

WEEKLY TEST MEDICAL PLUS - 01,02 B, 01 R
SOLUTION Date 29 -12-2019

[PHYSICS]

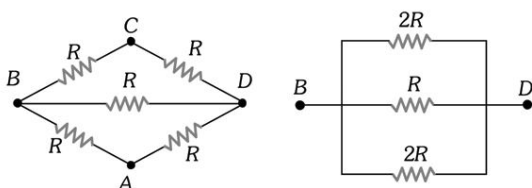
1. (d) After simplifying the network, equivalent resistance obtained between A and B is 8Ω .

2. (a) Equivalent resistance $R = 4 + \frac{3 \times 6}{3+6} = 6\Omega$ and main current $i = \frac{E}{R} = \frac{3}{6} = 0.5A$

Now potential difference across the combination of 3Ω and 6Ω , $V = 0.5 \times \left(\frac{3 \times 6}{3+6}\right) = 1\text{Volt}$

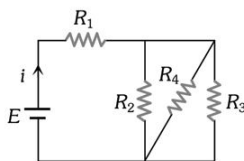
3. (d) Let the value of shunt be r . Hence the equivalent resistance of branch containing S will be $\frac{Sr}{S+r}$

In balance condition, $\frac{P}{Q} = \frac{Sr/(S+r)}{R}$. This gives $r = 8\Omega$



4. (c) In given circuit three resistance R_2, R_4 and R_3 are parallel.

$$\begin{aligned} \frac{1}{R} &= \frac{1}{R_2} + \frac{1}{R_4} + \frac{1}{R_3} \\ &= \frac{1}{50} + \frac{1}{50} + \frac{1}{75} \\ &= \frac{75+75+50}{50 \times 75} \end{aligned}$$



$$R = \frac{50 \times 75}{75 + 75 + 50} = \frac{50 \times 75}{200} = \frac{75}{4} \Omega = 18.75\Omega$$

This resistance is in series with R_1

$$\therefore R_{\text{resultant}} = R_1 + R = 100 + 18.75 = 118.75\Omega$$

5. (b) When resistances 4Ω and 12Ω are connected in series $= 4 + 12 = 16\Omega$

When these resistance are connected in parallel.

$$\frac{1}{R_p} = \frac{1}{4} + \frac{1}{12} \Rightarrow R_p = \frac{4 \times 12}{4+12} = \frac{4 \times 12}{16} = 3\Omega$$

6. (b) Since voltmeter records $5V$, it means the equivalent. Resistance of voltmeter and 100Ω must be 50 , because in series grouping if resistances are equal, they share equal potential difference. It conclude that resistance of voltmeter must be 100Ω .

7. (b) For no current through galvanometer, we have

$$\left(\frac{E_1}{500+X}\right)X = E \Rightarrow \left(\frac{12}{500+X}\right)X = 2 \Rightarrow X = 100 \Omega$$

8. (a) $0.9(2+r) = 0.3(7+r) \Rightarrow 6+3r = 7+r \Rightarrow r = 0.5 \Omega$

9. (a) Since both the resistors are same, therefore potential difference $= V+V = E \Rightarrow V = \frac{E}{2}$

10. (b) Let the current in the circuit $= i = \frac{V}{R}$

$$\text{Across the cell, } E = V + ir \Rightarrow r = \frac{E-V}{i} = \frac{E-V}{V/R} = \left(\frac{E-V}{V}\right)R$$

11. (a) For maximum energy, we have
External resistance of the circuit

$$= \text{Equivalent internal resistance of the circuit i.e. } R = \frac{r}{2}$$

12. (a) $E \propto l$ (balancing length)

13. (b) $r = \left(\frac{l_1-l_2}{l_2}\right) \times R = \left(\frac{l_1-2}{2}\right) \times 5 \dots (i)$

$$\text{and } r = \left(\frac{l_1-3}{3}\right) \times 10 \dots (ii)$$

On solving (i) and (ii) $r = 10 \Omega$

14. a

15. (b) In the part $c b d$,

$$V_c - V_b = V_b - V_d \Rightarrow V_b = \frac{V_c + V_d}{2}$$

In the part $c a d$

$$V_c - V_a > V_a - V_d \Rightarrow \frac{V_c + V_d}{2} > V_a \Rightarrow V_b > V_a$$

16. (b) Volume $= Al = 3 \Rightarrow A = \frac{3}{l}$

$$\text{Now } R = \rho \frac{l}{A} \Rightarrow 3 = \frac{\rho \times l}{3/l} = \frac{\rho l^2}{3} \Rightarrow l^2 = \frac{9}{\rho} = \frac{3}{\sqrt{\rho}}$$

17. (a) With rise in temperature specific resistance increases

18. (d) Charge $= \text{Current} \times \text{Time} = 5 \times 60 = 300 \text{ C}$

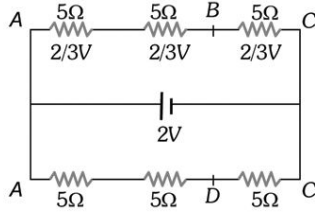
19. (d) $R = \frac{V}{i} = \frac{100 \pm 0.5}{10 \pm 0.2} = 10 \pm 0.25 \Omega$.

20. (d) $R \propto \frac{l^2}{m} \Rightarrow R_1 : R_2 : R_3 = \frac{l_1^2}{m_1} : \frac{l_2^2}{m_2} : \frac{l_3^2}{m_3}$

$$\Rightarrow R_1 : R_2 : R_3 = \frac{9}{1} : \frac{4}{2} : \frac{1}{3} = 27 : 6 : 1$$

21. (d) $\frac{R_1}{R_2} = \left(\frac{r_2}{r_1}\right)^4 \Rightarrow \frac{R}{R_2} = \left(\frac{3r/4}{r}\right)^4 = \frac{81}{256} = R_2 = \frac{256}{81}R$

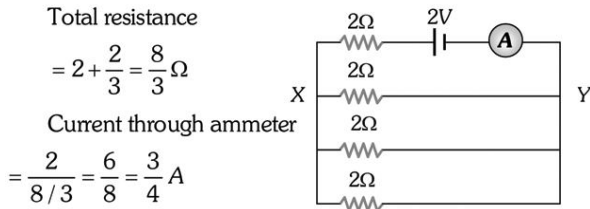
22. (c) The given circuit can be redrawn as follows



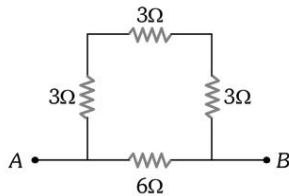
For identical resistances, potential difference distributes equally among all. Hence potential difference across each resistance is $\frac{2}{3}V$, and potential difference between A and B is $\frac{4}{3}V$.

23. (c) $R_{\text{equivalent}} = \frac{(30 + 30)30}{(30 + 30) + 30} = \frac{60 \times 30}{90} = 20\Omega$
 $\therefore i = \frac{V}{R} = \frac{2}{20} = \frac{1}{10} \text{ ampere}$

24. (b) Resistance across XY = $\frac{2}{3}\Omega$

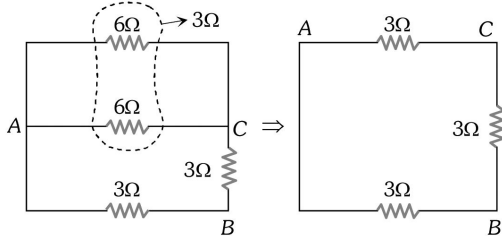


25. (d) The circuit reduces to



$$R_{AB} = \frac{9 \times 6}{9 + 6} = \frac{9 \times 6}{15} = \frac{18}{5} = 3.6\Omega$$

26. (b) Given circuit is equivalent to

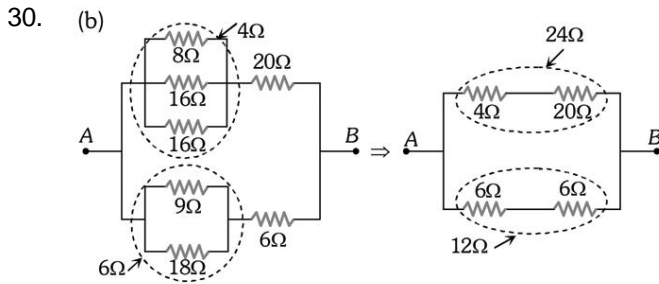


So the equivalent resistance between points A and B is equal to $R = \frac{6 \times 3}{6 + 3} = 2\Omega$

27. (b) Current through each arm DAC and DBC = 1A
 $V_D - V_A = 2$ and $V_D - V_B = 3 \Rightarrow V_A - V_B = +1V$

28. (d) $R_{\text{effective}} = r + \frac{3r}{2} = \frac{5r}{2}$

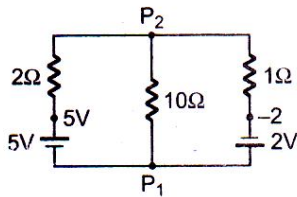
29. (c) $V_p - V_q = \left(\frac{6}{3} + \frac{12 \times 6}{12 + 6}\right)(0.5) = (2 + 4)(0.5) = 3V$



$$R_{AB} = \frac{24 \times 12}{24 + 12} = 8\Omega$$

31. Internal resistance of the cell,
 $r = \frac{E - V}{V} R = \frac{2.2 - 2}{2} \times 4\Omega = 0.4\Omega$

32. Let potential of P_1 be 0 V and potential of P_2 be V_0 .
 Now, apply KCL at P_2 .



$$\frac{V_0 - 5}{2} + \frac{V_0 - 0}{10} + \frac{V_0 - (-2)}{1} = 0$$

or $V_0 = \frac{5}{16}$

33. From the given circuit,
 $V_A - (6 \times 2) - 12 - (9 \times 2) + 4 - (5 \times 2) = V_B$
 or $V_A - 12 - 12 - 18 + 4 - 10 = V_B$
 or $V_A - V_B = 48 \text{ volt}$

34.

35. As the PD between 4Ω and 3Ω (in parallel) are the same,

$$4 \times 1 \text{ amp} = 3 \times i_1 \text{ or } i_1 = \frac{4}{3} \text{ A (Let } i_1 = \text{Current in}$$

3Ω resistance)

$$\text{Total resistance of } 4 \Omega \text{ and } 3 \Omega = 12/7 \Omega$$

$$\text{Current in } MQP \text{ (upper branch)} = 1 + \frac{4}{3} = \frac{7}{3} \text{ A}$$

$$\therefore \text{ PD (across upper branch)} = \frac{12}{7} \times \frac{7}{3} = 4 \text{ V}$$

$$\text{Current in } MNP = \frac{4}{125} = \frac{4 \times 4}{5} = \frac{16}{5} \text{ A}$$

$$\begin{aligned} \therefore \text{ PD across } 1 \Omega &= \frac{16}{5} \text{ A} \times 1 \Omega \\ &= \frac{16}{5} \text{ volt} = 3.2 \text{ volt} \end{aligned}$$

36. Before adding, total resistance = 5Ω
 After adding, the central one is a Wheatstone network
 \therefore Total resistance = $1 + (2 \text{ and } 2 \text{ in parallel}) + 1$
 $= 3 \Omega$
 \therefore Ratio of resistances = $(5/3)$

37. From balanced Wheatstone bridge concept,

$$\frac{55 \Omega}{R} = \frac{20}{80}$$

$$\text{or } R = 220 \Omega$$

- 38.

$$I = \frac{2E}{R + R_1 + R_2}$$

According to given condition, $E - IR_2 = 0$

$$\text{or } \frac{E}{R_2} = I = \frac{2E}{R + R_1 + R_2}$$

$$\text{or } R_1 + R_2 + R = 2R_2$$

$$\text{or } R = R_2 - R_1$$

39. Current through arm CAD , $I = \frac{V}{8}$ amp

Potential difference between C and A

$$V_C - V_A = \frac{V}{8} \times 4 = \frac{V}{2} \text{ Volt}$$

Current through CBD , $I' = \frac{V}{4}$ amp

Potential difference between C and B

$$V_C - V_B = \frac{V}{4} \times 1 = \frac{V}{4} \text{ Volt}$$

Potential difference between A and $B = V_A - V_B$

$$\begin{aligned} \therefore V_A - V_B &= (V_C - V_B) - (V_C - V_A) \\ &= \frac{V}{4} - \frac{V}{2} = -\frac{V}{4} \end{aligned}$$

$$\text{or } V_A - V_B < 0 \text{ or } V_A < V_B$$

As $V_A < V_B$, so direction of current will be from B to A .



40. Applying Kirchhoff's loop rule to give mgh , we get;

$$-3i - 10i - 3i - 5.2 + 10 = 0$$

or $i = 0.3$ amp

41. Since, given circuit is in the form of Wheatstone bridge,

$$\frac{1}{R_{eq.}} = \frac{1}{(4+2)} + \frac{1}{(6+3)}$$

$$\therefore R_{eq.} = \frac{18}{5}$$

$$\therefore V = i R_{eq.} \quad \text{or} \quad i = \frac{V}{R_{eq.}} = \frac{5V}{18}$$

42. From Kirchhoff's law,

$$I \times 2 + I \times 1 = 18 - 12 = 6$$

Current in the circuit,

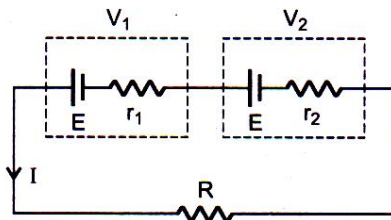
$$I = \frac{V}{R} = \frac{6}{3} = 2 \text{ A}$$

Voltage drop across 2Ω ,

$$V_1 = 2 \times 2 = 4 \text{ V}$$

\therefore Voltmeter reading = $18 - 4 = 14$ volt

- 43.



From circuit, $V_1 + V_2 = IR$

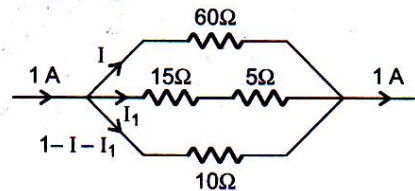
or $E - Ir_1 + E - Ir_2 = IR$

Given, $Ir_1 = E$

$\therefore Ir_1 - Ir_1 + Ir_1 - Ir_2 = IR$

$\therefore R = r_1 - r_2$

44. Using voltage is same in all three branches:



45. The given network of resistances between points A and B is equivalent to a balanced Wheatstone bridge.

Hence, $R_{AB} = R$

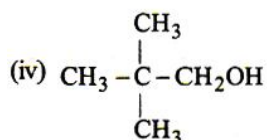
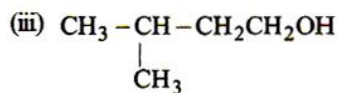
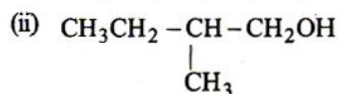
and current flowing in $AFCEB = \frac{V}{2R}$

- 46.

Glycol is used as an antifreeze in automobiles.

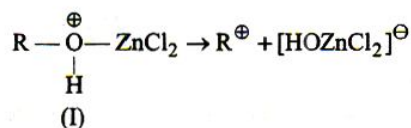
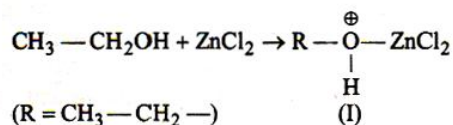
47.

Four primary alcohols of $C_5H_{11}OH$ are possible. These are:



48.

$ZnCl_2$ is a Lewis acid and interacts with alcohol.

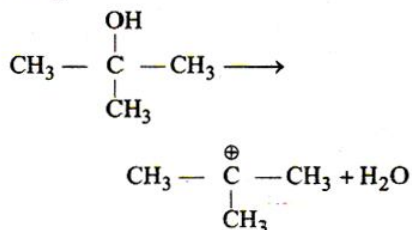


1 mole of carbon = 12 gm of carbon
 $= 6.023 \times 10^{23}$ C-atoms.

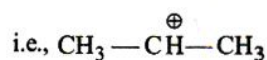
Carbocation is formed as an intermediate in the S_N1 mechanism which this reaction undergoes.

In the absence of $ZnCl_2$, formation of primary carbocation is difficult which is the case with (ii) while (i) undergoes reaction.

(iii) Tertiary carbocation is easily formed due to its stability.

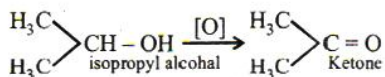
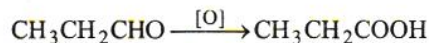


(iv) In the presence of $ZnCl_2$, 2° carbocation is formed from $(CH_3)_2-\underset{\substack{| \\ H}}{C}-OH$

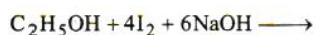


54.

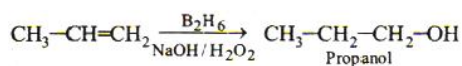
Primary alcohol on oxidation give aldehyde which on further oxidation give carboxylic acid whereas secondary alcohols give ketone.



55.

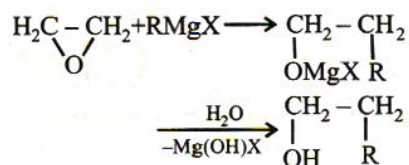


56.



57.

We know that



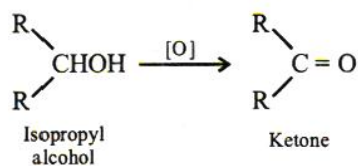
58.

Due to -I-effect of the three C-Cl-bonding between Cl and C-atom of the OH group, $\text{CCl}_3\text{CH}(\text{OH})_2$ is most stable.

59.

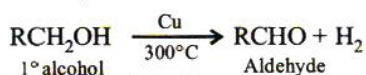
Secondary alcohols on oxidation give ketones.

Note : - Primary alcohols form aldehydes.



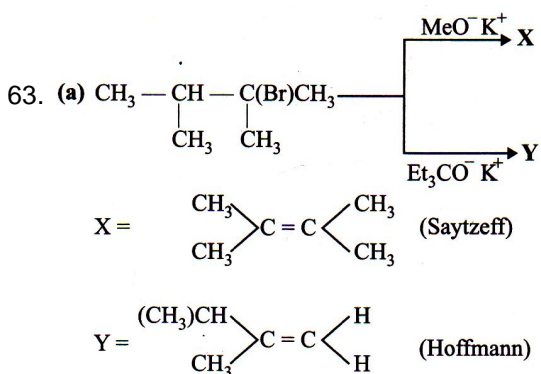
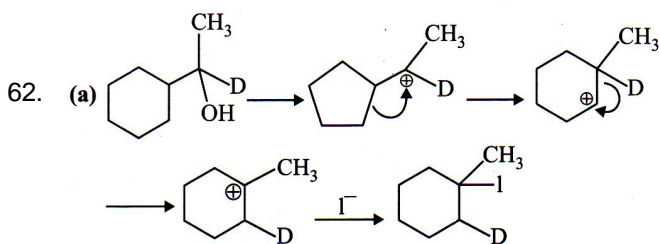
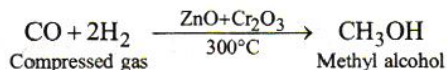
60.

1° Alcohols on catalytic dehydrogenation give aldehydes.



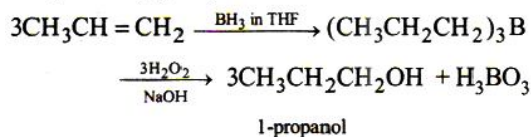
61.

Water gas is mixed with half of its volume of hydrogen. The mixture is compressed to approximately 200 – 300 atmospheres. It is then passed over a catalyst ($\text{ZnO} + \text{Cr}_2\text{O}_3$) at 300°C . Methyl alcohol vapours are formed which are condensed



64.

KMnO_4 (alkaline) and $\text{OsO}_4 / \text{CH}_2\text{Cl}_2$ are used for hydroxylation of double bond while O_3 / Zn is used for ozonolysis. Therefore, the right option is (c), i.e.,



65.

Lucas reagent is conc. $\text{HCl} + \text{anhyd. ZnCl}_2$.

66.

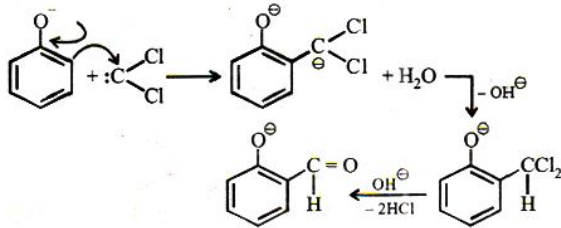
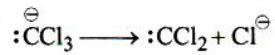
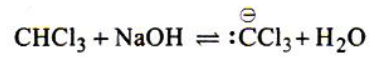
Electron withdrawing $-\text{NO}_2$ group has very strong $-I$ and $-R$ effects so, compound 3 will be most acidic.

67.

This is an example of Williamson ether synthesis reaction in which sodium alkoxide reacts with alkyl halide and gives ether.

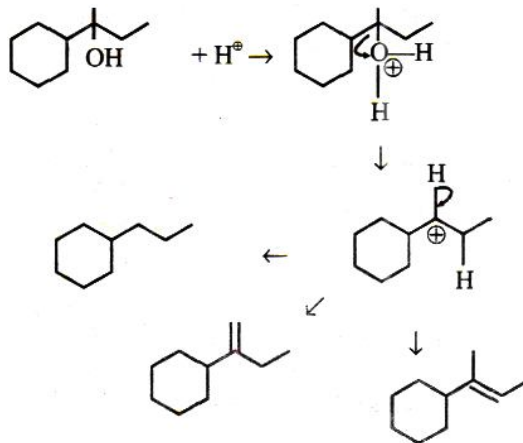


68.

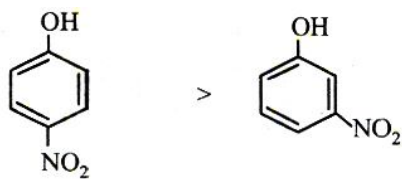


Therefore functional group - CHO is introduced.

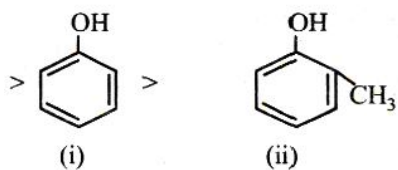
69.



70.



(iv) (-I and -M effects, both increase acidity) > (iii) (only -I effect)



(i) > (ii) (+I effect of CH₃ group decreases acidity)

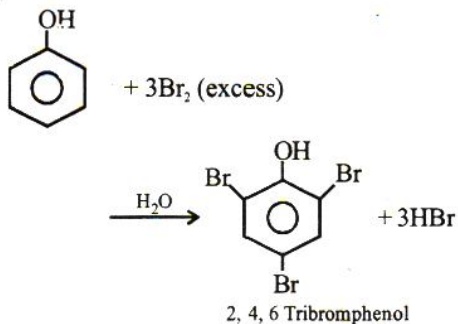
∴ Correct choice : (b)

71.

Phenol is most acidic because its conjugate base is stabilised due to resonance, while the rest three compounds are alcohols, hence, their corresponding conjugate bases do not exhibit resonance

72.

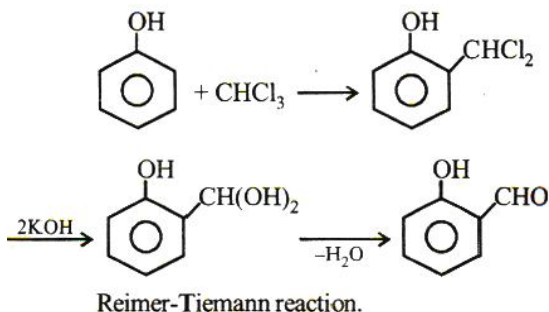
With Br_2 water, phenol gives 2, 4, 6-tribromophenol.



73.

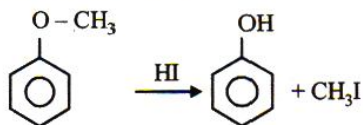
Due to strong electron-donating effect of the OH group, the electron density in phenol is much higher than that in toluene, benzene and chlorobenzene and hence phenol is readily attacked by the electrophile.

74.



75.

When $\text{Ar}-\text{O}-\text{R}$ ethers are reacted with HI, they are cleaved at weaker $\text{O}-\text{R}$ bond to give phenol and alkyl iodide.



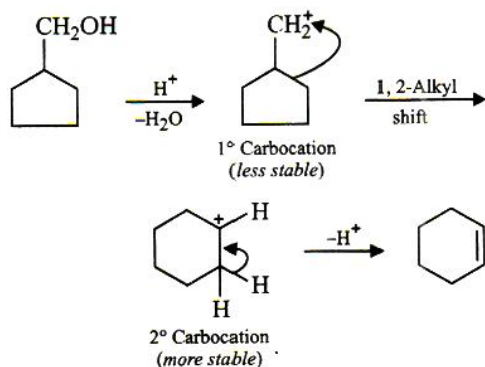
76. (d) As this is alkaline hydrolysis.

77.

Williamson synthesis is one of the best methods for the preparation of symmetrical and unsymmetrical ethers. In this method, an alkyl halide is allowed to react with sodium alkoxide.



84.



85.

$\text{C}_2\text{-OH}$ is 3° while $\text{C}_5\text{-OH}$ is 2° . Since 3° alcohols are weaker acids than 2° alcohols, therefore, 3° alcohols are stronger bases than 2° alcohols, *i.e.*, option (a) is correct.

86.

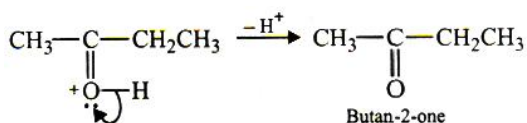
The order of reactivity depends upon the stability of the carbocations formed, *i.e.*, $\text{FCH}_2\text{CH}^+\text{CH}_3$, $\text{FCH}_2\text{CH}_2\text{CH}^+\text{CH}_3$, $\text{CH}_3\text{CH}^+\text{CH}_3$ and PhCH_2^+ . Since the relative stabilities of these carbocations follow the order:

$\text{PhCH}_2^+ > \text{CH}_3\text{CH}^+\text{CH}_3 > \text{FCH}_2\text{CH}_2\text{CH}^+\text{CH}_3 > \text{FCH}_2\text{CH}^+\text{CH}_3$, therefore, the order of reactivity of the alcohols (I, II, III and IV) follows the sequence: $\text{IV} > \text{III} > \text{II} > \text{I}$.

87.

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88.

89.

Due to almost identical sizes of $2p$ -orbitals of C and F, +R-effect and -I-effect of F almost balance each other and hence p -fluorophenol is almost as acidic as phenol. However, p -chlorophenol and p -nitrophenol are more acidic than phenol. Further, due to stronger -R and -I-effect of NO_2

group, p -nitrophenol is a much stronger acid than p -chlorophenol in which Cl has only weak +R and -I-effect. Thus, option (c) is correct.

90.

3° Alcohols react fastest with Lucas reagent by $\text{S}_{\text{N}}1$ mechanism (*i.e.*, carbocation intermediate) to give turbidity.