WEEKLY TEST MEDICAL PLUS - 01 & 02 Balliwala SOLUTION Date 09 -02-2020

[PHYSICS]

1. D
2. C
3. B
4. C
5. D
6. B
7. A
8. D
9. The electromagnetic wave having the shortest wavelength is γ-rays.
10. The part of the spectrum of the electromagnetic radiation used to cook food is ultraviolet rays.
11. Velocity of light $= \sqrt{\mu\,\varepsilon}$, where, μ is permeability and ε is permittivity of the medium.
12. $$\frac{E_0}{B_0} = c$$
    Also, $k = \frac{2\pi}{\lambda}$ and $\omega = 2\pi v$
    These relation given $E_0\ k = B_0\omega$.
13. The wavelength of the γ-rays is shorter. However the main distinguishing feature is the nature of emission.
14. Speed of electromagnetic waves in vacuum
    $$= \frac{1}{\sqrt{\mu_0\ \varepsilon_0}} = \text{constant}$$
15. The electron placed in the path of electromagnetic wave will experience force due to electric field vector and not due to magnetic field vector.
16. In purely inductive circuit voltage leads the current by 90°.
17. We have $X_C = \frac{1}{C \times 2\pi f}$ and $X_L = L \times 2\pi f$
18. $$X_C = \frac{1}{\omega C} = \frac{1}{2\pi fC} \Rightarrow X_C \propto \frac{1}{f}$$
19. $$X_L = 2\pi vL = 2 \times \pi \times 50 \times \frac{1}{\pi} = 100\,\Omega$$

20.

$Z=\sqrt{R^2+X_L^2}$, $X_L=\omega L$ and $\omega=2\pi f$

$\therefore Z=\sqrt{R^2+4\pi^2 f^2 L^2}$

21.

$$Z=\sqrt{R^2+(X_L-X_C)^2}$$

$$=\sqrt{100^2+\left(0.5\times 100\pi-\frac{1}{10\times 10^{-6}\times 100\pi}\right)^2}$$

$= 189.72\ \Omega$

22.

At $A: X_C > X_L$

At $B: X_C = X_L$

At $C: X_C < X_L$

23.

$X_L=2\pi fL \Rightarrow X_L \propto f \Rightarrow \frac{1}{X_L} \propto \frac{1}{f}$

i.e., graph between $\frac{1}{X_L}$ and f will be a hyperbola.

24.

From phasor diagram it is clear that current is lagging with respect to E_{rms}. This may be happen in LCR or LR circuit.

25.

$$\nu=\frac{1}{2\pi\sqrt{LC}}=\frac{1}{2\pi\sqrt{10^{-6}\times 10^{-4}}}=\frac{10^5}{2\pi}Hz$$

26.

Reactance $X=X_L-X_C=2\pi fL-\frac{1}{2\pi fC}$

27.

Phase angle $\tan\varphi=\frac{\omega L}{R}=\frac{2\pi\times 200}{300}\times\frac{1}{\pi}=\frac{4}{3}$

$\therefore\ \varphi=\tan^{-1}\frac{4}{3}$

28.

As explained in solution (1) for frequency $0-f_r$, Z decreases hence $(i=V/Z)$, increases and for frequency $f_r-\infty$, Z increases hence i decrees.

29.

Frequency $=\frac{1}{2\pi\sqrt{LC}}$

So the combination which represents dimension of frequency is $\frac{1}{\sqrt{LC}}=(LC)^{-1/2}$

30.

Impedance of LCR circuit will be minimum at resonant frequency so $\nu_0 = \frac{1}{2\pi\sqrt{LC}}$

$$= \frac{1}{2\pi\sqrt{1\times10^{-3}\times0.1\times10^{-6}}} = \frac{10^5}{2\pi} Hz$$

31.

$R = 6 + 4 = 10\,\Omega$

$X_L = \omega L = 2000\times5\times10^{-3} = 10\Omega$

$X_C = \frac{1}{\omega C} = \frac{1}{2000\times50\times10^{-6}} = 10\Omega$

$\therefore Z = \sqrt{R^2 + (X_L - X_C)^2} = 10\Omega$

Amplitude of current $= i_0 = \frac{V_0}{Z} = \frac{20}{10} = 2A$

32.

$R = \frac{P}{i_{rms}^2} = \frac{240}{16} = 15\Omega$

$Z = \frac{V}{i} = \frac{100}{4} = 25\Omega$

Now $X_L = \sqrt{Z^2 - R^2} = \sqrt{(25)^2 - (15)^2} = 20\Omega$

$\therefore \quad 2\pi\nu L = 20 \Rightarrow L = \frac{20}{2\pi\times50} = \frac{1}{5\pi} Hz$

33.

At resonant frequency current in series LCR circuit is maximum.

34.

As the current i leads the voltage by $\frac{\pi}{4}$, it is an RC circuit, hence $\tan\varphi = \frac{X_C}{R} \Rightarrow \tan\frac{\pi}{4} = \frac{1}{\omega CR}$

$\Rightarrow \omega CR = 1$ as $\omega = 100$ rad/sec

$\Rightarrow CR = \frac{1}{100}\sec^{-1}$.

From all the given options only option (a) is correct.

35.

Power $= I^2R = \left(\frac{I_p}{\sqrt{2}}\right)^2 R = \frac{I_p^2 R}{2}$

36.

Phase angle $\varphi = 90°$, so power $P = Vi\cos\varphi = 0$

37.

$$V_{rms} = \frac{200}{\sqrt{2}},\ i_{rms} = \frac{1}{\sqrt{2}}$$

$$\therefore P = V_{rms}\, i_{rms} \cos\varphi = \frac{200}{\sqrt{2}} \frac{1}{\sqrt{2}} \cos\frac{\pi}{3} = 50 \text{ watt}$$

38.

$$\because P = Vi\cos\varphi,\ \therefore P \propto \cos\varphi$$

39.

The instantaneous values of e.m.f. and current in inductive circuit are given by $E = E_0 \sin \omega t$ and $i = i_0 \sin\left(\omega t - \frac{\pi}{2}\right)$ respectively.

So, $P_{inst} = Ei = E_0 \sin\omega t \times i_0 \sin\left(\omega t - \frac{\pi}{2}\right)$

$$= E_0 i_0 \sin\omega t\left(\sin\omega t \cos\frac{\pi}{2} - \cos\omega t \sin\frac{\pi}{2}\right)$$

$$= E_0 i_0 \sin\omega t \cos\omega t$$

$$= \frac{1}{2} E_0 i_0 \sin 2\omega t (\sin 2\omega t = 2 \sin\omega t \cos\omega t)$$

Hence, angular frequency of instantaneous power is 2ω.

40.

$$i_{WL} = i_{rms} \sin\varphi \Rightarrow \sqrt{3} = 2\sin\varphi \Rightarrow \sin\varphi = \frac{\sqrt{3}}{2}$$

$$\Rightarrow \phi = 60° \text{ so p.f. } = \cos\varphi = \cos 60^o = \frac{1}{2}$$

41.

$$P = E_{rms} i_{rms} \cos\varphi = \frac{E_0}{\sqrt{2}} \times \frac{i_0}{\sqrt{2}} \times \frac{R}{Z}$$

$$\Rightarrow \frac{E_0}{\sqrt{2}} \times \frac{E_0}{Z\sqrt{2}} \times \frac{R}{Z} \Rightarrow P = \frac{E_0^2 R}{2Z^2}$$

Given $X_L = R$ so, $Z = \sqrt{2}R \Rightarrow P = \frac{E_0^2}{4R}$

42.

$$\tan\phi = \frac{X_L}{R} = \frac{X_C}{R} \Rightarrow \tan 60^o = \frac{X_L}{R} = \frac{X_C}{R}$$

$$\Rightarrow X_L = X_C = \sqrt{3}\, R$$

i.e., $Z = \sqrt{R^2 + (X_L - X_C)^2} = R$

So average power $P = \frac{V^2}{R} = \frac{200 \times 200}{100} = 400 \text{ W}$

43.

$$P = E_v I_v \cos\phi; P = E_v \frac{E_v}{R}\frac{R}{Z}$$

$$P = \frac{E_v^2 R}{Z^2} = \frac{110 \times 110 \times 11}{22 \times 22} W = 275\,\text{W}.$$

44.

With DC : $P = \frac{V^2}{R} \Rightarrow R = \frac{(10)^2}{20} = 5\Omega;$

With AC : $P = \frac{V_{rms}^2 R}{Z^2} \Rightarrow Z^2 = \frac{(10)^2 \times 5}{10} = 50\Omega^2$

Also $Z^2 = R^2 + 4\pi^2 v^2 L^2$

$\Rightarrow 50 = (5)^2 + 4(3.14)^2 v^2 (10 \times 10^{-3})^2 \Rightarrow v = 80\text{ Hz}.$

45.

$$P = \frac{1}{2} V_0 i_0 \cos\varphi \Rightarrow 1000 = \frac{1}{2} \times 200 \times i_0 \cos 60^o$$

$$\Rightarrow i_0 = 20\text{ A} \Rightarrow i_{rms} = \frac{i_0}{\sqrt{2}} = \frac{20}{\sqrt{2}} = 10\sqrt{2}A.$$

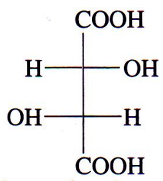
[CHEMISTRY]

46. Starch is a natural polymer.
47. A
48. Orlon is a chain-growth polymer.
49. B
50. Isoprene (2-methyl-1, 3-butadiene) is the monomer of natural rubber.
51. B
52. Saran is a copolymer.
53. C
54. B
55. Terylene has ester linkages.
56. A
57. Polymerization of caprolactam yields nylon-6.
58. D
59. B
60. Natural rubber is an elastomer. The irregular geometry of the molecules involves weak van der Waals force of attraction.
61. C
62. A
63. B
64. B
65. For monosaccharides, the value of n in $C_nH_{2n}O_n$ varies from 3 to 7.
66. The number of monosaccharides in oligosaccharides varies from 2 to 10.
67. The prefix L in L-glyceraldehyde implies the absolute configuration of asymmetric carbon.

68. The number of optical isomers in an aldose containing n asymmetric carbon atoms is 2^n.

69. Both glucose and fructose are reducing sugars. Sucrose is a non-reducing sugar.
Pentanal contains —CHO group. it shows the test. Acetophenone does not contain —CHO group. it does not show the test.

70. A

71. L-Tartaric acid is 

. The L isomer has —OH on the left of the last asymmetric carbon placed at the bottom of the molecule.

72. An amino acid contains an amino group attached to α-carbon atom.

73. The amino acids are basic units of protei

74. The number of amino acids commonly found in proteins is 20.

75. The number of essential amino acids is 10.

76. Isoleucine contains nonpolar —$CH(CH_3)CH_2CH_3$ group.

77. Zwitterion is a doubly-charged species.

78. At low pH, an amino acid exists as $H_3\overset{+}{N}CHRCOOH$.

79. At high pH, an amino acid exists as $H_2NCHRCOO^-$.

80. **Glycine does not contain chiral carbon atom. Hence, it is not optically active.**

81. **Proteins contains exclusively L isomers of amino acids.**

82. **The amino acid** $H_2N\underset{\underset{COOH}{|}}{CH}(CH_2)_4NH_2$ **at low pH exists as** $H_3\overset{+}{N}\underset{\underset{COOH}{|}}{CH}(CH_2)_4NH_3$.

83. **The pH of the solution at which amino acids exist as Zwetterion follows the order**
acidic side chain < neutral chain < basic side chain.

84. **The amino acid** $H_2N\underset{\underset{COOH}{|}}{CH}(CH_2)_2COOH$ **at low pH exists as** $H_3\overset{+}{N}\underset{\underset{COOH}{|}}{CH}(CH_2)_2COOH$.

85. **The amino acid** $H_2N\underset{\underset{COOH}{|}}{CH}(CH_2)_2COOH$ **at high pH exists as** $H_2N\underset{\underset{COO^-}{|}}{CH}(CH_2)_2COO^-$.

86. **In the representation of a dipeptide, amino group is present at the left end.**

87. **At pH = 2, alanine is protonated to NH_2 and at pH = 10, —COOH group ionizes to —COO^-**

88. Initial amount of H^+ = VM = $(0.06025\ dm^3)(0.1\ mol\ dm^{-3})$ = 0.006025 mol
Remaining amount of H^+ = $(0.01625\ dm^3)(0.1\ mol\ dm^{-3})$ = 0.00125 mol
Amount of H^+ reacted = (0.006025 – 0.001625) mol = 0.0044 mol
Mass of NH_3 produced = (Amount of H^+) (M_{NH_3}) = (0.0044 mol) $(17\ g\ mol^{-1})$ = 0.0748 g

$$\text{Per cent of nitrogen} = \left(\frac{M_N}{M_{NH_3}}\right)(m_{NH_3})\left(\frac{100}{m_{compound}}\right) = \left(\frac{14}{17}\right)(0.0748)\left(\frac{100}{0.156}\right) = 39.5$$

89. $$\text{Per cent of sulphur} = \left(\frac{M_S}{M_{BaSO_4}}\right)(m_{BaSO_4})\left(\frac{100}{m_{compound}}\right) = \left(\frac{32}{233}\right)(0.9336)\left(\frac{100}{0.244}\right) = 52.5$$

90. C