\left[Co(NH_3)_5(H_2O)\right]Cl_3$

B. $\left[Co(NH_3)_5(NO_2)\right]Cl_2$

C. $\left[Co(NH_3)_5(NO_3)\right](NO_3)_2$

D. $\left[Co(NH_3)_5Cl\right]SO_4$

Answer: B

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12. The tendency of X in $BX_3(X = F, Cl, OMe, NMe)$ to form a π bond with boron follows the order

A. $BCl_3 < BF_3 < B(OMe)_3 < B(NMe_2)_3$

B. $BF_3 < BCl_3 < B(OMe)_3 < B(NMe_2)_3$

C. $BCl_3 < B(NMe_2)_3 < B(OMe)_3 < BF_3$

D. $BCl_3 < BF_3 < B(NMe_2)_3 < B(OMe)_3$

Answer: A

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13. Consider the following statement about Langmuir isotherm :

(i) The free gas and adsorbed gas are in dynamic equilibrium

(ii) All adsorption sites are equivalent

(iii) The initially adsorbed layer can act as a substrate for further adsorption.

(iv) The ability of a molecule to get adsorbed at a given site is independent of the occuption of neighbouring sites

The correct statement are

A. (i),(ii),(iii) and (iv)

B. only (i),(ii) and (iv)

C. only (i),(iii) and (iv)

D. only (i),(ii) and (iii)

Answer: C

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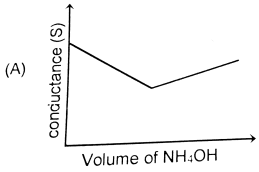
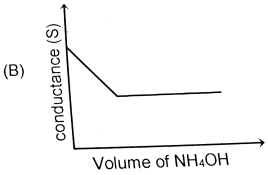
14. Among the following , the plot that correctly represents the conductometric titration of 0.05 M H_2SO_4 with 0.1 M NH_4OH is

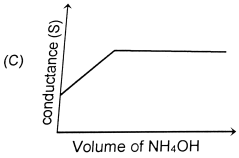
A.



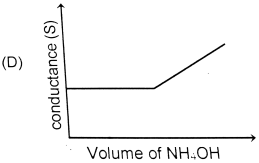
B.



C.



D.



Answer: B

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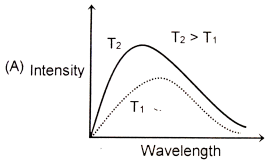
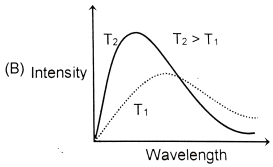
15. The correct representation of wavelength intensity relationship of an ideal blackbody radiation at two different temperatures T_1 and T_2 is

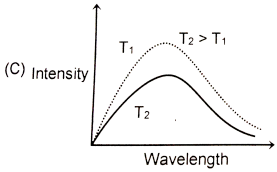
A.



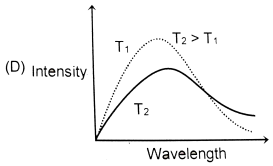
B.



C.



D.



Answer: A

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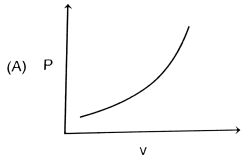
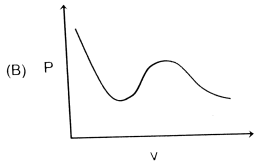
16. The pressure (P)- volume (V)isotherm of a van der Waals gas, at the temperature at which it undergoes gas to liquid transition , is correctly represented by

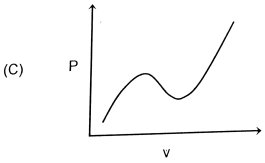
A.



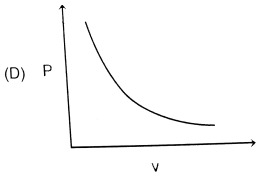
B.



C.



D.



Answer: B

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17. A buffer solution can be prepared by mixing equal volumes of

A. 0.2 M NH_4OH and 0.1 M HCl

B. 0.2 M NH_2OH and 0.2 M HCl

C. 0.2 M NaOH and 0.1 M CH_3COOH

D. 0.1 M NH_4OH and 0.2 M HCl

Answer: A

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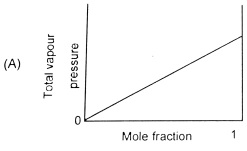
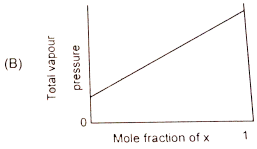
18. The plot of total vapour pressure as a function of mole fraction of the component of an ideal solution formed by mixing liquids X and Y is

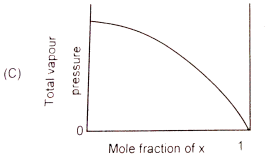
A.



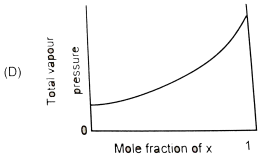
B.



C.



D.



Answer: B

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19. On complete hydrogenation, natural rubber produces

A. polyethylene

B. ethylene-propylene copolymer

C. polyvinyl chloride

D. polypropylene

Answer: B

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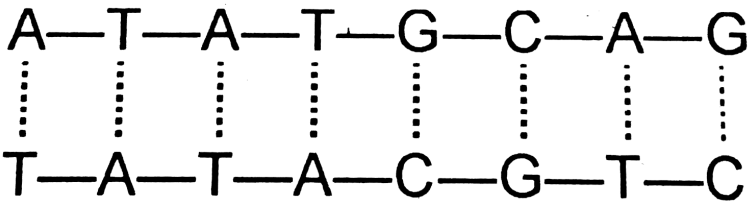
20. The average energy of each hydrogen bond in A-T pair is x kcal mol^{-1} and that in G-C pair is y kcal mol^{-1}. Assuming that no other interaction exists between the nucleotides, the approximate energy required in kcal mol^{-1} to split the following double stranded DNA into two single strands is



[each dashed line may represent more than one hydrogen bond between the base pairs]

A. 10x+9y

B. 5x+3y

C. 15x+6y

D. 5x+4.5y

Answer: A

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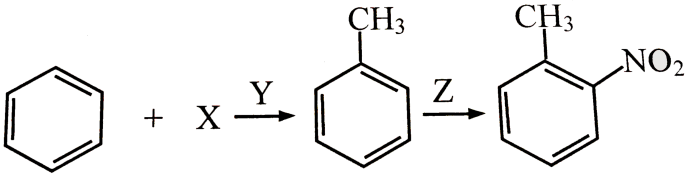
Matematics

1. In the following reations X,Y and Z are



A. $X = CH_3Cl, Y$ = anhydrous $AlCl_3, Z = HNO_3 + H_2SO_4$

B. $X = CH_3COCl, Y$ = anhydrous $AlCl_3, Z = HNO_3 + H_2SO_4$

C. $X = CH_3Cl, Y = cons.\ H_2SO_4, Z = HNO_3 + H_2SO_4$

D. $X = CH_3Cl, Y = dilH_2SO_4, Z = HNO_3$

Answer: a

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exercise

1. Which of the following is correct?

A. The equilibrium constant does not depend on temperature.

B. It tells us about how fast the reaction takes place.

C. At equilibrium, the forward and the backward reaction stops so that the reactant and product concentration becomes equal.

D. The equilibrium constant remains same whether we start from the reactant side or the product side

Answer: D

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2. Which of the following contains $1^\circ, 2^\circ \text{ and } 3^\circ$ carbon atom?

A. 2,2-dimethylcyclohexane

B. cyclohexane

C. Methylcyclohexane

D. 2,3,4-trimethylpentane

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3. Highest dipole moment among the following:

A. $AlCl_3$

B. $SbCl_6^-$

C. $AsCl_3$

D. $\mathbb{C}l_4$

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4. I.P values (in ev) of Na, Mg, Al, Si,Ar are 5.47,7.6,5.98,8.15,15.75 (some values are given). Then I.P of K will be:

A. 10ev

B. 8ev

C. 4.3ev

D. 6.7ev

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5. Which of the following can be purified by steam distillation?

A. Glucose

B. Aniline

C. Acetone

D. Ethanol

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6. A 10 litre container has 1 litre water gas (CO:H_2::1:1) 9 litre of atomospheric gas is present (20% oxygen by volume). If the gas inside the container are ignited then moles of CO_2 produced is:

A. 0.022

B. 0.90

C. 0.01

D. 0.91

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7. The unpaired electron of Cu have quantum number

A. l=0,m=0,s=1/2

B. l=1,m=0,s= -1/2

C. l=2,m=1,s= -1/2

D. l=3,m=2,s= +1/2

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8. A compound formed by elements M and N crystallizes in HCP lattice. The 2/3 of the OV's are occupied by N and M occupies by lattice points . Find the simplest formula of the compound.

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9. Find the number of stereoisomers in $\left[M_1(NH_3)_3Cl_3\right]$ and $\left[M_1(en)_2Cl_2\right]Cl$ respectively.

A. 4,3

B. 2,3

C. 3,2

D. 3,4

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10. $CH_3COOH \xleftarrow{acid} X \xrightarrow{Reduction} CH_3CH_2NH_2$

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11. Calculate magetic moment of Ni in $Ni(dmg)_2$ complex

A. 5.83

B. 0

C. 1.73

D. 2.25

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12. A 0.1 molal aqueous solution of $CuSO_{4.5}H_2O$ at 1bar pressure. find the new boiling point (K_b value of water 0.512)

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13. Which of the following is always true for a spontaneous process

A. Change in Gibbs energy of reaction is always negative.

B. Change in Gibbs energy of reaction and surrounding always negative

C. Change in entropy of reaction is always positive

D. Change in entropy of reaction and surrounding is always positive

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14. Which of the following will give a blue solution when copper is dipped in it?

A. $AgNO_3$

B. ZnCl_2`

C. $FeCl_3$

D. $MgSO_4$

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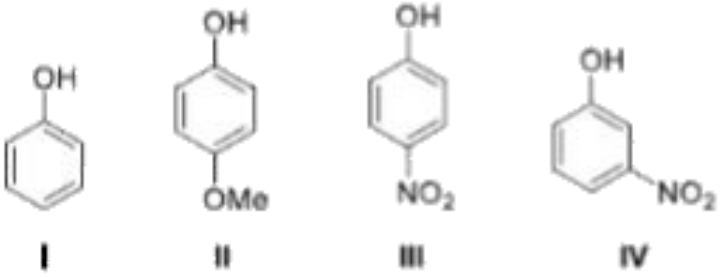
PART I (Chemistry)

1. The acidity is



I II III IV

follows the order

A. $I > II > III > IV$

B. $IV > III > II > I$

C. $III > IV > I > II$

D. $III > II > IV > I$

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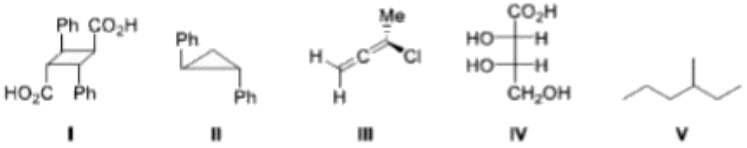
2. Among the following



the compound which can exhibit optical activity are :

A. only II , IV and V

B. only IV and V

C. only I , II and IV

D. only I , II and IV

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3. A molecule which has 1°, 2° and 3° carbon atom is :

A. 2 , 3 , 4-trimethylpentane

B. chlorocyclohexane

C. 2,2-dimethylcyclohexane

D. methylcyclohexane

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4. Which of the following can be purified by steam distillation?

A. acetone

B. aniline

C. glucose

D. ethanol

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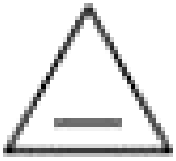
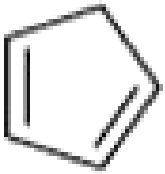
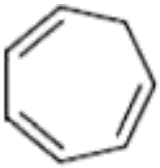
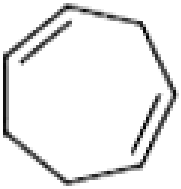
5. Among the following the most acidic compound is :

A. 

B. 

C. 

D. 

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6. A closed 10 L vessel contains 1 L water gas $(1:1CO:H_2)$ and 9 L air (20 % O_2 by volume) at STP . The contents of the vessel are ignited . The

number of moles of CO_2 in the vessel is closed to :

A. 0.22

B. 0.022

C. 0.90

D. 3.60

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7. A certain metal has a work function of $\Phi = 2$ e V . It is irradiated first with 1 W of 400 nm light and later with 1 W of 800 nm light . Among the following , the correct statement is :

[Given : Planck constant (h) = $6.626 \times 10^{-34} m^2 kgs^{-1}$, Speed of light (e) = $3 \times 10^8 ms^{-1}$]

A. Both colors of light give rise to same number of photoelectrons

B. 400 nm light gives rise to less energetic photoelectrons than 800 nm light

C. 400 nm light leads to more photoelectrons

D. 800 nm light leads to more photoelectrons

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8. Among the following the correct statement about the chemical equilibrium is :

A. Equilibrium constant is independent of temperature

B. Equilibrium constant tells us how fast the reaction reaches equilibrium

C. At equilibrium the forward and the backward reaction stop so that concentrations of reactants and products are constant

D. Equilibrium constant is independent of whether you start the reaction with reactants or products .

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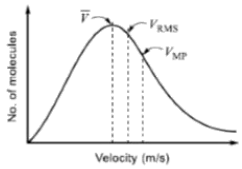
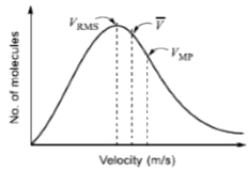
9. Among the following , the plot that shows the correct marking of most probable velocity (V_{MP}) average velocity $\left(\overrightarrow{V}\right)$ and root mean square velocity (V_{RMS}) is :

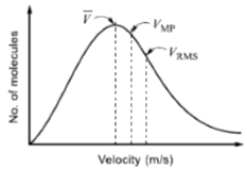
A.



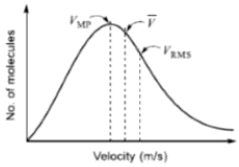
B.



C.



D.



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10. The correct set of quantum numbers for the unpaired electron of Cu atom is :

A. $n = 3, l = 2, m = -2, s = +\frac{1}{2}$

B. $n = 3, l = 2, m = +2, s = -\frac{1}{2}$

C. $n = 4, l = 0, m = 0, s = +\frac{1}{2}$

D. $n = 4, l = 1, m = +1, s = +\frac{1}{2}$

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11. Among the following, the most polar molecule is :

A. $AlCl_3$

B. CCl_4

C. $SeCl_6$

D. $AsCl_3$

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12. The covalent characters of $CaCl_2$, $BaCl_2$, $SrCl_2$ and $MgCl_2$ follow the order :

A. $CaCl_2 < BaCl_2 < SrCl_2 < MgCl_2$

B. $BaCl_2 < SrCl_2 < CaCl_2 < MgCl_2$

C. $CaCl_2 < BaCl_2 < MgCl_2 < SrCl_2$

D. $SrCl_2 < MgCl_2 < CaCl_2 < BaCl_2$

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13. Among the following, the correct statement is :

A. 100. has four significant figures

B. 1.00×10^2 has four significant figures

C. 2.005 has four significant figures

D. 0.0025 has four significant figures

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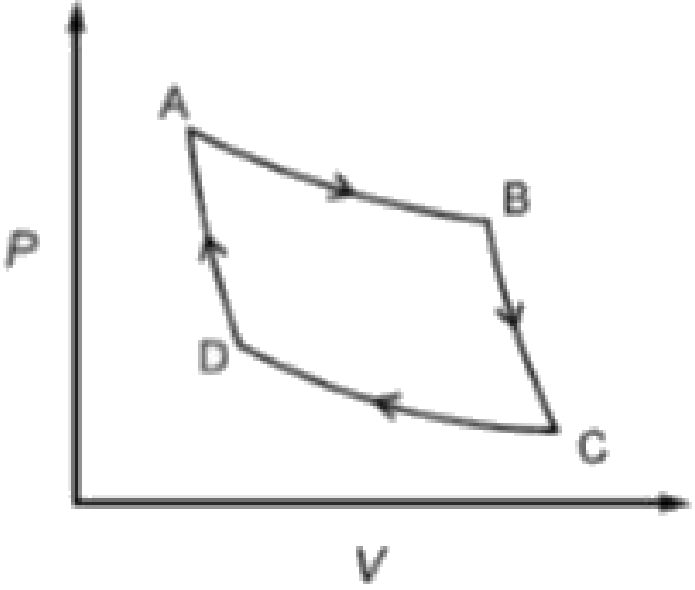
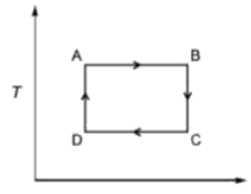
14. A thermodynamic cycle in the pressure (P) - volume (V) plane is given below :

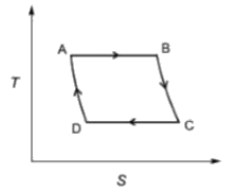


AB and CD are isothermal processes while BC and DA are adiabatic processes. The same cycle in the temperature (T) - entropy (S) plane is :

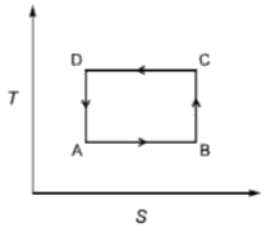
A.



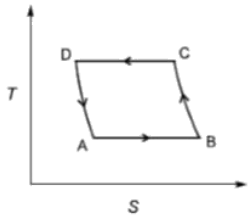
B.



C.



D.



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15. The first ionization potential (IP) of the elements Na, Mg, Si, P, Cl and Ar are 5.14, 7.65, 8.15, 10.49, 12.97 and 15.76 eV, respectively. The IP (in eV) of K is closest to :

A. 13.3

B. 18.2

C. 4.3

D. 6.4

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16. Which ONE of the following chemicals serves as a substrate for carbonic anhydrase ?

A. O_2

B. CO_2

C. NO_2

D. CO

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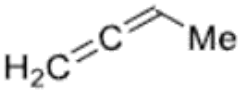
Part II Chemistry

1. A hydrocarbon X with molecular fomula C_4H_6 decolorizes bromine water and forms a white precipitate in ethanolic $AgNO_3$ solution. Treatment of X with $HgCl_2$ in aqueous H_2SO_4 produces a compounds, which gives a yellow precipitate when treated with I_2 and NaOH. The structure of X is :

A. 

B. 

C. 

D. 

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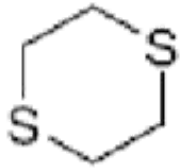
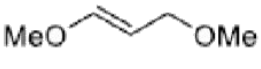
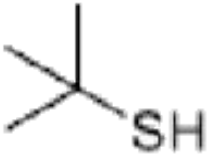
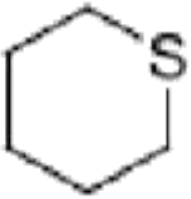
2. 0.102 g of an organic compound X was oxidized with fuming nitric acid. The resulting solution, after reaction with an excess of aqueous $BaCl_2$ produced 0.233 g of $BaSO_4$ as a precipitate , compound X is likely to be :

[Given : Atomic wt. of Ba = 137]

A. 

B. 

C. 

D. 

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3. The specific heat of a certain substance is 0.86 $Jg^{-1}K^{-1}$. Assuming ideal solution behavior. The energy required (in J) to heat 10 g of 1 molal of its aqueous solution from 300 K is closed to :

[Given molar mass of the substance = 58 g mol^{-1}, specific heat of water = $4.2Jg^{-1}K^{-1}$]

A. 401.7

B. 424.7

C. 420

D. 86

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4. Strength of a H_2O_2 solution is labelled as 1.79 N. its strength can also be expressed as closest to :

A. 20 volume

B. 5 volume

C. 10 volume

D. 15 volume

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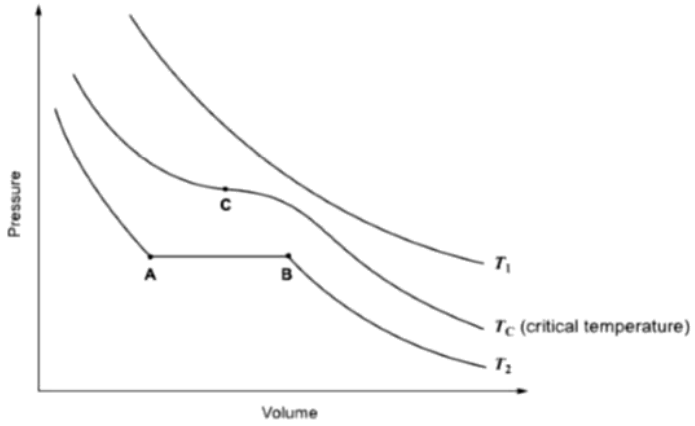
5. The isotherms of a gas are shown below :



Among the following

(i) At T_1 , the gas cannot be liquified

(ii) At point B, liquid starts to appear at T_2

(iii) T_C is the highest temperature at which the gas can be liquified

(iv) At point A , a small increase in pressure condense the whole system to a liquid.

teh correct statements are :

A. only(i) and (ii)

B. only (i) (iii) and (iv)

C. only (ii),(iii) and (iv)

D. (i) , (ii), (iii) and (iv)

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