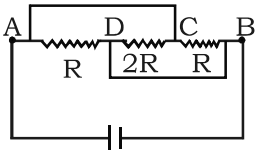
MAHESH TUTORIALS SCIENCE

00 – 00		Q. Booklet Serial No: 120715	
Test No : 1211	3 Hrs.		Q. Booklet Version : 11

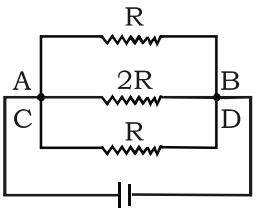
Hints & Solutions

PART A - PHYSICS

1. **b)** **From right to left**



equivalent circuit is :

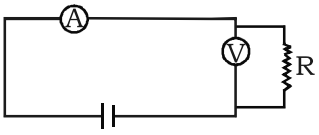


Right side of 2R is at higher potential. so, Current will flow from right to left

2. **a)** **Zero**

In steady state both the capacitor will be fully charged and act as open circuit. Circuit is not complete, so, potential different across all circuit element is zero.

3. **d)** **A will increase, V will decrease**



Initially $R_V \to \infty$ If we add a resistance parallel to voltmeter

$R_{eff} < R_V$

$I = \frac{V}{R}$ as R decreases, V will increases.

Let the resistance of Ammeter is R_A

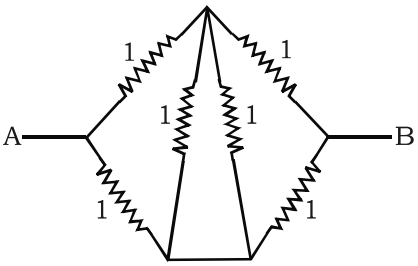
Voltage acress voltmeter is

$$V_r = \frac{V R_{eff}}{R_{eff} + R_A} = \frac{V}{1 + \frac{R_A}{R_{eff}}}$$

If R_{eff} decreases, V will also decrease.

4. **c)** $\frac{8}{7}\Omega$

Circuit can be redrawn as :



$R_{eq} = \frac{8}{7}\Omega$

5. **b)** **2C $I^2 R^2$**

Current through the resistance parallel to capacitor is 2I

p d = 2IR

So, potential difference across capacitor is 2IR.

$U = \frac{1}{2}CV^2 = \frac{1}{2}C(2\,I\,R)^2$

$= 2C\,I^2R^2$

6. **a)** **In all cases**

Initially : – $\frac{R_1}{R_4} = \frac{R_2}{R_3}$

If we change the position of cell and galvanometer. For zero deflection,

$\frac{R_1}{R_2} = \frac{R_3}{R_4}$

If $\frac{R_1}{R_4} = \frac{R_2}{R_3} \Rightarrow \frac{R_1}{R_2} = \frac{R_3}{R_4}$

i.e, if the bridge is balanced, by changing the position of galvanometer also it will be balanced.

7. **b)** **The potential difference between point X and ground would increase**

If switch is open, equivalent resistance of the circuit will increase. so, current will decreases. so, Pd between earth and x will increase.

8. **b)** **6.7×10^{-4} Cm^{-2}**

$dq = \sigma . b dx$

b is width

$$\frac{dq}{dt} = \sigma b \frac{dx}{dt}$$

$$I = \sigma b v$$

$$\sigma = \frac{I}{bV} = \frac{10^{-4}}{50cm \times 30cm/s}$$

$$\sigma = \frac{1}{15} \times 10^{-6}$$

$\sigma = 6.7 \times 10^{-8}$ C cm^{-2}

$\sigma = 6.7 \times 10^{-4}$ C Cm^{-2}

9. **c)** $\frac{\rho_1 + \rho_2}{2}$

$R = R_1 + R_2$

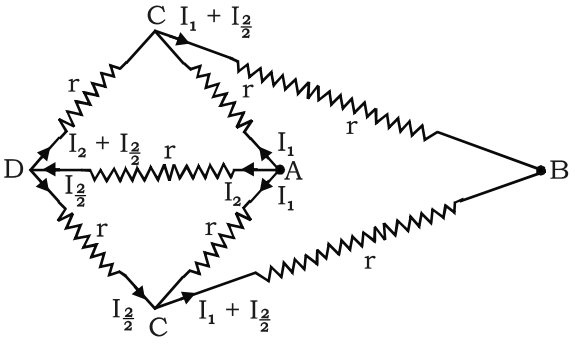
$$\rho \frac{L_1 + L_2}{A} = \rho_1 \frac{L_1}{A} + \rho_2 \frac{L_2}{A}$$

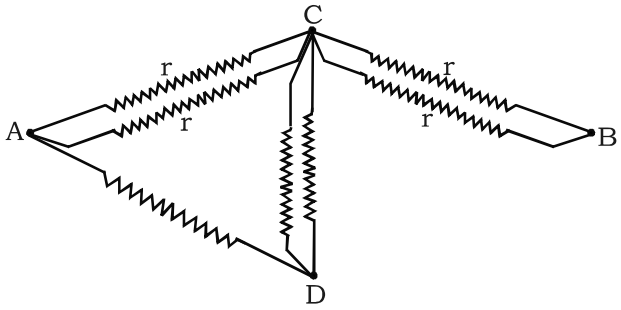
$$\rho = \frac{\rho_1 L_1 + \rho_2 L_2}{L_1 + L_2}$$

If $L_1 = L_2$

$$\rho = \frac{\rho_1 + \rho_2}{2}$$

10. **b)** $\frac{7r}{8}$





$$r_{eq} = \frac{\frac{3r}{2} \cdot \frac{r}{2}}{\frac{3r}{2} + \frac{r}{2}} + \frac{r}{2}$$

$$= \frac{3r}{8} + \frac{r}{2}$$

$$= \frac{7r}{8}$$

11. **a)** **20Ω**

Assume that we are connecting a resistance r.

so,

$$\frac{\frac{20}{20r}}{20 + r} = \frac{10}{5}$$

$$10 = \frac{20r}{20 + r}$$

$2r = 20 + r$

$r = 20\Omega$

12. **a)** $\frac{2Rr}{R + r}$

This is two balanced wheatstone bridge

$$\frac{1}{R_{eq}} = \frac{1}{4R} + \frac{1}{2r} + \frac{1}{4R}$$

$$\frac{1}{R_{eq}} = \frac{1}{2R} + \frac{1}{2r}$$

$$\frac{1}{R_{eq}} = \frac{(R + r)}{2Rr}$$

$$R_{eq} = \frac{2Rr}{R + r}$$

13. **b)** **D to B**

Without resistance R

$V_D > V_B$

So, Current will flow from D to B

14. **a)** **300%**

Let initially resistance is r

Initial length is L and Area A.

As length increased by 100%, new length will be 2L. Let new Area is A′

V = const

LA = 2L . A′

$A' = \frac{A}{2}$

new resistance $r' = \rho . \frac{2L}{\frac{A}{2}}$

$= 4r$

$\Delta r = 3r$

$\% \Delta r = \frac{\Delta r}{r} \times 100 = 300\%$

15. **b)** $\frac{1}{3}$

$\frac{I_1}{I_2} = \frac{R_2}{R_1}$

$\frac{I_1}{I_2} = \frac{\frac{L_2}{A_2}}{\frac{L_1}{A_1}} = \frac{A_1}{A_2}.\frac{L_2}{L_1}$

$= \frac{A_1 / A_2}{L_1 / L_2}$

$= \frac{\left(\frac{r_1}{r_2}\right)^2}{L_1 / L_2}$ $\frac{4/9}{4/3}$

$= \frac{1}{3}$

16. **c)** $\frac{q\omega}{2\pi}$

$I = \frac{Q}{T} = \frac{q}{2\pi / \omega} = \frac{q\omega}{2\pi}$

17. **a)** **is doubled**

$V_d = \frac{eM}{me} E$

If V is doubled, electric field will also be doubled. So, V_d is doubled.

18. **b)** **700 K**

$R = R_0[1 + \alpha \Delta T]$

$1.5 = 1[1 + 0.00125 \times (T - 300)]$

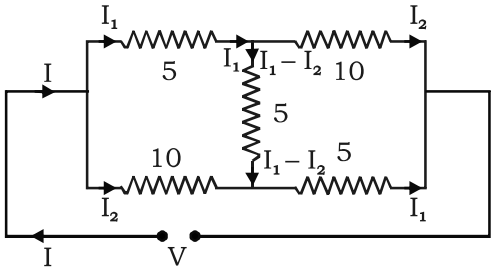
$0.5 = 0.00125(T - 300)$

$T - 300 = \frac{0.5000}{0.0125}$

$T - 300 = 400$

$T = 700$ K

19. **c)** **7 ohm**



Let equivalent resistance is B

V = IR

$I = I_1 + I_2$ .... (i)

$V = I_1 5 + (I_1 - I_2)5 + I_1.5$

$V = 15 I_1 + 5I_2$ .... (ii)

$V = I_1.5 + I_2.10$ .... (iii)

from (ii) and (iii)

$10 I_2 + 5 I_1 = V]$

$15 I_1 - 5 I_2 = V] \times 2$

$35I_1 = 3V$

$I_1 = \frac{3V}{35}$

$10I_2 + 5I_1 = V$

$10I_2 + \frac{15V}{35} = V$

$10I_2 = V - \frac{15V}{35}$

$10I_2 = \frac{20V}{35}$

$I_2 = \frac{2V}{35}$

$$\therefore \quad R = \frac{V}{I} = \frac{V}{I_1 + I_2}$$

$$= \frac{V}{\frac{3V}{35} + \frac{2V}{37}} = 7\Omega$$

20. **c) 9.85 Ω**

4, 6, 12 and 20 are in parallel

$$\frac{1}{R_{1_{eq}}} = \frac{1}{4} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20}$$

$$\frac{1}{R_{1_{eq}}} = \frac{15 + 10 + 5 + 3}{60}$$

$$= \frac{33}{60} = \frac{11}{20}$$

$$\frac{1}{R_{1_{eq}}} = \frac{20}{11}$$

3, 5 and $R_{1_{eq}}$ are in series

$$R_{eq} = 8 + \frac{20}{11}$$

$$= \frac{108}{11} = 9.8$$

21. **a) 1.7 A**

Junction rule,

$I = 1.7\ A$

22. **d)** $\frac{\alpha_1 + \alpha_2}{2}, \frac{\alpha_1 + \alpha_2}{2}$

$R_1 = R_{o_1}[1 + \alpha_1 \Delta T]$

$R_2 = R_{o_2}[1 + \alpha_2 \Delta T]$

For series

$R = R_1 + R_2$

$= R_{o_1}[1 + \alpha_1 \Delta T] + R_{o_2}[1 + \alpha_2 \Delta T]$

$R_1 + R_2 = \left(R_{o_1} + R_{o_2}\right) + R_{o_1}\alpha_1 \Delta T] + R_{o_2}\alpha_2 \Delta T]$

$R_1 + R_2 =$

$$\left(R_{o_1} + R_{o_2}\right)\left[1 + \frac{R_{o_1}\alpha_1 \Delta T + R_{o_2}\alpha_2 \Delta T}{R_{o_1} + R_{o_2}}\right]$$

$$R = R_0\left[1 + \frac{R_{o_1}\alpha_1 + R_{o_2}\alpha_2}{R_{o_1} + R_{o_2}}\Delta T\right]$$

$$\alpha_{eff} = \frac{R_{o_1}\alpha_1 + R_{o_2}\alpha_2}{R_{o_1} + R_{o_2}}$$

If $R_{o_1} = R_{o_2}$

$$\alpha_{eff} = \frac{\alpha_1 + \alpha_2}{2}$$

Similarly in case of parallel

$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$$

$$\frac{R_{o_1}R_{o_2}}{R_{o_1}R_{o_2}}(1 + \alpha\Delta T) =$$

$$\frac{R_{o_1}(1 + \alpha_1 \Delta T)R_{o_2}(1 + \alpha_2 \Delta T)}{R_{o_1}(1 + \alpha_1 \Delta T) + R_{o_2}(1 + \alpha_2 \Delta T)}$$

$$(1 + \alpha\Delta T) = \frac{(1 + \alpha_1 \Delta T)(1 + \alpha_2 \Delta T)}{\left(1 + \frac{\alpha_1 + \alpha_2}{1}\Delta T\right)}$$

$$(1 + \alpha\Delta T) = 1 + \left(\alpha_1 + \alpha_2 - \frac{\alpha_1 + \alpha_2}{2}\right)\Delta T$$

$$= \alpha_1 + \alpha_2$$

23. **b) 1.5 A**

$R_{eq} = 2W$

$$I = \frac{V}{R_{eq}} = \frac{3}{2}A$$

24. **b) Both have the same resistance**

$A_S = 2A_R$

$L_S = 2L_R$

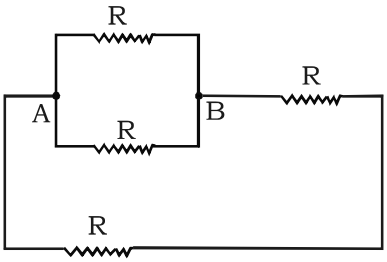
So, $\frac{L_S}{A_S} = \frac{L_R}{A_S}$

$I_S = I_R$

25. **b)** $\frac{E}{3R}$

26. **c) 2 R/5**

The points which are earthed are connected



$$R_{eq} = \frac{\frac{R}{2} \cdot 2R}{\frac{R}{2} + 2R} = \frac{R^2}{5R/2}$$

$$= 2R/5$$

27. **d) 2.75 Ω**

Resistance of two parts will be

$$R_1 = \frac{\pi/6}{2\pi} R_o$$

$$= \frac{R_o}{12} = 3\Omega$$

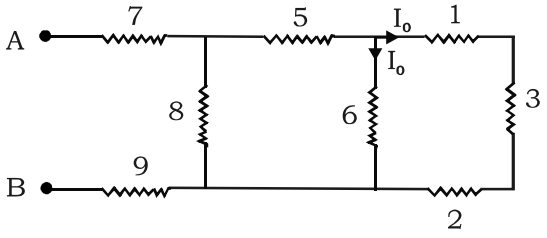
$$R_2 = 33\Omega$$

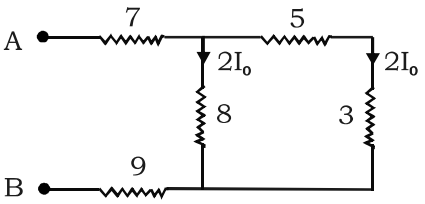
$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$$

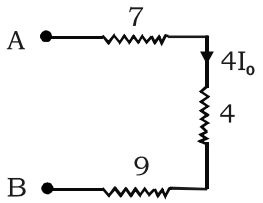
$$= \frac{33 \times 3}{36} = \frac{33}{12}\Omega$$

$$= 2.75\ \Omega$$

28. **a) 20 volt**







$V = 20.4\ I_o$

$V = 80 . 0 . 25$

$$V = 80 \times \frac{25}{100}$$

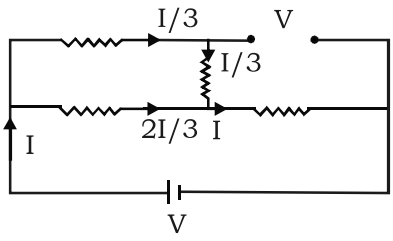
$V = 20V$

29. **a) 4 rows, 6 cells in a row**

$$\frac{r}{R} = \frac{m}{n}$$

$m = 4, \quad n = 6$

30. **c) 12 volt**



$V = 15V$

$R_{eq} = 5R/3 = 5W$

$I = 3A$

$$V = \frac{I}{3} R + I\,R$$

$$V = \frac{3}{3} . 3 + 3 . 3$$

$V = 12\ V$

PART B - CHEMISTRY

31. **c) 2-propanol**

$CH_3CH_2CH_2OH \xrightarrow{PCl_5} CH_3CH_2CH_2Cl$ (A)

$\xrightarrow[-HCl]{\text{alc. KOH}} CH_3CH = CH_2$

$\xrightarrow[(ii)H_2O.heat]{(i)conc.H_2SO_4} CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$

2–Propanol

32. **c) $(CH_3)_2CHMgBr$ acid hydrolysis**

$(CH_3)_2CHMgBr + C_6H_5-\overset{\overset{O}{\|}}{C}-CH_3$

$\left((CH_3)_2\overset{\ominus}{C}H\,Mg^{2+}\,Br^{\ominus}\right)$

$\longrightarrow C_6H_5-\underset{\underset{CH_3}{|}}{\overset{\overset{O^{\ominus}}{|}}{C}}-CH\begin{matrix}CH_3\\CH_3\end{matrix}$

$\xrightarrow{H^+/H_2O} C_6H_5-\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}-\overset{\overset{CH_3}{|}}{CH}-CH_3$

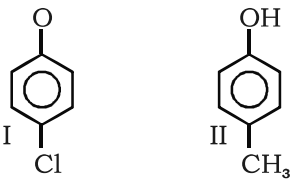
33. **d) 2-methyl-2-propanol**

$CH_3-\underset{\underset{NH_2}{|}}{CH}-CH_3 \xrightarrow{HNO_2} CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$ (A)

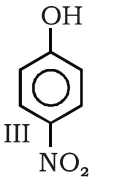
$\xrightarrow[oxd^n]{[O]} CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ (B) $\xrightarrow[ii)\ H^+/H_2O]{i)\ CH_3MgI} CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$

(2–methyl–2–propanol)

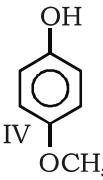
34. **d) III > I > II > IV**



$-Cl \Rightarrow -I > +R$ $\quad -CH_3 \Rightarrow HC, +I$



$-NO_2 \Rightarrow -I, -R$



$-OCH_3 \Rightarrow +R > -I$

EWG increases acidic strength.

III > I > II. IV

35. **b) CH_3OH**

rate of esterification $\propto$

$$\frac{1}{\text{steric hindrance on alkyl group of alcohol as well as acid}}$$

36. **c) Acetylene**

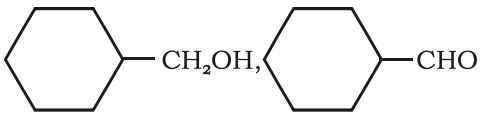
only 1 π bmd can be formed

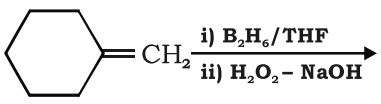
$\therefore$ aceylene cant be formed

37. **c) Tertiary alcohol by S_N1**

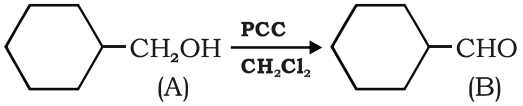
Lucas test follows S_N1 mechanism

38. **c)**





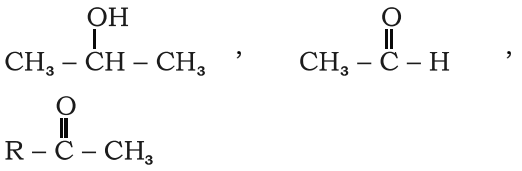
(Anti Markonikoff Add^n)



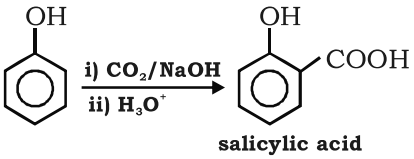
39. **c) isobutyl alcohol**

+ve Iodoform test can be shown by.

CH_3-CH_2OH , $R-\underset{\underset{OH}{|}}{CH}-CH_3$,

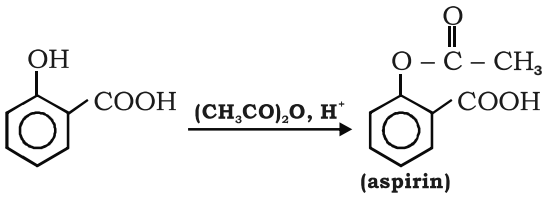


40. **b) salicylic acid**



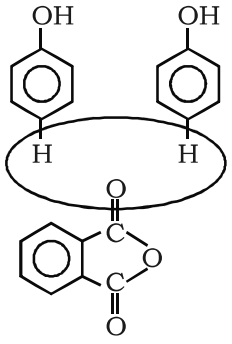
salicylic acid

41. **b) $(CH_3CO)_2O, H^+$.**

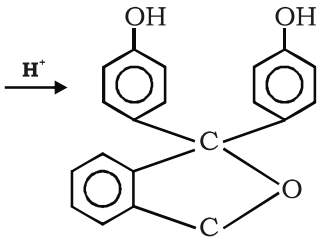


(aspirin)

42. **a) phenolphthalein**

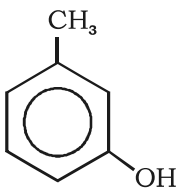


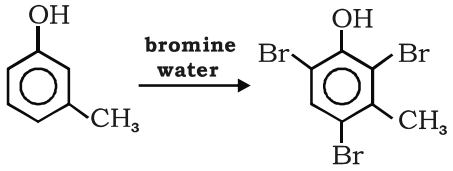
(phthalic anhydride)



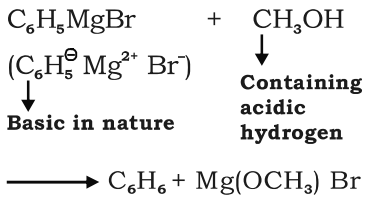
phenolphthalein

43. **c)**



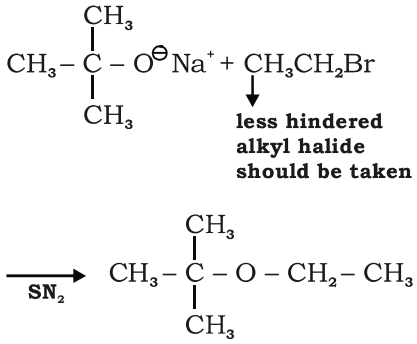


44. **a) C_6H_6**



45. **c) sodium tert-butoxide and ethyl bromide**

Williamson's synthesis follows SN2 reaction



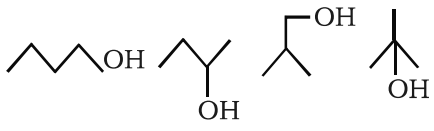
46. **a) $CHCl_3/NaOH$**

Reimer-Tiemann Reaction

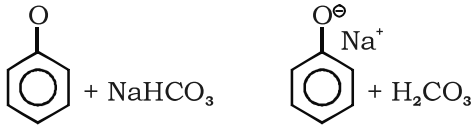
47. **d) Neutral $FeCl_3$**

$FeCl_3$ is used to test enol form

48. **d) 4**

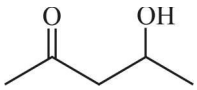


49. **a) sodium bicarbonate**



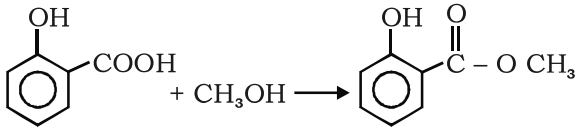
H_2CO_3 is stronger acid than phenol
Rule : Strong acid displace weak acid

50. **a)**



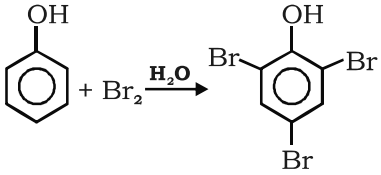
Formation of conjugated system which is stabilised due to resonance. Also **β**–Hydrogen is acidic in option (a)

51. **c) salicylic acid**

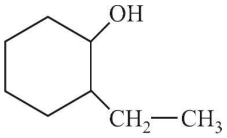


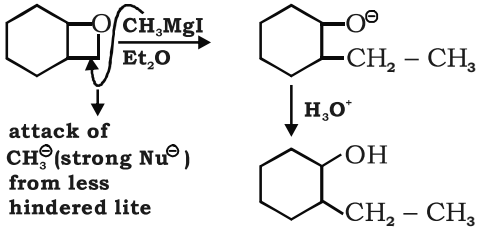
(oil of winter green)

52. **d) 2, 4, 6-tribromophenol**



53. **d)**





54. **b)** **$CH_3—O—CH_3$**

Na reacts with compound having aridic hydrogen and releases H_2 gas.

$$H\,X + Na \longrightarrow Na^+X^\ominus + \frac{1}{2}H_2$$

$$C_2H_5OH + Na \longrightarrow C_2H_5O^\ominus\,Na^+ + \frac{1}{2}H_2$$

$$CH_3COOH + Na \longrightarrow CH_3COO^\ominus\,Na^+ + \frac{1}{2}H_2$$

$$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 + Na$$

$$\longrightarrow CH_3-\underset{\underset{O^\ominus Na^+}{|}}{CH}-CH_3 + \frac{1}{2}H_2$$

$CH_3 – O – CH_3$ + Na
(doesn't contain acidic Hydrogen)
Acidic Hydrogen or active Hydrogen means Hydrogen attached to more electronegative atom.

55. **a) in presence of H_2SO_4 at 413 K**

Ether is formed lower temp (413 K)
Alkene is formed at relatively higher temp (443 K)

56. **d) a sulphide ore**

sulphide ores separted by froth floatating method which is based on different wettability

57. **b) silver**

Fact

58. **b) a reducing agent**

Al is used to reduce the other metal.

59. **d) All**

Copper glance → Cu_2S
Galena → PbS
Iron pyrites → FeS_2
} Roasting is required for sulphide ores to convert into oxides

60. **c) slagging**

Fact