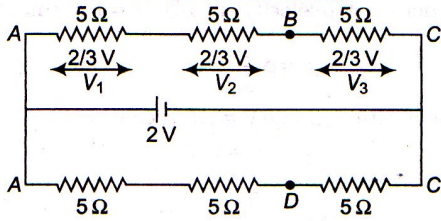


**WEEKLY TEST MEDICAL PLUS - 03 TEST - 23 RAJPUR**  
**SOLUTION Date 12-01-2020**

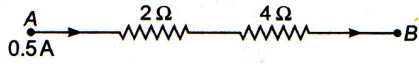
**[PHYSICS]**

1.  $i = neAv_d$  or  $v_d = \frac{i}{neA}$  or  $v_d \propto \frac{i}{A}$
  
2. For cube surface area is  $(50 \times 10^{-2})^2$   
 $\therefore$  Resistance,  $R = \rho \frac{l}{A}$   
 $= 50 \times 10^{-8} \times \frac{50 \times 10^{-2}}{(50 \times 10^{-2})^2}$   
 $= 10^{-6} \Omega$
  
3. Volume of wire =  $Al$   
given,  $3 = Al$   
 $\therefore A = \frac{3}{l}$   
Now, Resistance,  $R = \rho \frac{l}{A}$   
 $3 = \frac{\rho l}{(3/l)} = \frac{\rho l^2}{3}$   
 $\therefore l^2 = \frac{9}{\rho}$   
 $\therefore l = \frac{3}{\sqrt{\rho}}$
  
4. Charge  $q = it$   
 $\therefore i = \frac{q}{t} = qf$   
 $= 1.6 \times 10^{-19} \times 6.6 \times 10^{15}$   
 $\approx 1\text{mA}$
  
5. Resistance,  $R = \rho \frac{l}{A}$   
and Resistivity  $\rho = \frac{m}{ne^2\tau}$   
 $\therefore R = \frac{ml}{ne^2\tau A}$

6. Given circuit can be redrawn as follows



7. The given circuit can be reduced to

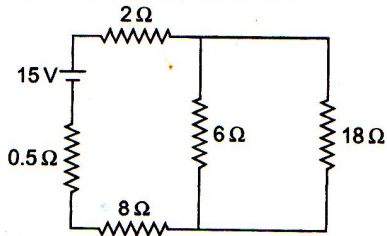


Equivalent resistance between A and B

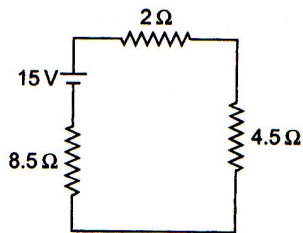
$$R_{AB} = 2 + 4 = 6\Omega$$

$$\therefore V_A - V_B = (6)(0.5) = 3V$$

8. The circuit can be reduced as follows



Step (1)



Step (2)

So, equivalent resistance across battery

$$R_{eq} = 8.5 + 2 + 4.5 = 15\Omega$$

Hence, current from the battery

$$i = \frac{15}{15} = 1A$$

$$9. \quad \text{PD across the circuit} = i \left( \frac{R_1 R_2}{R_1 + R_2} \right) = 1.2 \times \frac{6 \times 4}{6 + 4}$$

$$= 2.88 \text{V}$$

$$\text{So, current through } 6\Omega \text{ resistance} = \frac{2.88}{6} = 0.48 \text{A}$$

**Alternative solution**

From current division law

$$i_1 = \left( \frac{R_2}{R_1 + R_2} \right) i$$

$$= 1.2 \left( \frac{4}{6 + 4} \right) = 1.2 \left( \frac{4}{10} \right)$$

$$= 0.48 \text{A}$$

10. As B connected to earth, so, potential of B is  $V_B = 0$ .  
Now, current in the given circuit,

$$i = \frac{50}{5 + 7 + 10 + 3} = 2 \text{A}$$

Potential difference between A and B is

$$V_A - V_B = 2 \times 12$$

$$\text{or } V_A - 0 = 24$$

$$V_A = 24 \text{V}$$

11. Current divides according to resistance, so current in  $6\Omega$  resistance is  $\frac{0.8}{2} = 0.4 \text{A}$

So, total current in circuit is  $0.8 + 0.4 = 1.2 \text{A}$  $\therefore$  Potential drop across  $4\Omega = 1.2 \times 4 = 4.8 \text{V}$ 

$$12. \quad i = \frac{\text{net emf}}{\text{net resistance}} = \frac{10 - 4}{1 + 2 + 3} = 1 \text{A}$$

13. Kirchhoff's first law, i.e.,  $\sum i = 0$  is based on law of conservation of charge, because at any junction, the incoming charge = outgoing charge.

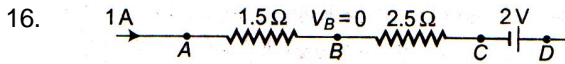
14. It is an open circuit and for open circuit, terminal potential difference = emf of cell i.e.,  $V = E$

15. Potential difference between A and B is given by

$$V_A - V_B = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2}$$

$$\therefore 4 = \frac{5X + 2 \times 10}{X + 10}$$

$$\therefore X = 20 \Omega$$



Potential difference between A and B

$$V_A - V_B = 1 \times 1.5$$

or

$$V_A - 0 = 1.5$$

∴

$$V_A = 1.5 \text{ V}$$

Potential difference between B and C

$$V_B - V_C = 1 \times 2.5$$

$$= 2.5 \text{ V}$$

∴

$$0 - V_C = 2.5 \text{ V}$$

∴

$$V_C = -2.5 \text{ V}$$

So, potential difference between C and D

$$V_C - V_D = -2 \text{ V}$$

or

$$-2.5 - V_D = -2$$

or

$$V_D = -0.5 \text{ V}$$

17. Two resistances are short circuited.

18. PD = 10 V

19.

20. Equal current (of 1 A) will be distributed in the two branches.

$$V_D - V_A = 2 \times 1 = 2 \text{ V}$$

and

$$V_D - V_B = 3 \times 1 = 3 \text{ V}$$

∴

$$V_A - V_B = +1 \text{ V}$$

21.

22.

$$\text{Power } P = \frac{V^2}{R}$$

∴

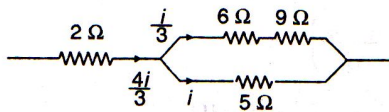
$$P \propto \frac{1}{R}$$

So,

$$\frac{P_1}{P_2} = \frac{R_2}{R_1}$$

23. In series  $i$  is same,  $H = i^2 Rt$ . Therefore,  $H \propto R$ .

24. Current will be distributed in the resistors as shown in figure.



Now,  $10 \text{ (cal/s)} = i^2(5)$  ... (i)

$$P = \left(\frac{4i}{3}\right)^2 (2) \quad \dots \text{(ii)}$$

From these two equations we get,

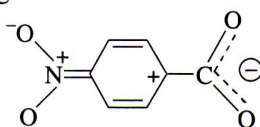
$$P = 7.1 \text{ cal/s}$$

25.  $V_A = E_A - ir_A = 2 - \left(\frac{4}{1.9 + 0.9 + 1}\right)(1.9) = 0$

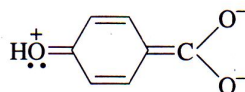
**CHEMISTRY**

46. The order of acid strength is  $\text{RCOOH} > \text{HOH} > \text{ROH} > \text{HC}\equiv\text{CH}$   
Electron-releasing alkyl group R in ROH makes it lesser acidic than  $\text{H}_2\text{O}$ .
47. Nearer the chlorine to the  $-\text{COOH}$  group, stronger the acidity. Hence, the correct order is  
 $\text{CH}_3\text{CH}_2\text{CHClCOOH} > \text{CH}_3\text{CHClCH}_2\text{COOH} > \text{CH}_2\text{ClCH}_2\text{CH}_2\text{COOH}$
48. Larger the electronegativity of halogen, stronger the acidity. Hence, the correct order is  
 $\text{FCH}_2\text{COOH} > \text{BrCH}_2\text{COOH} > \text{ICH}_2\text{COOH}$
49. Tollens reagent gives white precipitate with methanoic acid and not with ethanoic acid.
50. Electron-releasing group makes benzoic acid a weaker acid while electron-attracting group makes it a stronger acid. Stronger the acid, lesser the value of  $\text{p}K_a^\circ$ . Hence, the correct order is  
 $\text{p}K_a^\circ(p\text{-O}_2\text{NC}_6\text{H}_4\text{COOH}) < \text{p}K_a^\circ(\text{C}_6\text{H}_5\text{COOH}) < \text{p}K_a^\circ(p\text{-HOC}_6\text{H}_4\text{COOH})$

51. The nitro group interacts with the phenyl ring and thereby induces some positive charge on the ring bearing the  $\text{COO}^-$  causing a strong electron-withdrawing inductive effects on  $\text{COO}^-$  group. This effect is base-stabilizing and thus acid strengthening.



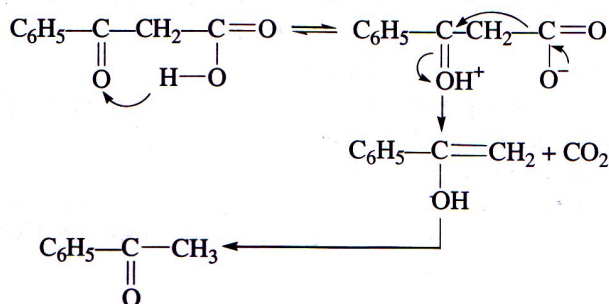
52. At *para* position,  $-\text{OH}$  places negative charge on the carboxylate group and thus making it



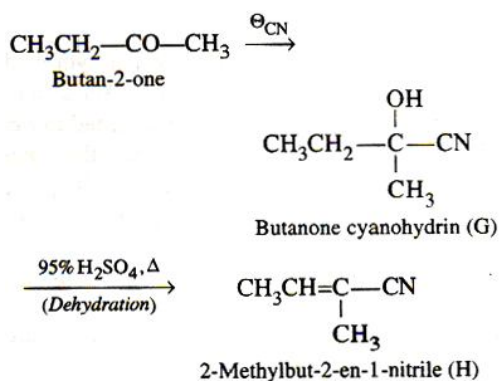
weaker than benzoic acid. This effect predominates over its electron-withdrawing acid strengthening inductive effect. However, at *meta* position, there is no such resonance effect and only inductive effect operates and because of its nearness to the  $\text{COOH}$  group, *meta* isomer is stronger acid than its *para* isomer.

53. *Meta* hydroxy is stronger than *para* isomer (see Q.52). Because of the *ortho* effect, *ortho* isomer is the strongest acid.
54. Increasing crowding near the site of esterification decreases the rate of esterification. Hence, the correct order is  $1^\circ > 2^\circ > 3^\circ$ .
55. Same as Q 54 The correct order is  $\text{RCH}_2\text{COOH} > \text{R}_2\text{CHCOOH} > \text{R}_3\text{CCOOH}$
56.  $\alpha$ -Hydrogen is replaced by chlorine. The product is  $\text{CH}_3\text{CH}(\text{Cl})\text{COOH}$ .
57. Heating calcium formate along with calcium benzoate produces benzaldehyde.
58. The products are CO and  $\text{H}_2\text{O}$ .  $\text{HCOOH} \xrightarrow{\text{Conc. H}_2\text{SO}_4} \text{CO} + \text{H}_2\text{O}$ .
59. The Hell-Volhard-Zelinsky reaction is used in the synthesis of  $\alpha$ -haloacids.
60. In  $p\text{-CH}_3\text{COC}_6\text{H}_4\text{COOH}$ , the CO group is also reduced by  $\text{LiAlH}_4$ .
61. Succinic acid ( $\text{HOOCCH}_2\text{CH}_2\text{COOH}$ ) gives cyclic anhydride on heating.

62.  $\beta$ -Ketoacids are unstable acids. These readily undergo decarboxylation through a cyclic transition state



- 63.
64. Bromine is lesser electronegative than fluorine. Bromine attached to  $\beta$ -carbon will cause least enhancement in the dissociation of halo substituted propanoic acid.
65. Carboxylic acids have relatively high boiling points because of hydrogen bonds. Their boiling points are somewhat higher than those of alcohols of comparable molar masses. Since there exists no hydrogen bondings in aldehydes, their boiling points are lower than those of corresponding alcohols.
66.  $\text{BH}_3/\text{THF}$  followed by  $\text{H}_3\text{O}^+$  reduces only  $-\text{COOH}$  group without affecting  $-\text{CO}-$  group.  $\text{LiAlH}_4$  reduces only  $-\text{COOH}$  group without affecting  $\text{C}=\text{C}$  group.
67. The order of reactivity is acid chloride  $>$  anhydride  $>$  ester.
68. The correct order is  $\text{Cl}^- < \text{RCOO}^- < \text{RO}^-$ .
69. The correct order is  $\text{Cl}^- < \text{RO}^- < \text{NH}_2^-$ .
70. Electron-withdrawal group increasing reactivity of hydrolysis while the electron-releasing group decreases reactivity. The correct order is  $p\text{-O}_2\text{NC}_6\text{H}_4\text{COCl} > \text{PhCOCl} > p\text{-CH}_3\text{OC}_6\text{H}_4\text{COCl}$ .
71. (a)
72. (a)
73. (b)
74. (b)
75. (a)
- 76.



Please note that hydrolysis of cyanides to carboxylic acids requires addition of a molecule of  $\text{H}_2\text{O}$ . Since 95%  $\text{H}_2\text{SO}_4$  cannot supply  $\text{H}_2\text{O}$ , therefore, dehydration of (G) occurs to give (H).

77.

Due to ortho-effect, *o*-nitrobenzoic acid is the strongest acid. Further since electron-withdrawing groups such as  $\text{NO}_2$  increase while electron-donating groups such as  $\text{OH}$  decrease the acid strength w.r.t. parent acid, therefore, the overall acidity increases in the order:  $\text{C} < \text{D} < \text{B} < \text{A}$ , i.e., option (d) is correct.