WEEKLY TEST MEDICAL PLUS - 03 TEST - 25 RAJPUR
SOLUTION Date 02-02-2020

[PHYSICS]

1. $\mathbf{F}_{net} = \mathbf{F}_e + \mathbf{F}_m = q\mathbf{E} + q(\mathbf{v} \times \mathbf{B})$
$= q(\mathbf{E} + \mathbf{v} \times \mathbf{B})$

2. For charged particle on circular path

$$\frac{mv^2}{r} = qvB$$

$$\therefore \quad r = \frac{mv}{qB}$$

For proton

$$R_p = \frac{mv}{qB} = \frac{\sqrt{2m_pE}}{qB}$$

For deutron

$$R_d = \frac{\sqrt{2\ m_dE}}{qB}$$

$$\therefore \quad \frac{R_d}{R_p} = \sqrt{\frac{m_d}{m_p}} = \sqrt{2}$$

$$\therefore \quad R_d = \sqrt{2}R_p$$

3. When charge particle move in circular path into a region of magnetic field, then time period of charged particle is given by

$$T = \frac{2\pi m}{qB}$$

$\therefore \quad T \propto m$ (q and B are same)

$\because \quad m_p > m_e$

$\therefore$ Time period of proton > Time period of electron.

4. $$r = \frac{mv}{qB}$$

For electron, $$r = \frac{mv}{eB}$$

$$\therefore \quad \frac{e}{m} = \frac{v}{Br}$$

5. For charged particle in uniform magnetic field, time period is given by

$$T = \frac{2\pi m}{qB}$$

$$\therefore \quad \text{Frequency, } \nu = \frac{1}{T} = \frac{qB}{2\pi m}$$

6. $$r = \frac{mv}{qB}$$

$$\Rightarrow \quad \frac{r_1}{r_2} = \frac{m_1v_1}{m_2v_2} \times \frac{q_2}{q_1}$$

$$= \frac{1 \times 2}{1 \times 3} \times \frac{2}{1} = \frac{4}{3}$$

7. From Fleming's left-hand rule the electron deflects, in – ve Y-direction.

8. $$T = \frac{2\pi m}{qB}.$$

9. $$r = \frac{\sqrt{2Km}}{Bq} \quad \text{or} \quad r \propto \frac{\sqrt{m}}{q}$$

$$\left(\frac{\sqrt{m}}{q}\right)_\alpha : \left(\frac{\sqrt{m}}{q}\right)_p : \left(\frac{\sqrt{m}}{q}\right)_d = \frac{\sqrt{4}}{2} : \frac{\sqrt{1}}{1} : \frac{\sqrt{2}}{1}$$

$$= 1 : 1 : \sqrt{2}$$

10. $$r = \frac{\sqrt{2Km}}{Bq}$$

or $$K \propto \frac{q^2}{m}$$ (for same radius)

11. Work done by magnetic force is zero.

12. $$T = \frac{2\pi m}{Bq}$$ or T is independent of r.

13. Velocity is in x-y plane and magnetic field along z-axis. Therefore, path of the electron will be a circle. Magnetic force cannot change the speed of a particle.

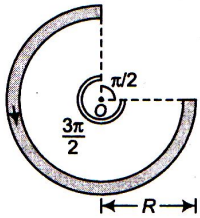
14. C

15. Magnetic force on B from both the wires is towards A

16. B

17. B

18. Magnetic field induction at O is



$$B = \frac{3}{4} \text{ (due to whole circle)}$$

$$= \frac{3}{4}\left(\frac{\mu_0 i}{2R}\right) = \frac{3\mu_0 i}{8R}$$

19. The direction of magnetic induction due to both semicircular parts will be perpendicular to the paper and inwards.

Also, $B = B_1 + B_2$

$$= \frac{\mu_0 i}{4 r_1} + \frac{\mu_0 i}{4 r_2}$$

$$= \frac{\mu_0 i}{4}\left(\frac{r_1 + r_2}{r_1 r_2}\right)$$

20. Magnetic field produced at the centre of orbit

$$B = \frac{\mu_0}{4\pi}\frac{2\pi i}{r}$$

$\because$ $i = \frac{q}{t} = qv$

$\therefore$ $B = \frac{\mu_0}{4\pi}\frac{2\pi (q v)}{r}$

$$= \frac{4\pi \times 10^{-7} \times 2 \times 3.14 \times 1.6 \times 10^{-19} \times 6.6 \times 10^{15}}{4\pi \times 0.53 \times 10^{-10}}$$

$$= 12.5 \text{ Wb/m}^2$$

21. Magnetic field at the centre of arc is given by

$$B = \frac{\mu_0}{4\pi}\frac{\theta i}{r}$$

$$= \frac{\mu_0}{4\pi} \times \frac{\pi}{2} \times \frac{i}{R}$$

$$= \frac{\mu_0 i}{8R}$$

22. Magnetic field due to straight wires will be zero.

23. $B =$ (due to circular wire) + (due to straight wire)

$$= \frac{\mu_0 I}{2R} + \frac{\mu_0}{2\pi}\frac{I}{R}$$

24. Magnetic field at O due to wire 1 will be zero.

$$B_{net} = B_2 + B_3$$

25. A
26. D
27. B
28. C

29. The component of velocity perpendicular to H will make the motion circular while that parallel to H will make it move along a straight line. The two together will make the motion helical.

30. A charged particle moves in a straight line under the action of an electric field whereas it moves in a circular path under the action of a magnetic field. Thus, for the particle moving in a circular path, $E = 0$, $B \neq 0$.

31. When particle describes circular path in a magnetic field, its velocity is always perpendicular to the magnetic force.

Power, $P = \mathbf{F} \cdot \mathbf{v} = Fv\cos\theta$

Here, $\theta = 90°$

$\therefore$ $P = 0$

But $P = \frac{W}{t} \Rightarrow W = P \times t$

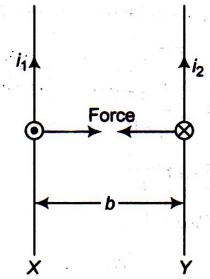
Hence, work done

$W = 0$ (everywhere)

32. According to Fleming's right-hand rule, the force on the charge will be towards west.

33. Let two long parallel thin wires X and Y carry current i and separated by a distance b apart.

The magnitude of magnetic field B at any point on Y due to current i_1 in X is given by



$$B = \frac{\mu_0}{2\pi}\frac{i_1}{b}$$

The magnitude of force acting on length l of Y is

$$F = i_2 Bl = i_2\left(\frac{\mu_0}{2\pi}\frac{i_1}{b}\right)l$$

Force per unit length is

$$\frac{F}{l} = \frac{\mu_0}{2\pi}\frac{i_1 i_2}{b}$$

Given, $i_1 = i_2 = i$, therefore,

$$\frac{F}{l} = \frac{\mu_0}{2\pi}\frac{i^2}{b}$$

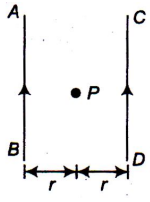
34. . At point P,

$$B_{net} = B_{AB} + B_{CD}$$

$$= \frac{\mu_0 i}{2r} + \frac{\mu_0 i}{2r}$$

$$= \frac{\mu_0 i}{r}$$

. If the radius of circle is r, then $2\pi r = l$



35.
36.
37.
38.
39.
40.
41.
42.
43.

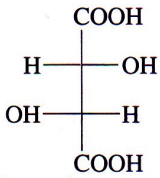
44. If the radius of circle is r, then $2\pi r = l$

$$\text{Area} = \pi r^2 = \frac{l^2}{4\pi}$$

$$\text{Magnetic moment} = IA = \frac{Il^2}{4\pi}$$

45.

[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