Code-↑

Aakash
Medical | IIT-JEE | Foundations
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ANSWERS & HINTS
for
WBJEEM - 2014
SUB : CHEMISTRY

CATEGORY - I

Q.1 to Q.45 carry one mark each, for which only one option is correct. Any wrong answer will lead to deduction of 1/3 mark.

1. During the emission of a positron from a nucleus, the mass number of the daughter element remains the same but the atomic number

   (A) is decreased by 1 unit (B) is decreased by 2 units
   (C) is increased by 1 unit (D) remains unchanged

   Ans : (A)

   Hints : ${}^{A}_{Z}X \rightarrow {}^{A}_{Z-1}Y + {}^{0}_{+1}e$

   Atomic number is decreased by 1

2. Four gases P, Q, R and S have almost same values of 'b' but their 'a' values (a, b are van der Waals constants) are in the order Q < R < S < P. At a particular temperature, among the four gases the most easily liquefiable one is

   (A) P (B) Q (C) R (D) S

   Ans : (A)

   Hints : More the value of 'a' for the gas, more is the intermolecular forces of attraction. Thus the gas can be easily liquefied.

3. β emission is always accompanied by

   (A) formation of antineutrino and α particle (B) emission of α particle and γ-ray
   (C) formation of antineutrino and γ-ray (D) formation of antineutrino and positron

   Ans : (C)

4. The values of ΔH and ΔS of a certain reaction are – 400 kJ mol^{-1} and –20 kJ mol^{-1}K^{-1} respectively. The temperature below which the reaction is spontaneous is

   (A) 100°K (B) 20°C (C) 20°K (D) 120°C

   Ans : (C)

   Hints : The reaction is spontaneous when ΔG is -ve

   $\Delta G < 0$

   $\Delta H - T\,\Delta S < 0$

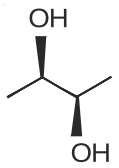
   $-400 - (T)(-20) < 0$

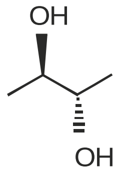
   $-400 + 20T < 0$

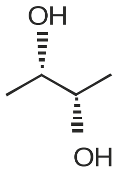
   $20T < 400$

   $T < \frac{400}{20}$; $T < 20K$

5. The correct statement regarding the following compounds is


I


II

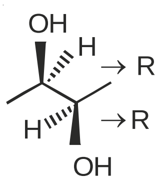

III

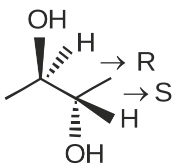
(A) all three compounds are chiral (B) only I and II are chiral

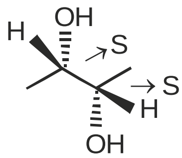
(C) I and III are diastereomers (D) only I and III are chiral

Ans : (D)

Hints :

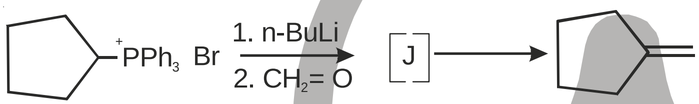

I

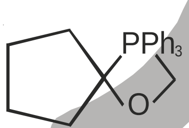
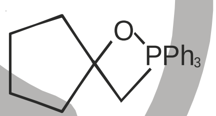
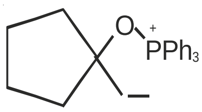

II


III

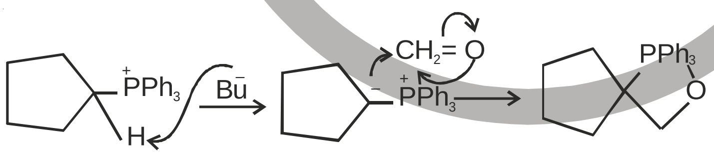
- I and III are enantiomers
- II has plane of symmetry hence achiral

6. The intermediate J in the following Wittig reaction is



(A)  (B)  (C)  (D) 

Ans : (A)

Hints : 

7. Among the following compounds, the one(s) that gives (give)effervescence with aqueous $NaHCO_3$ solution is (are)

$(CH_3CO)_2O$	CH_3COOH	PhOH	CH_3COCHO
I	**II**	**III**	**IV**

(A) I and II (B) I and III (C) only II (D) I and IV

Ans : (A)

Hints : $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$

$$CH_3-\overset{\overset{\large O}{\|}}{C}-O-\overset{\overset{\large O}{\|}}{C}-CH_3 + H_2O \rightarrow 2CH_3COOH$$

$$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$$

8. The system that contains the maximum number of atoms is

(A) 4.25 g of NH_3 (B) 8 g of O_2 (C) 2 g of H_2 (D) 4 g of He

Ans : (C)

Hints : a) 4.25g NH_3 = $\left(\frac{4.25}{17}\right)N_A \times 4 = N_A$ atoms

b) 8 g O_2 = $\left(\frac{8}{32}\right)N_A \times 2 = \frac{N_A}{2}$ atoms

c) 2 g H_2 = $\left(\frac{2}{9}\right)N_A \times 2 = 2N_A$ atoms

d) 4 g He = $\left(\frac{4}{4}\right)N_A = N_A$atoms

9. Metal ion responsible for the Minamata disease is

(A) Co^{2+} (B) Hg^{2+} (C) Cu^{2+} (D) Zn^{2+}

Ans : (B)

Hints : Hg^{2+} causes Minamata diseases

10. Among the following observations, the correct one that differentiates between SO_3^{2-} and SO_4^{2-} is

(A) Both form precipitate with $BaCl_2$, SO_3^{2-} dissolves in HCl but SO_4^{2-} does not

(B) SO_3^{2-} forms precipitate with $BaCl_2$, SO_4^{2-} does not

(C) SO_4^{2-} forms precipitate with $BaCl_2$, SO_3^{2-} does not

(D) Both form precipitate with $BaCl_2$, SO_4^{2-} dissolves in HCl but SO_3^{2-} does not

Ans : (A)

Hints : $BaCl_2 + SO_4^{2-} \rightarrow BaSO_4\downarrow + 2Cl^-$

$BaCl_2 + SO_3^{2-} \rightarrow BaSO_3\downarrow + 2Cl^-$

But $BaSO_3$ dissolves in HCl as $BaSO_3 + 2HCl \rightarrow BaCl_2 + SO_2\uparrow + H_2O$

11. The pH of 10^{-4} M KOH solution will be

(A) 4 (B) 11 (C) 10.5 (D) 10

Ans : (D)

Hints : $[OH^-] = 10^{-4}$ M $\Rightarrow$ pOH = 4

pH + pOH = 14, $\therefore$ pH = 14 - 4 = 10

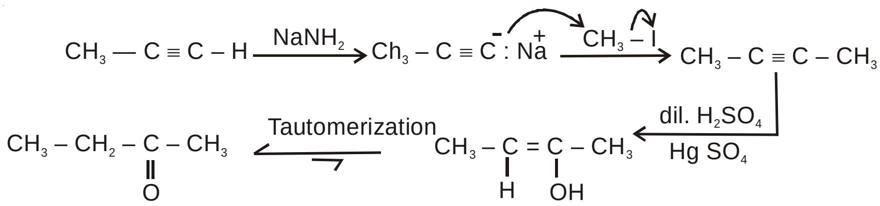
12. The reagents to carry out the following conversion are

(A) $HgSO_4$/dil H_2SO_4 (B) BH_3;H_2O_2/NaOH

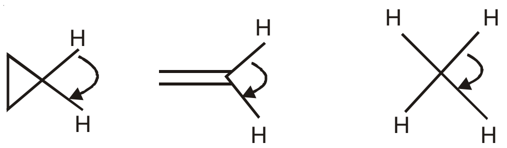
(C) OsO_4; HIO_4 (D) $NaNH_2$/CH_3I; $HgSO_4$/dil H_2SO_4

Ans : (D)

Hints :  or $CH_3 — C \equiv C – H$



13. The correct order of decreasing H-C-H angle in the following molecules is

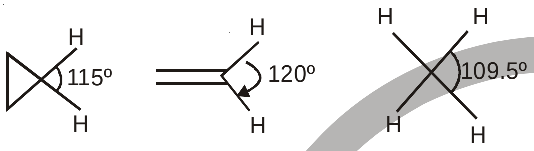


I II III

(A) I > II > III (B) II > I > III (C) III > II > I (D) I > III > II

Ans : (B)

Hints : II > I > III



I II III

14. $_{98}Cf^{246}$ was formed along with a neutron when an unknown radioactive substance was bombarded with $_{6}C^{12}$. The unknown substance was

(A) $_{91}Pa^{234}$ (B) $_{90}Th^{234}$ (C) $_{92}U^{235}$ (D) $_{92}U^{238}$

Ans : (C)

Hints : $_{z}X^{A} + {}_{6}C^{12} \rightarrow {}_{98}Cf^{246} + {}_{0}n^{1}$

$z + 6 = 98$ $A + 12 = 246 + 1$

$\Rightarrow z = 92$ or, $A = 247 - 12$

$= 235$

$\therefore$ The element is $_{92}U^{235}$

15. The rate of a certain reaction is given by, rate = k $[H^+]^n$. The rate increases 100 times when the pH changes from 3 to 1. The order (n) of the reaction is

(A) 2 (B) 0 (C) 1 (D) 1.5

Ans : (C)

Hints : Rate $r = k[H^+]^n$

New rate, $r' = 100\ r$

pH changes from 3 to 1

i.e. $[H^+] = 10^{-3}$M changes to $[H^+]' = 10^{-1}$M

i.e. conc. increases 100 times $\dfrac{[H^+]'}{[H^+]} = \dfrac{10^{-1}}{10^{-3}} = 100$

$$\frac{r'}{r} = \left(\frac{[H^+]'}{[H^+]}\right)^n \qquad \text{or, } 100 = (100)^n$$

or, $n = 1$

16. ($_{32}Ge^{76}$, $_{34}Se^{76}$) and ($_{14}Si^{30}$, $_{16}S^{32}$) are examples of

(A) isotopes and isobars (B) isobars and isotones

(C) isotones and isotopes (D) isobars and isotopes

Ans : (B)

Hints : $\left({}_{32}Ge^{76}, {}_{34}Se^{76}\right)$ Same atomic mass = isobars

$\left({}_{14}Si^{30}, {}_{16}Se^{32}\right)$

A – Z = 30 – 14 = 16 Same no. of neutrons = isotones

and 32 – 16 = 16

17. The enthalpy of vaporization of a certain liquid at its boiling point of 35ºC is 24.64 kJ mol^{-1}. The value of change in entropy for the process is

(A) 704 J K^{-1}mol^{-1} (B) 80 J K^{-1}mol^{-1} (C) 24.64 J K^{-1}mol^{-1} (D) 7.04 J K^{-1}mol^{-1}

Ans : (B)

Hints : $\Delta S = \frac{q_{rev}}{T}$

At constant pressure, $q_{rev} = \Delta H_{transformation}$

$\Delta S_{vap} = \frac{\Delta H_{vap}}{T_b}$; T_b = boiling point, ΔH_{vap} = Enthalpy of vapourization

$= \frac{24.64 \times 10^3 \text{ Jmol}^{-1}}{308 \text{ K}} = 80 \text{ JK}^{-1}\text{mol}^{-1}$

18. Given that :

$C + O_2 \rightarrow CO_2$; $\Delta H^o = -x$ kJ

$2CO + O_2 \rightarrow 2CO_2$; $\Delta H^o = -y$ kJ

The heat of formation of carbon monoxide will be

(A) $\frac{y-2x}{2}$ (B) y + 2x (C) 2x – y (D) $\frac{2x-y}{2}$

Ans : (A)

Hints : i) $C + O_2 \rightarrow CO_2$; $\Delta H^o = -x$ kJ

ii) $2CO + O_2 \rightarrow 2CO_2$; $\Delta H^o = -y$ kJ

Eq (i) × 2

$2C + 2O_2 \rightarrow 2CO_2$, $\Delta H^o = -2x$ kJ

Writing eq. (ii) in reverse order

$2CO_2 \rightarrow 2CO + O_2$, $\Delta H^o = y$ kJ

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adding, $2C + O_2 \rightarrow 2CO$, $\Delta H = (y - 2x)$ kJ

For 2 mol CO, $\Delta H = (y - 2x)$ kJ

$\therefore$ For 1 mol CO, $\Delta H_f = \left(\frac{y-2x}{2}\right)$ kJ

$\therefore$ Enthalpy of formation, $\Delta H^o_f = \frac{y-2x}{2}$

19. Commercial sample of H_2O_2 is labeled as 10V. Its % strength is nearly

(A) 3 (B) 6 (C) 9 (D) 12

Ans : (A)

Hints : 10 volume H_2O_2 means

1 mL H_2O_2 solution produces 10 mL O_2 at STP

$2H_2O_2 \longrightarrow 2H_2O + O_2$

2 mol 1 mol

2 × 34 g 22.4 L at STP

68 g

22400 mL O_2 at STP is produced from 68 g. H_2O_2

$\therefore$ 10 mL O_2 is produced from $\frac{68 \times 10}{22400}$ g = 0.03036 g H_2O_2

$\therefore$ 1 mL H_2O_2 solution contains 0.03 g H_2O_2 (approx.)

$\therefore$ 100 mL H_2O_2 solution contains 0.03 × 100

= 3 g H_2O_2 (approx.)

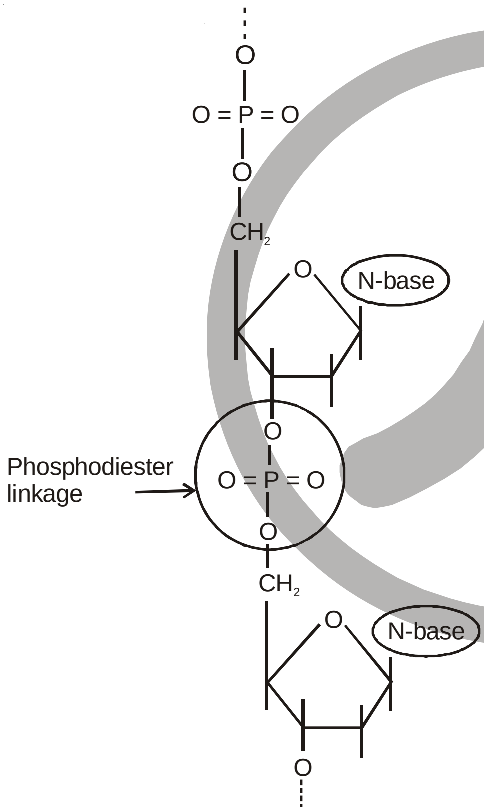
20. In DNA, the consecutive deoxynucleotides are connected via

(A) phospho diester linkage (B) phospho monoester linkage

(C) phospho triester linkage (D) amide linkage

Ans : (A)

Hints :

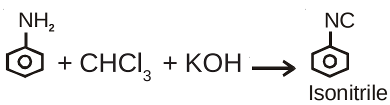


21. The reaction of aniline with chloroform under alkaline conditions leads to the formation of

(A) Phenyl cyanide (B) Phenyl isonitrile (C) Phenyl cyanate (D) Phenyl isocyanate

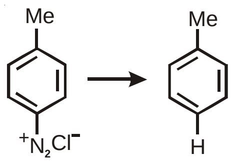
Ans : (B)

Hints :



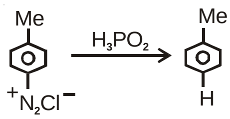
This is the carbylamine reaction

22. The reagent with which the following reaction is best accomplished is



(A) H_3PO_2 (B) H_3PO_3 (C) H_3PO_4 (D) $NaHSO_3$

Ans : (A)

Hints : 

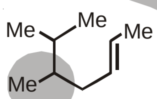
23. At a certain temperature the time required for the complete diffusion of 200 mL of H_2 gas is 30 minutes. The time required for the complete diffusion of 50 mL of O_2 gas at the same temperature will be

(A) 60 minutes (B) 30 minutes (C) 45 minutes (D) 15 minutes

Ans : (B)

Hints : $\frac{r_{H_2}}{r_{O_2}} = \frac{\sqrt{M_{O_2}}}{\sqrt{M_{H_2}}} = \frac{V_{H_2}/t_{H_2}}{V_{O_2}/t_{O_2}}$, $\sqrt{\frac{32}{2}} = \frac{200}{30} \times \frac{t_{O_2}}{50}$ = or $4 = \frac{4}{30} \times t_{O_2}$, $\therefore$ t_{O_2} = 30 min

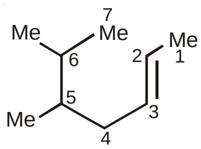
24. The IUPAC name of the following molecule is



(A) 5,6-Dimethyl hept-2-ene (B) 2,3-Dimethyl hept-5-ene

(C) 5,6-Dimethyl hept-3-ene (D) 5-Isopropyl hex-2-ene

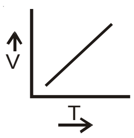
Ans : (A)

Hints :  5,6 - Dimethyl hept-2-ene

25. For one mole of an ideal gas the slope of V vs. T curve at constant pressure of 2 atm is X lit $mol^{-1}K^{-1}$. The value of the ideal universal gas constant 'R' in terms of X is

(A) X lit atm $mol^{-1}K^{-1}$ (B) X/2 lit atm $mol^{-1}K^{-1}$ (C) 2X lit atm $mol^{-1}K^{-1}$ (D) 2X atm $lit^{-1}mol^{-1}K^{-1}$

Ans : (C)

Hints : 

PV = RT, $V = \frac{R}{P} \times T$, $m = \frac{R}{P} = X$, or R = X.P, = 2X L.atm $mol^{-1}K^{-1}$

('m' is the slope)

26. An atomic nucleus having low n/p ratio tries to find stability by

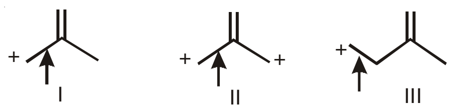
(A) the emission of an α particle (B) the emission of a positron

(C) capturing an orbital electron (K-electron capture) (D) emission of a β particle

Ans : (B)

Hints : B and C both option are correct but as single option, B is more appropriate.

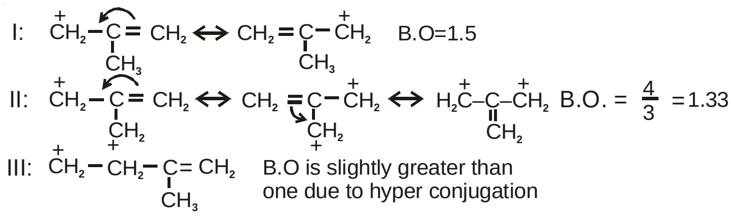
27. The correct order of decreasing length of the bond as indicated by the arrow in the following structure is



(A) I>II>III (B) II>I>III (C) III>II>I (D) I>III>II

Ans : (C)

Hints :



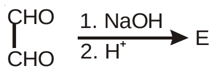
28. If Cl_2 is passed through hot aqueous NaOH, the products formed have Cl in different oxidation states. These are indicated as

(A) –1 and +1 (B) –1 and +5 (C) +1 and +5 (D) –1 and +3

Ans : (B)

Hints : Reaction : $3Cl_2 + 6NaOH$ (hot & conc) $\rightarrow 5\,Na\overset{-1}{Cl} + Na\overset{+5}{Cl}O_3 + 3H_2O$

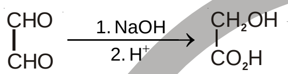
29. In the following reaction, the product E is



(A) $CH_2OH-CHO$ (B) $CHO-CO_2H$ (C) CH_2OH-CO_2H (D) CO_2H-CO_2H

Ans : (C)

Hints : Reaction :



(Intramolecular Cannizaro's reaction)

30. The amount of electrolytes required to coagulate a given amount of AgI colloidal solution (–ve charge) will be in the order

(A) $NaNO_3 > Al_2(NO_3)_3 > Ba(NO_3)_2$ (B) $Al_2(NO_3)_3 > Ba(NO_3)_2 > NaNO_3$

(C) $Al_2(NO_3)_3 > NaNO_3 > Ba(NO_3)_2$ (D) $NaNO_3 > Ba(NO_3)_2 > Al_2(NO_3)_3$

Ans : (D)

Hints : For [AgI] I^- Negatively charged sol, effective ion for coagulation is cation and amount of electrolyte required $\propto \frac{1}{\text{charge content}}$. Also note that $Al(NO_3)_3$ is written as $Al_2(NO_3)_3$ in the questions paper.

31. The value of ΔH for cooling 2 mole of an ideal monoatomic gas from 225°C to 125°C at constant pressure will be given $C_p = \frac{5}{2}R$]

(A) 250 R (B) –500 R (C) 500 R (D) –250 R

Ans : (B)

Hints : Here, n = 2

$$C_p = \frac{5}{2}R$$

$$\Delta T = 125 - 225 = -100$$

$$\Delta H = nC_p\,\Delta T = 2 \times \frac{5}{2}R \times (-100) = -500\,R$$

32. The quantity of electricity needed to separately electrolyze 1M solution of $ZnSO_4$, $AlCl_3$ and $AgNO_3$ completely is in the ratio of

(A) 2 : 3 : 1 (B) 2 : 1 : 1 (C) 2 : 1 : 3 (D) 2 : 2 : 1

Ans : (A)

Hints : $Zn^{2+} + 2e^- \rightarrow Zn$

$Al^{2+} + 3e^- \rightarrow Al$

$Ag^+ + e^- \rightarrow Ag$

$\therefore$ Quantity of electricity required = 2 : 3 : 1

33. The emission spectrum of hydrogen discovered first and the region of the electromagnetic spectrum in which it belongs, respectively are

(A) Lyman, ultraviolet (B) Lyman, visible (C) Balmer, ultraviolet (D) Balmer, visible

Ans : (D)

Hints : Fact

34. As per de Broglie's formula a macroscopic particle of mass 100 gm and moving at a velocity of 100 cm s^{-1} will have a wavelength of

(A) 6.6×10^{-29} cm (B) 6.6×10^{-30} cm (C) 6.6×10^{-31} cm (D) 6.6×10^{-32} cm

Ans : (C)

Hints : m = 100 g, v = 100 cm s^{-1} = 1 ms^{-1}

$$\lambda = \frac{h}{mv} = \frac{6.626 \times 10^{-34}}{0.1 \times 1} = 6.626 \times 10^{-33} \text{ m} = 6.626 \times 10^{-31} \text{ cm}$$

35. The electronic configuration of Cu is

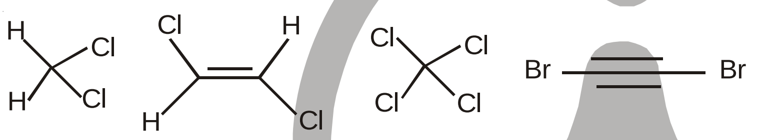
(A) $Ne3s^2 3p^6 3d^9 4s^2$ (B) $Ne3s^2 3p^6 3d^{10} 4s^1$ (C) $Ne3s^2 3p^6 3d^3 4s^2 4p^6$ (D) $Ne3s^2 3p^6 3d^5 4s^2 4p^4$

Ans : (B)

Hints : Cu : z = 29

[Ne] $3s^2 3p^6 3d^{10} 4s^1$

36. The compound that will have a permanent dipole moment among the following is

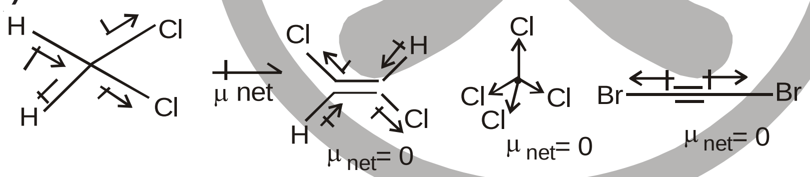


I **II** **III** **IV**

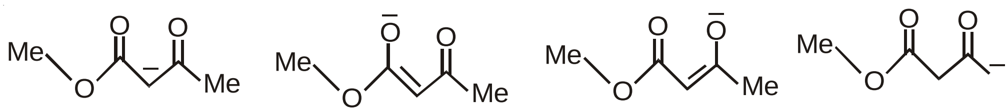
(A) I (B) II (C) III (D) IV

Ans : (A)

Hints :



37. Among the following structures the one which is not a resonating structure of others is

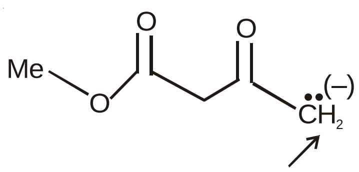


I **II** **III** **IV**

(A) I (B) II (C) III (D) IV

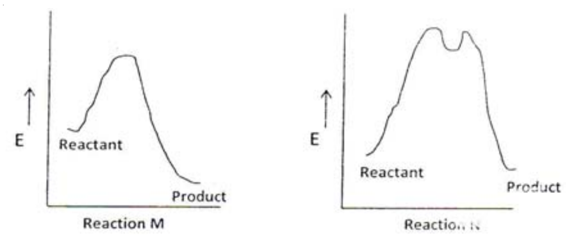
Ans : (D)

Hints :



A hydrogen is removed from this carbon. But, in resonating structure, position of atoms do not changes.

38. The correct statement regarding the following energy diagrams is



(A) Reaction M is faster and less exothermic than Reaction N

(B) Reaction M is slower and less exothermic than Reaction N

(C) Reaction M is faster and more exothermic than Reaction N

(D) Reaction M is slower and more exothermic than Reaction N

Ans : (C)

Hints :

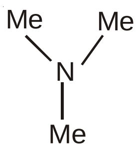
Activation energy ($\Delta E_M < \Delta E_N$)

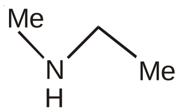
Reaction M is faster than N.

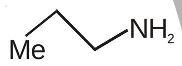
ΔH_M is more negative than ΔH_N

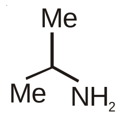
Reaction M is more extothermic than N

39. An amine C_3H_9N reacts with benzene sulfonyl chloride to form a white precipitate which is insoluble in aq. NaOH. The amine is

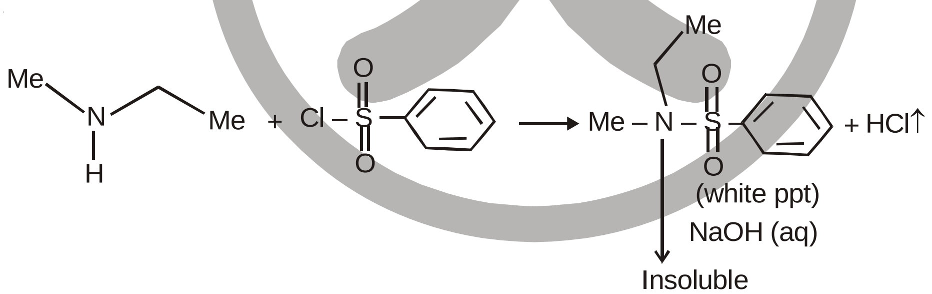
(A) 

(B) 

(C) 

(D) 

Ans : (B)

Hints : 

40. Among the followings, the one which is not a "greenhouse gas", is

(A) N_2O (B) CO_2 (C) CH_4 (D) O_2

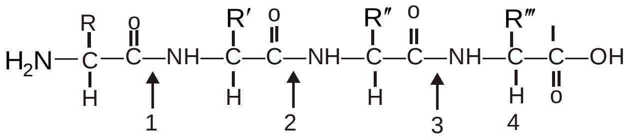
Ans : (D)

Hints : O_2 is not a green house gas

41. The number of amino acids and number of peptide bonds in a linear tetrapeptide (made of different amino acids) are respectively

(A) 4 and 4 (B) 5 and 5 (C) 5 and 4 (D) 4 and 3

Ans : (D)

Hints : 

No. of amino acids = 4
No. of Peptide bonds = 3

42. The 4th higher homologue of ethane is

(A) Butane (B) Pentane (C) Hexane (D) Heptane

Ans : (C)

Hints : homologus differ by CH_2 unit

$\therefore$ 4th homologue of ethene is C_6H_{14} $\left\{C_2H_6 + (CH_2)_4\right\}$

43. The hydrides of the first elements in groups 15 - 17, namely NH_3, H_2O and HF respectively show abnormally high values for melting and boiling points. This is due to

(A) small size of N, O and F
(B) the ability to form extensive intramolecular H-bonding
(C) the ability to form extensive intramolecular H-bonding
(D) effective van der Walls interaction

Ans : (B)

Hints : NH_3, H_2O and HF form extensive intermolecular Hydrogen bonding due to high ionic potential of N, O and F.

44. The two half cell reactions of an electrochemical cell is given as

$Ag^+ + e^- \rightarrow Ag$; $E^0_{Ag+/Ag} = -0.3995$ V

$Fe^{++} \rightarrow Fe^{+++} + e^-$; $E^0_{Fe^{+++}/Fe^{++}} = -0.7120$ V

(A) –0.3125 V (B) 0.3125 V (C) 1.114 V (D) –1.114 V

Ans : (B)

$$Ag^+ + e \rightarrow Ag \quad -0.3995\text{ V (cathode)}$$

$$Fe^{+2} - e \rightarrow Fe^{+3} \quad -(-0.7120)\text{V (Anode)}$$

Hints :

$$Ag^+ + Fe^{+2} \rightarrow Ag + Fe^{+3} \quad \Delta E = 0.3125\text{ V}$$

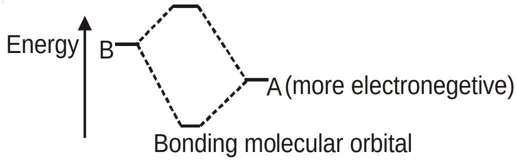
$E^o\text{ cell} = E^o_C - E^o_A$ E^o cell= 0.3125 V

45. In case of heteronuclear diatomics of the type AB, where A is more electronegative than B, bonding molecular orbital resembles the character of A more than that of B. The statement

(A) is false
(B) is true
(C) can not be evaluated since data is not sufficient
(D) is true only for certain systems

Ans : (B)

Hints :

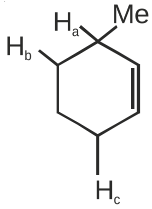


Bonding molecular orbital
resembles A more closely

CATEGORY - II

Q.46 to Q.55 carry two marks each, for which only one option is correct. Any wrong answer will lead to deduction of 2/3 mark

46. The order of decreasing ease of abstraction of Hydrogen atoms in the following molecule is

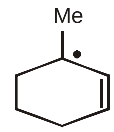


(A) $H_a > H_b > H_c$ (B) $H_a > H_c > H_b$

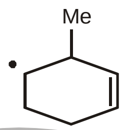
(C) $H_b > H_a > H_c$ (D) $H_c > H_b > H_a$

Ans : (B)

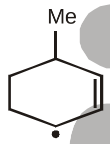
Hints : The more stable is the radical formed after H atom abstraction, easier is the abstraction



radical after H_a abstraction (tertiary allyl radical)



radical after H_b abstraction (secondary radical)



radical after H_c abstraction (secondary allyl radical)

stability order of free radical is 3° allyl > 2° allyl > 2°alkyl

$\therefore\ H_a > H_c > H_b$

47. The bond angle in NF_3(102.3°) is smaller than NH_3(107.2°). This is because of

(A) large size of F compared to H (B) large size of N compared to F

(C) opposite polarity of N in the two molecules (D) small size of H compared to N

Ans : (C)

Hints : In NF_3, dipole moment vector point in the direction of F. Thus electron cloud shifts towards F in N–F bond. This reduces bond pair-bond pair repulsion in N–F and hence a decrease in bond angle FNF.

48. The compressibility factor (Z) of one mole of a van der Waals gas of negligible 'a' value is

(A) 1 (B) $\frac{bp}{RT}$ (C) $1+\frac{bp}{RT}$ (D) $1-\frac{bp}{RT}$

Ans : (C)

Hints: <u>Vander Waal's Equation</u>

$\left(P+\frac{a}{V^2}\right)(V-b)=RT$ (for 1 mole of gas) $\Rightarrow$ P(V–b) = RT$\Rightarrow$PV – Pb = RT $\Rightarrow$ PV = RT + Pb$\Rightarrow$ Z = $\frac{PV}{RT}=1+\frac{Pb}{RT}$

Z= Compressibility on neglecting "a".

49. At 25°C, the molar conductance of 0.007 M hydrofluoric acid is 150 mho cm^{2}mol^{-1} and $\Lambda^\circ_m = 500$ mho cm^{2}mol^{-1}. The value of the dissociation constant of the acid at the gas concentration at 25°C is

(A) 7×10^{-4} M (B) 7×10^{-5} M (C) 9×10^{-3} M (D) 9×10^{-4} M

Ans : (D)

Hints : α(degree of dissociation) = $\frac{150}{500}=0.3 \therefore K_a = \frac{C\alpha^2}{1-\alpha}=\frac{0.007\times(0.3)^2}{1-0.3}=9\times10^{-4}M$.

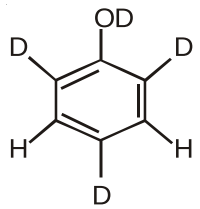
Here, α can't be neglected w.r.t 1 due to large value

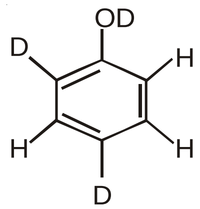
50. A piece of wood from an archaeological sample has 5.0 counts min^{-1} per gram of C-14, while a fresh sample of wood has a count of 15.0 min^{-1} $gram^{-1}$. If half life of C-14 is 5770 years, the age of the archaeological sample is
(A) 8,500 years (B) 9,200 years (C) 10,000 years (D) 11,000 years
Ans : (B)

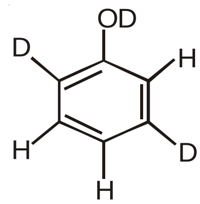
Hints : $\frac{0.693}{t_{1/2}}t = 2.303\log\frac{[\text{Activity of fresh sample}]}{[\text{Activity of fossil}]}$, $\frac{0.693}{5770}t = 2.303\log\frac{15}{5} \Rightarrow t = \frac{2.303(\log 3)(5770)}{0.693}$ yrs

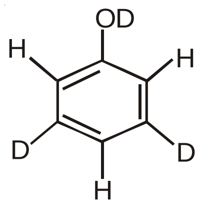
= 9,200 Yrs (approx)

51. When phenol is treated with D_2SO_4/D_2O, some of the hydrogens get exchanged. The final product in this exchange reaction is

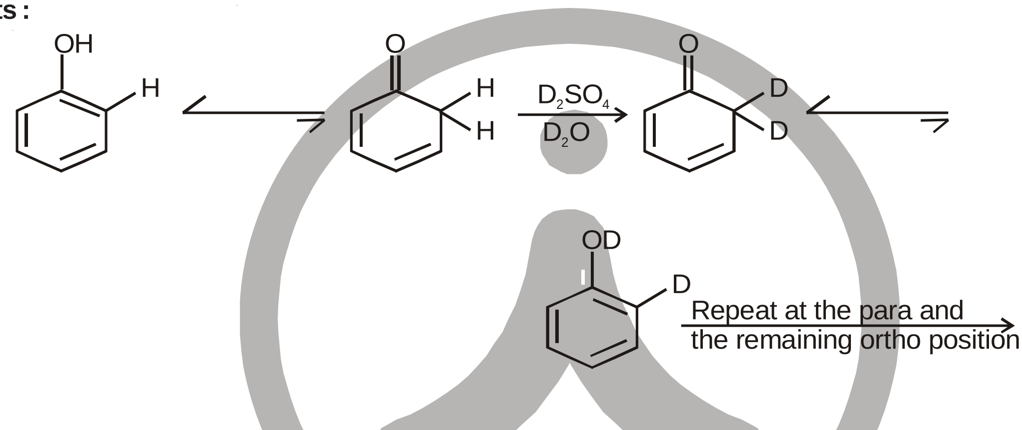
(A) 

(B) 

(C) 

(D) 

Ans : (A)
Hints :

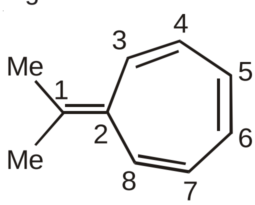


52. To observe an elevation of boiling point of 0.05°C, the amount of solute (Mol. Wt. = 100) to be added to 100 g of water (K_b=0.5) is
(A) 2 g (B) 0.5 g (C) 1 g (D) 0.75 g
Ans : (C)

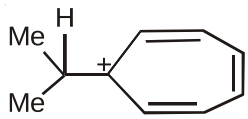
Hints : $\Delta T_b = K_b m$, $0.05 = .5 \times X$ $0.05 = \frac{0.5x}{100} \times 10$; X = 1 g.

53. The structure of XeF_6 is experimentally determined to be distorted octahedron. Its structure according to VSEPR theory is
(A) Octahedron (B) Trigonal bipyramid (C) Pentagonal bipyramid (D) Tetragonal bipyramid
Ans : (C)
Hints : Xe is surrounded by 6 bond pairs and one lone pair. The geometry (geometry of electron pairs) is pentagonal bipyramid.

54. The most likely protonation site in the following molecule is



(A) C-1 (B) C-2 (C) C-3 (D) C-6
Ans : (A)

Hints :  Aromatic as well as tartiary carbocation

55. The volume of ethyl alcohol (density 1.15 g/cc) that has to be added to prepare 100 cc of 0.5 M ethyl alcohol solution in water is

(A) 1.15 cc (B) 2 cc (C) 2.15 cc (D) 2.30 cc

Ans : (B)

Hints : Mass of ethyl alcohol before and after the preparation must be equal.

x(volume in cc) × $\frac{1.15g}{mL} = \frac{100 \times 0.5}{1000} \times 46$, x = 2 cc

CATEGORY - III

Q.56 to Q.60 carry two marks each, for which one or more than one options may be correct. Marking of correct options will lead to a maximum mark of two on pro rata basis. There will be no negative marking for these questions. However, any marking of wrong option will lead to award of zero mark against the respective question – irrespective of the number of correct options marked.

56. Cupric compounds are more stable than their cuprous counterparts in solid state. This is because

(A) the endothermic character of the 2nd I P of Cu is not so high

(B) size of Cu^{2+} is less than Cu^{+}

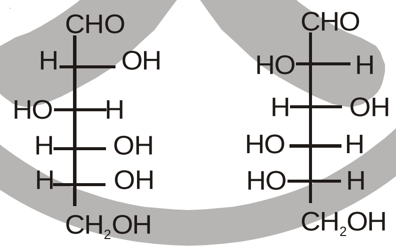
(C) Cu^{2+} has stabler electronic configuration as compared to Cu^{+}

(D) the lattice energy released for cupric compounds is much higher than Cu^{+}

Ans : (A, B, D)

Hints : Actually 2nd IP of Cu (1958 kJ/mol) is not very high as compared to 1st IP (745 kJ/mol). In addition the gain in lattice energy due to +2 state and small size of Cu^{+2} favour the divalent state in the solid.

57. Among the following statements about the molecules X and Y, the one (s) which is (are) correct is (are)



X Y

(A) X and Y are diastereomers

(B) X and Y are enantiomers

(C) X and Y are both aldohexoses

(D) X is a D-sugar and Y is an L-sugar

Ans : (B, C, D)

Hints : 'X' and 'Y' are mirror images of each other. They are aldohexoses too. In 'X', –OH of the asymmetric 'C' farthest from –CHO is on the right, so it is 'D'-Sugar. 'Y' , on the other hand, has –OH on the left. Thus it is a L-sugar.

58. For a spontaneous process, the correct statement(s) is (are)

(A) $(\Delta G_{system})_{T,P} > 0$

(B) $(\Delta S_{system}) + (\Delta S_{surroundings}) > 0$

(C) $(\Delta G_{system})_{T,P} < 0$

(D) $(\Delta U_{system})_{T,V} > 0$

Ans : (B, C)

Hints : Spontaneity of of the process can be expressed either by taking entropy changes of system and surrounding together or by considering free energy change of the system alone at constant temperature and pressure. The known criteria are : $(\Delta G_{sys})_{T,P} < 0$ and $(\Delta S_{sys}) + (\Delta S_{sur}) > 0$

59. The formal potential of Fe^{3+}/Fe^{2+} in a sulphuric acid and phosphoric acid mixture (E°=+0.61V) is much lower than the standard potential (E°=+0.77V). This is due to

(A) formation of the species $[FeHPO_4]^+$

(B) lowering of potential upon complexation

(C) formation of the species $[FeSO_4]^+$

(D) high acidity of the medium

Ans : (A, B, D)

Hints : Formation of complex by Fe^{3+} reduces its concentration. Thereby lowers the formal reduction potential.

60. Two gases X (Mol. Wt. M_x) and Y(Mol. Wt. M_Y; $M_Y > M_x$) are at the same temperature T in two different containers. Their root mean square velocities are C_X and C_Y respectively. If the average kinetic energies per molecule of two gases X and Y are E_x and E_Y respectively, then which of the following relation (s) is (are) true?

(A) $E_x > E_Y$

(B) $C_x > C_Y$

(C) $E_x = E_Y = \frac{3}{2}RT$

(D) $E_X = E_Y = \frac{3}{2}k_BT$

Ans : (B, D)

Hints : For same temperature, higher the molar mass, lower is the rms velocity.KE of individual molecules is expressed in terms of K_B not R