

WEEKLY TEST OYJ TEST - 18  
SOLUTION Date 18-08-2019

**[PHYSICS]**

1.

Initial magnetic induction,

$$B_i = 0$$

Final magnetic induction,

$$B_f = 5 \times 10^{-4} \text{ tesla}$$

Area,  $A = 1 \text{ m}^2$

Number of turns,  $N = 1000$

Initial flux,  $\phi_i = NAB_i$

Final flux,  $\phi_f = NAB_f$

$$\begin{aligned} \Delta\phi &= \phi_f - \phi_i = NA(B_f - B_i) \\ &= 1000 \times 1 \times (5 \times 10^{-4} - 0) \\ &= 0.5 \text{ weber} \end{aligned}$$

$$\Delta t = 0.1 \text{ sec}$$

$$\begin{aligned} \therefore e &= -\frac{\Delta\phi}{\Delta t} \\ &= -\frac{5 \times 10^{-1}}{0.1} = -5 \text{ volt} \\ e &= 5 \text{ volt (numerically)}. \end{aligned}$$

2.

The wire  $ab$  which is moving with a velocity  $v$  is equivalent to an emf source of value  $Bvl$  with its positive terminal towards  $a$ . Further, the equivalent emf has an internal resistance  $R$ .

$\therefore$  Potential difference

$$V_a - V_b = Bvl - IR.$$

3.

$$\phi = 50t^2 + 4$$

According to Faraday's 2nd law of e.m. induction

$$e = -\frac{d\phi}{dt} = -100t$$

At  $t = 2 \text{ sec}$ ,  $e = -100 \times 2 = -200 \text{ volt}$

$$\therefore I = [e/R] = \frac{200}{400} = 0.5 \text{ amp.}$$

$$4. \quad \frac{1}{2}mv_0^2 = \frac{1}{2}Li_{\max}^2$$

$$\therefore i_{\max} = \sqrt{\frac{m}{L}}v_0$$

5.

$$V_C = Bvl$$

$$\therefore q = CV_C = BvlC = \text{constant}$$

$$\therefore I_C = \frac{dq}{dt} = 0$$

$$U_C = \frac{1}{2}CV^2 = \frac{1}{2}CB^2L^2v$$

6.

From right hand rule, we can see that P and Q points are at higher potential than O.

7.

$I_C$  is  $90^\circ$  ahead of the applied voltage and  $I_L$  lags behind the applied voltage by  $90^\circ$ . So, there is a phase difference of  $180^\circ$  between  $I_L$  and  $I_C$ .

$$\therefore I = I_C - I_L = 0.2 \text{ A}$$

8.

$I_R$  and  $I_L$  are in same phase and phase difference between them and applied voltage lies between  $0^\circ$  and  $90^\circ$ .

9.

$V$  function is sin function.  $I$  function is ahead of  $V$  function. Hence, the circuit should be capacitive in nature.

$$\text{Further, } \phi = 45^\circ$$

$$\therefore X_C = R \quad \text{or} \quad \omega C = R$$

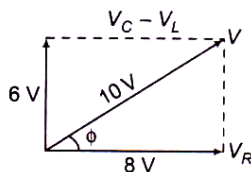
$$\text{or} \quad C = \frac{R}{\omega} = \frac{R}{100} = 0.01 R$$

In option (b), this condition is satisfied.

10.

$$V = \sqrt{V_R^2 + (V_C - V_L)^2} = 10 \text{ V}$$

$V_C > V_L$ , hence current leads the voltage.



$$\text{Power factor} = \cos \phi = \frac{8}{10} = 0.8$$

11.

$$V_S = \sqrt{V_R^2 + V_L^2} = \sqrt{(70)^2 + (20)^2} = 72.8 \text{ V}$$

$$\tan \phi = \frac{X_L}{R} = \frac{V_L}{V_R} = \frac{20}{70} = \frac{2}{7}$$

12.

$i = \frac{V}{R}$ , i.e. circuit is in resonance. Hence,

13.

$$\begin{aligned}
 V_C &= V_L = 200 \text{ V} \\
 P &= I_{\text{rms}}^2 R = \left( \frac{V_{\text{rms}}}{Z} \right)^2 R \\
 &= \left[ \frac{(V_0/\sqrt{2})^2}{R^2 + \omega^2 L^2} \right] R \\
 &= \frac{V_0^2 R}{2(R^2 + \omega^2 L^2)}
 \end{aligned}$$

14.

$$X_L = \omega L$$

If  $\omega$  is very low, then  $X_L \approx 0$ 

$$\therefore V_L \approx 0$$

$$\text{or } V = V_C = V_0$$

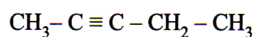
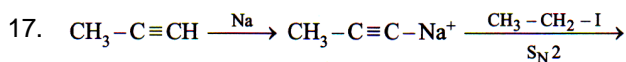
15.

$$V_R = \sqrt{V^2 - V_C^2} = \sqrt{(10)^2 - (8)^2} = 6 \text{ V}$$

$$\tan \phi = \frac{X_C}{X_R} = \frac{V_C}{V_R} = \frac{8}{6} = \frac{4}{3}$$

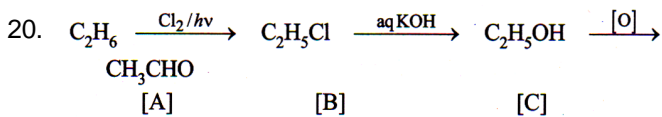
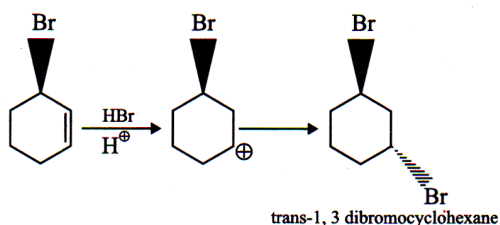
**[CHEMISTRY]**

16. 1, 2, 3, 4, 5, 6-hexachlorocyclohexane.



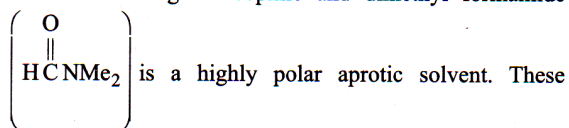
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19.

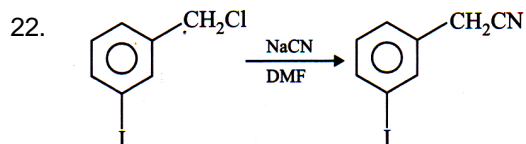
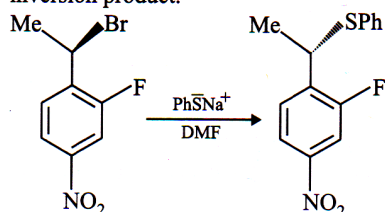


21. The product (a) will be formed.  
Nucleophilic substitution of an alkyl halide is easier as compared to that of an aryl halide.

$\text{PhS}^-$  is a strong nucleophile and dimethyl formamide

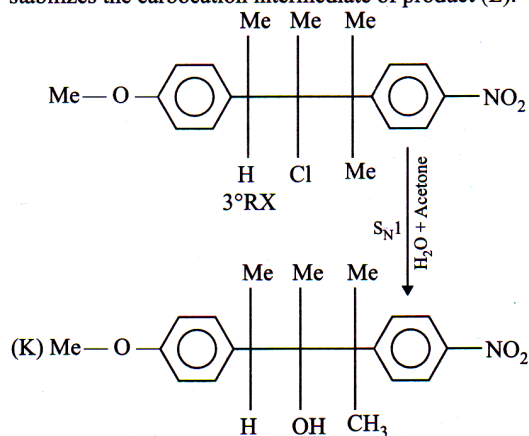


reagents favour  $\text{S}_{\text{N}}2$  reaction, the major product formed is inversion product.

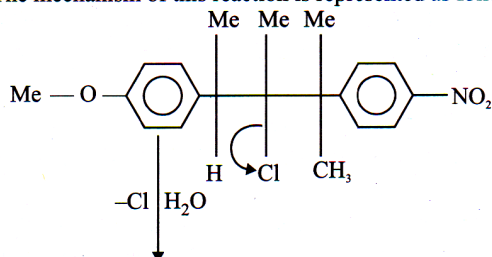


(side chain is attacked)

23. The product (K) is formed through simple nucleophilic substitution while the major product (L) is formed through 1,2 -  $\text{H}^\oplus$  shift viz  $\text{S}_{\text{N}}1$  reaction and the methoxy group stabilizes the carbocation intermediate of product (L).

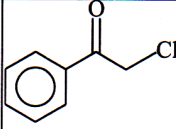



The mechanism of this reaction is represented as follows.

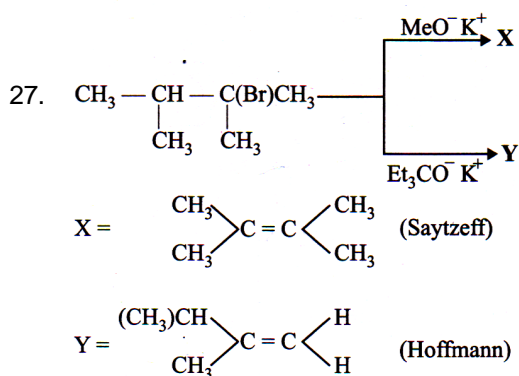


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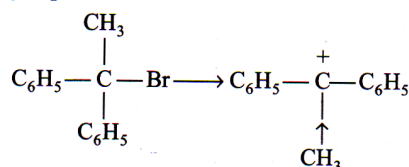
Relative reactivity for  $S_N2$  reaction in the given structures is

Substrate		$\text{CH}_3\text{Cl}$	$\text{H}_2\text{C}=\text{CH}-\text{CH}_2\text{Cl}$	
	(S)	(P)	(R)	(Q)
Relative Rates Towards $S_N2$	100000	200	79	0.02

25. As RX is  $3^\circ$  so carbocation being reactive intermediate mainly racemization occurs.
26. According to stability of carbocation



28.  $S_N1$  reaction involves the formation of carbocations, hence higher the stability of carbocation, more will be the reactivity of the parent alkyl halide. Thus tertiary carbocation formed from (c) is stabilized by two phenyl groups and one methyl group, hence most stable.



29.  $S_N1$  reaction gives racemic mixture with slight predominance of that isomer which corresponds to inversion because  $S_N1$  also depends upon the degree of 'shielding' of the front side of the reacting carbon.
30. Due to the presence of electron rich methoxy group (+I) at p-position the polarity increases on C-X bond by which it becomes more reactive towards nucleophilic attack of ethanol, p-nitro and chloro are electron deficient group decrease the polarity of C-X bond. Hence by them it becomes difficult to react with ethanol due to less polarity. Methyl group is less electron rich than methoxy group.