

WEEKLY TEST MEDICAL PLUS - 03 TEST - 20 RAJPUR
 SOLUTION Date 22-12-2019

[PHYSICS]

31. For charged spherical conductor. Potential inside the sphere is same as that on its surface

$$V_{\text{in}} = V_{\text{surface}} = \frac{q}{10} \text{ stat volt}$$

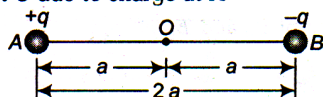
$$V_{\text{out}} = \frac{q}{15} \text{ state volt}$$

$$\therefore \frac{V_{\text{out}}}{V_{\text{in}}} = \frac{2}{3}$$

$$\therefore V_{\text{out}} = \frac{2}{3} V$$

$$V_{\text{in}} = \frac{2}{3} V$$

32. Potential at O due to charge at A



$$\therefore V_1 = \frac{1}{4\pi\epsilon_0} \cdot \frac{q}{a}$$

Potential at O due to charge at B

$$V_2 = \frac{1}{4\pi\epsilon_0} \cdot \frac{(-q)}{a}$$

Potential at mid-point O

$$V = \frac{1}{4\pi\epsilon_0} \cdot \frac{q}{a} + \frac{1}{4\pi\epsilon_0} \cdot \frac{(-q)}{a} = 0$$

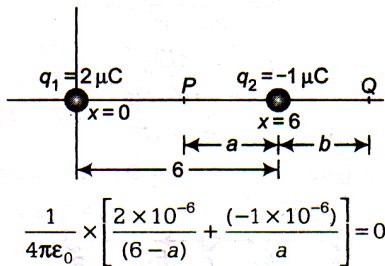
33. As electric potential of spheres are same, is

$$V_A = V_B$$

$$\therefore \frac{\sigma_A \cdot a}{\epsilon_0} = \frac{\sigma_B \cdot b}{\epsilon_0}$$

or
$$\frac{\sigma_A}{\sigma_B} = \frac{b}{a}$$

34. Let potential will be zero at two points P and Q , then,



$$\frac{1}{4\pi\epsilon_0} \times \left[\frac{2 \times 10^{-6}}{(6-a)} + \frac{(-1 \times 10^{-6})}{a} \right] = 0$$

$$\therefore a = 2$$

So, distance of P from origin

$$x = 6 - 2 = 4$$

At external point Q ,

$$\frac{1}{4\pi\epsilon_0} \times \left[\frac{2 \times 10^{-6}}{(6+b)} + \frac{(-1 \times 10^{-6})}{b} \right] = 0$$

$$\therefore b = 6$$

So, distance of Q from origin

$$x = 6 + 6 = 12$$

35. Let radius of big drop is R and radius of small drops is r ,

\therefore Volume of big drop = $8 \times$ volume of small drops

$$\text{or } \frac{4}{3} \pi R^3 = 8 \times \frac{4}{3} \pi r^3$$

$$\text{or } R = 2r$$

Potential of big drop

$$V = \frac{Q}{C} = \frac{8q}{(8)^{1/3} C} \quad (q \text{ is charge on small drop})$$

$$\therefore V = (8)^{2/3} v$$

$$\therefore \frac{V_{\text{big}}}{V_{\text{small}}} = (8)^{2/3} = \frac{4}{1}$$

36. Electric field is negative of potential gradient, i.e.,

$$E = -\frac{dV}{dx} = -\frac{d}{dx} (5x^2 + 10x - 9)$$

$$= -10x - 10$$

$$\therefore (E)_{x=1} = -10 \times 1 - 10$$

$$= -20 \text{ V/m}$$

37. Electric field is given by

$$E = -\frac{\Delta V}{\Delta r} = \frac{30 - (-10)}{2 \times 10^{-2}}$$

$$= 2000 \text{ V/m}$$

- 38.

$$E = \frac{V}{r}$$

$$\therefore r = \frac{V}{E} = \frac{3000}{500} = 6 \text{ m}$$



39. When α -particle is accelerated through a potential difference V , then kinetic energy of α -particle

$$\begin{aligned} K &= qV \\ &= (2e)V \text{ J} \\ &= 2 \times 1.6 \times 10^{-19} \times 10^6 \text{ J} \\ &= \frac{2 \times 1.6 \times 10^{-19} \times 10^6}{1.6 \times 10^{-19}} \text{ eV} \\ &= 2 \text{ MeV} \end{aligned}$$

40. \therefore Potential difference = $\frac{\text{Work done}}{\text{Charge}}$

$$\begin{aligned} \therefore W &= qV \\ 20 &= 5 \times V \\ V &= 2 \text{ volt} \end{aligned}$$

41. $W = U_f - U_i$

Here $U_f = 0$

$$\begin{aligned} \therefore W &= -U_i \\ &= -\frac{(9 \times 10^9)}{0.1} [(1)(-2) + (1)(4) + (-2)(4)] \times 10^{-12} \\ &= 0.54 \text{ J} \end{aligned}$$

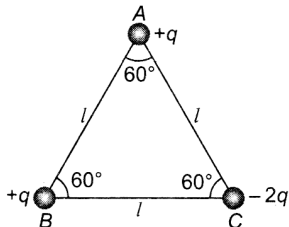
42. $v = at = \left(\frac{qE}{m}\right)t$

$$v \propto \frac{q}{m} \text{ or KE} \propto \frac{q^2}{m^2}$$

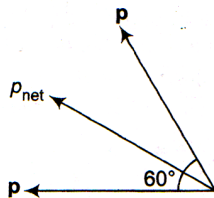
$$\therefore \frac{K_1}{K_2} = \left(\frac{2}{1/2}\right)^2 = 16$$

- 43.

- 44.



The direction of dipole moment is shown in figure.



Net electric dipole moment

$$\begin{aligned} P_{\text{net}} &= \sqrt{p^2 + p^2 + 2pp \cos 60^\circ} \\ &= \sqrt{3}p \\ &= \sqrt{3} ql \quad (\because p = ql) \end{aligned}$$

45. On equatorial line electric field is given by

$$E_{\text{equat}} = \frac{1}{4\pi\epsilon_0} \cdot \frac{2p}{r^3}$$

On axial line

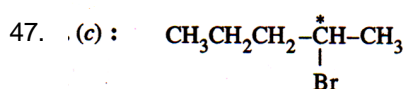
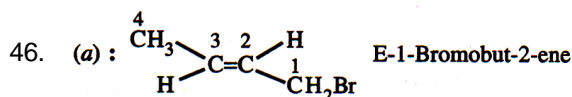
$$E_{\text{axial}} = \frac{1}{4\pi\epsilon_0} \cdot \frac{p}{r^3}$$

$$\therefore E_{\text{axial}} = 2E_{\text{equat}}$$

But since their directions are opposite. Hence,

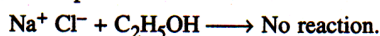
$$E_a = -2E_e$$

[CHEMISTRY]



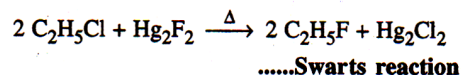
2-Bromopentane (2° , optically active)

48. (c) : Cl^- ion being a weak nucleophile cannot displace OH^- ion which is a stronger nucleophile.

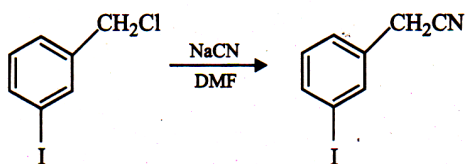


49. (d) : ZnCl_2 being a Lewis acid coordinates with the O atom of $\text{C}_2\text{H}_5\text{OH}$.

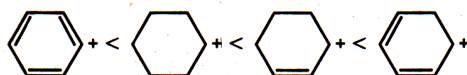
50. (c) : Fluoroethane is prepared by halogen exchange method



51. (d) : Alkyl halides are more reactive than aryl halides, therefore, only the halogen in the side chain is displaced.



52. (b) : The reactivity depends upon the stability of the carbocations which the alkyl chlorides give on ionization. Now stability of the carbocations increases in the order:



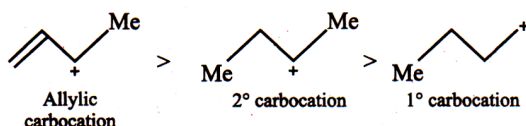
Therefore, the reactivity of their corresponding alkyl chlorides follows the same order, i.e., $\text{IV} < \text{I} < \text{II} < \text{III}$.

53. (a) : Diazonium salts react with CuBr/HBr (Sandmeyer reaction) to form bromobenzene.

54. (d) : Boiling points increase as the number of carbon atoms in the alkyl halide increases. Therefore, the boiling points of II, III and IV with four carbon atoms is higher than that of I with three carbon atoms. Further, the boiling points decrease with the number of branches. Thus,

the boiling points of the four alkyl halides increase in the order: $I < IV < III < II$.

55. (c) : The reactivity in S_N1 reactions depends upon the stability of the intermediate carbocations. Since the stability of the carbocations derived from (A), (B) and (C) follows the order:



therefore, S_N1 reactivity of these three bromides follows the order: $B > C > A$, i.e., option (c) is correct.

56. (b) : Stronger the acid, weaker is its conjugate base and hence higher is its leaving group ability.

Now basicity increases in the order: $CF_3-SO_3^- < C_6H_5SO_3^- < CH_3COO^- < C_6H_5O^-$ and hence

its leaving group ability decreases in the reverse

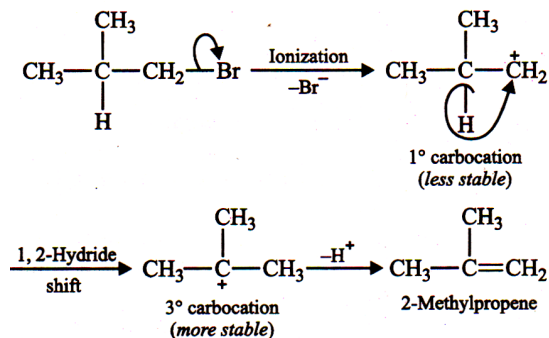
order, i.e., $CF_3-SO_3^-$ (I), $C_6H_5SO_3^-$ (II) >

CH_3COO^- (IV) > $C_6H_5O^-$ (III), i.e., option (b) is correct.

57. (d) : Due to the presence of $-ve$ charge on the oxygen atom, CH_3O^- , HO^- and CH_3CCO^- ions are more nucleophilic than H_2O . Further, due to $+I$ -effect of the CH_3 group, CH_3O^- is more nucleophilic than OH^- . Further, since in CH_3COO^- , $-ve$ charge on oxygen is stabilized by resonance, therefore, its nucleophilicity is lower than those of CH_3O^- and HO^- . Thus, the overall nucleophilicity of all the species decreases in the order: $CH_3O^- > HO^- > CH_3COO^- > H_2O$, i.e., option (d) is correct.

58. (a) : The leaving group ability decreases as the basicity of the nucleophile increases. Since the basicity increases in the order: $Br^- < Cl^- < CH_3COO^- < HO^- < H^-$, therefore, their leaving group ability decreases in the reverse order, i.e., $Br^- > Cl^- > CH_3COO^- > HO^- > H^-$. Thus, option (a) is correct.

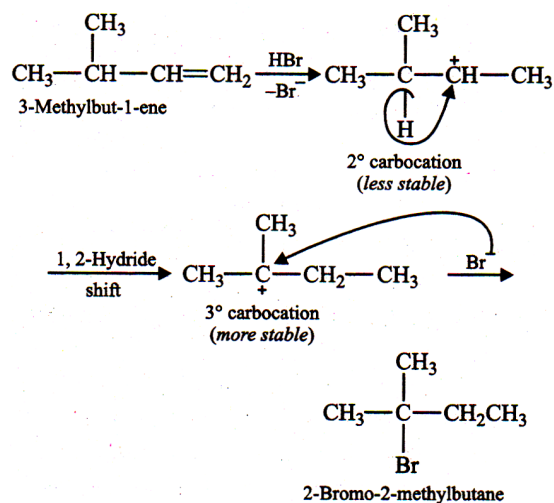
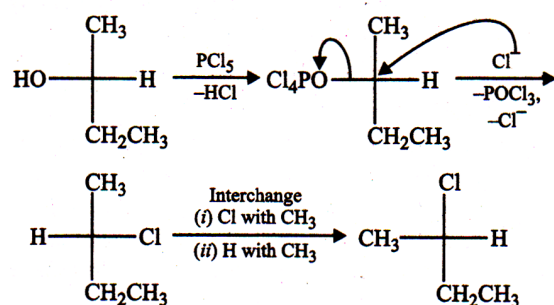
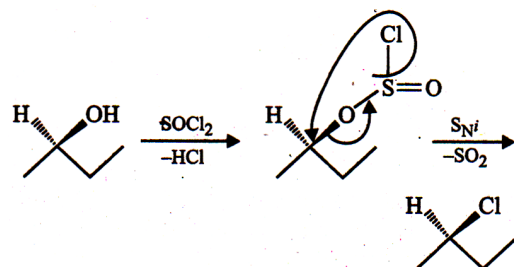
59. (c) : Although the given alkyl halide is 1°, yet the carbocation which it generates on ionization, rearranges to form a more stable 3° carbocation which in presence of a strong base (CH_3O^-) prefers to undergo elimination rather than substitution to afford 2-methylpropene



60. (a) : As the steric hindrance increases at the α -carbon atom holding the halogen, the reactivity towards $\text{S}_{\text{N}}2$ mechanism decreases, i.e., $\text{I} > \text{III} > \text{II} > \text{IV}$.
61. (a) : Chlorobenzene (least-reactive), vinyl chloride (more reactive), chloroethane (most reactive).
62. (c) : Electron-withdrawing groups increase and electron-donating groups decrease the reactivity towards nucleophilic substitution. Further, more the number of electron-withdrawing groups, higher is the reactivity. Thus, option (c), i.e., $\text{iv} > \text{iii} > \text{ii} < > \text{i}$ is correct.
63. (a) : Electron-withdrawing groups (i.e., NO_2 , CO_2R , etc.) increase the reactivity of aryl halides towards nucleophilic substitution reactions by stabilizing the intermediate carbanion.
64. (c) : Cl is *o*, *p*-directing, therefore, a mixture of *o*- and *p*-chloroacetophenone is obtained.
65. (d) : Being strained cyclopropane ring readily opens up to form only *n*-propyl bromide. In contrast, reaction (a) gives a mixture of *n*-propyl and isopropyl bromides, reaction (b) gives isopropyl

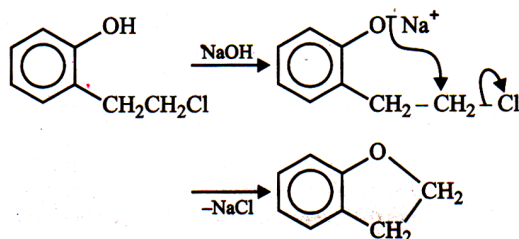
bromide while reaction (c) does not occur at all.

66. (d)

67. (a) : PCl_5 reacts by $\text{S}_{\text{N}}2$ mechanism and hence inversion of configuration occurs.68. (d) : Reaction occurs by $\text{S}_{\text{N}}\text{i}$ mechanism with retention of configuration69. (b) : The dipole moment of CH_3Cl , CH_3Br and CH_3I decreases as the electronegativity of the halogen decreases. However, due to much smaller size of F as compared to that of Cl, dipole moment (product of charge and distance) of CH_3F is lower than that of CH_3Cl . Thus, option (b) is correct.

70. (b) : Due to symmetry, the molecules of *p*-dichlorobenzene fit closely in the lattice. As a result intermolecular forces are the strongest in *p*-dichlorobenzene and hence it has the highest *m.p.* and lowest solubility.

71. (c) :



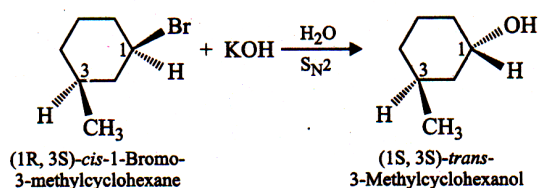
72. (d) : As the size of the alkyl group increases, the S_N2 reactivity decreases. Further, C-Cl bond is stronger and more difficult to cleave than C-Br bond. Thus, option (d) is correct.

73. (b) : 1° Alkyl halides, *i.e.*, CH_3Br .

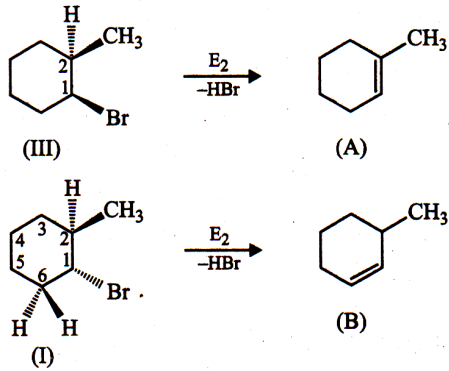
74. (d) : S_N2 reactions occur with inversion of configuration. Therefore an optically active reactant gives an optically active product whose sign of rotation cannot be predicted, *i.e.*, option (d) is correct.

75. (c) : With strong bases like $\text{CH}_3\text{CH}_2\text{O}^-$, *tert*-butyl bromide undergoes elimination to form $(\text{CH}_3)_2\text{C}=\text{CH}_2$ but with weak nucleophiles such as $\text{CH}_3\text{CH}_2\text{OH}$ substitution occurs to afford *tert*-butyl ethyl ether, $(\text{CH}_3)_3\text{C}-\text{O}-\text{CH}_2\text{CH}_3$.

76. (d) : In S_N2 reactions, inversion of configuration occurs.

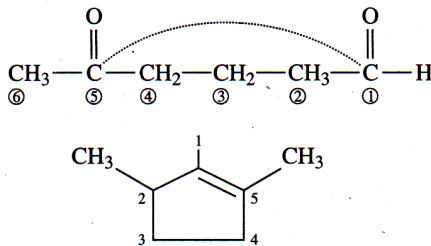


77. (b) : In E_2 reactions, *trans*-elimination occurs. Since in compound (III), there is a *trans*-H-atom on C_2 carbon carrying the CH_3 group, therefore elimination occurs readily to give stable alkene (A).

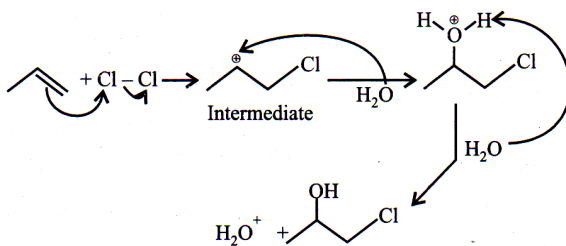
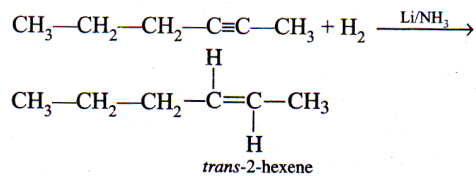


In compound (I), *trans*-H is not available on C₂ but there is a *trans*-H available on C₆, therefore, elimination occurs on the other side to give less stable alkene (B). Compound (II), however, does not have a *trans*-H on either side (i.e., C₂ or C₆), therefore, E₂ reaction does not occur. Thus, option (b) is correct.

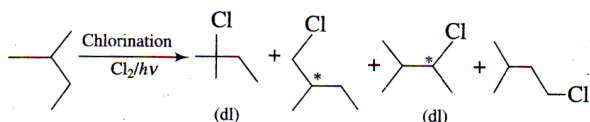
78.



79.

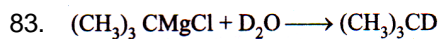
80. 2-hexyne gives *trans*-2-hexene on treatment Li/NH₃

81. On chlorination of 2-methyl butane



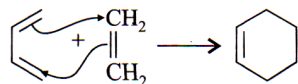
Four chiral compounds are formed.

82.



84.

85. It is Diels-Alder reaction,



86. Least substituted alkene is most reactive for H_2 . *Trans* is more symmetrical than *cis* and so *cis* is more reactive.

87.

88. B

