SOLUTION & ANSWER FOR VITEEE-2008

Join now for
BITSAT Online Practice
Test Series Click here to know more

VERSION - P

PART – 1 [PHYSICS]

1. In nature, the electric charge of any system is always–

Ans: Quantisation of charge
Choice (D)

2. The energy stored in the capacitor as shown in   Fig. (a) is 4.5×10^{-6} J. If the battery is replaced   by –

Ans: $\dfrac{1}{2}\dfrac{Q^2}{C}$

$= 4.5 \times 10^{-6}$ J

$\dfrac{1}{2}\dfrac{Q^2}{2C} = \dfrac{4.5}{2}\times 10^{-6}$

Choice (B)

3. Equal amounts of a metal are converted into   cylindrical wires of different lengths (L) and cross-sectional –

Ans: $R = \rho\dfrac{\ell}{A} = \rho\dfrac{\ell^2}{V}$
Choice (C)

4. If the force exerted by an electric dipole on a   charge q at a distance of 1 m is F, the force–

Ans: $F \propto \dfrac{1}{R^3}$

$\dfrac{F_1}{F_2} = \dfrac{1}{8}$

Choice (D)

5. A solid sphere of radius R_1 and volume charge   density $r = \dfrac{\rho_0}{r}$ is enclosed by a hollow sphere of   radius R_2 with negative surface charge density–

Ans: $Q_{in} = \int \rho 4\pi r^2\, dr$

$= \dfrac{4\pi\rho_0\, R_1^2}{2}$

$= 4p\ R_2{}^2 s$
Choice (C)

6.   A solid spherical conductor of radius R has a   spherical cavity of radius a9a < R) at its centre. A   charge +Q is kept at the center.–

Ans:

Choice (B)

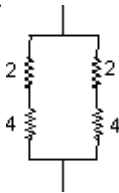**7.**   A cylindrical capacitor has charge Q and length L. If both –

Ans: $U_1 = \dfrac{1}{2}\dfrac{Q^2}{C}$

$U_2 = \dfrac{1}{2}\dfrac{(2Q)^2}{2C}$

Choice (B)

8.   Three resistances of 4 W each are connected as shown in figure. If the point D divides the resistance –

Ans:

Choice (C)

9.   The resistance of a metal increases with increasing –

Ans: Vibration of lattice ions increases with
       temperature
Choice (B)

10.   In the absence of applied potential, the electric current flowing through-

Ans: Thermal velocity of electrons is in random
       directions
Choice (C)

11.   A meter bridge is used to determine the resistance of an unknown wire by measuring the balance point length l. If the wire is replaced by –

Ans:

12.   Identify the INCORRECT statement regarding –

Ans: Supercurrent always flows on the surface
       of the superconductor
Choice (B)

13.   A sample of HCl gas is placed in an electric field of $3 \times 10^4\ NC^{-1}$. The dipole moment of each HCl molecule is –

Ans: $t = pE$
Choice (C)

14. When a metallic plate swings between the –

Ans: Lenz's law
Choice (C)

15. When an electrical appliance is switched on, it responds almost-

Ans: Electromagnetic waves travel with the
speed of light
Choice (B)

16. Two identical incandescent light bulbs are connected as shown in the figure. When the circuit is an AC voltage source–

Ans: At resonance $X_L = X_C$
Choice (B)

17. A transformer rated at 10 kW is used to connect a 5 kV transmission line to a 240 V circuit. The ratio –

Ans: $n = \dfrac{5000}{240}$
Choice (B)

18. Three solenoid coils of same dimension, same number of turns and same number of layers of winding are taken. Coil 1 with inductance L_1 was wound using a Mn wire of resistance 11 W / m; –

Ans: Alternate winding in opposite direction
total flux = 0
Choice (C)

19. Light travels with a speed of 2×10^8 m/s in crown glass of refractive index 1.5. What is the speed of light –

Ans: $n_1 v_1 = n_2 v_2$
Choice (B)

20. A parallel beam of fast moving electrons is incident normally on a narrow slit. A screen is placed at a large distance from the slit.–

Ans: $\sin q = \dfrac{\lambda}{b}$
Choice (C)

21. Two beams of light will not give rise to an –

Ans: Since the polarization vectors are
perpendicular their vector sum ^{1} 0

Choice (C)

22. A slit of width `a' is illuminated with a monochromatic light of wavelength l from a distant source and the diffraction pattern –

Ans: $\sin q = \dfrac{\lambda}{a}$

Choice (B)

23. A thin film of soap solution (n = 1.4) lies on the top of a glass plate (n = 1.5). When visible light is incident almost normal to the plate, two adjacent reflection –

Ans: $n_1 l_1 = n_2 l_2$
$2n_1 = 3n_2$
$\text{Þ } n_1 = 3$
$d = 3 \times \dfrac{420}{1.4} \times \dfrac{1}{2} = 450$
Choice (B)

24. If the speed of a wave doubles as it passes from shallow water into deeper water, –

Ans: $c = fl$
Choice (C)

25. A light whose frequency is equal to 6×10^{14} Hz is incident on a metal whose work function is 2 eV –

Ans: $hu = f + K.E$
Choice (C)

26. An electron microscope is used to probe the atomic arrangements to a resolution of $5 \overset{0}{A}$. What should be the electric potential –

Ans: $\dfrac{12.2}{\sqrt{V}} = \lambda \left(\overset{0}{A} \right)$

Choice (D)

27. Which phenomenon best supports the theory that matter –

Ans: Electrons behave also as waves of $l = \dfrac{h}{p}$

Choice (B)

28. The radioactivity of a certain material drops to $\dfrac{1}{16}$ of the initial value in 2 hours. The half –

Ans: Activity changes from A_0 to $A_0/16$ implies 4   half-lives.
Choice (C)

29. An observer `A' sees an asteroid with a radioactive element moving by at a speed = 0.3 c and measures the radioactivity decay time to be $T_A$. Another observer `B' –

Ans: Moving clocks are slower $T_B < T_A$
        Choice (A)

30. ^{234}U has 92 protons and 234 nucleons total in its nucleus. It decays by emitting an alpha –

Ans: $^{234}U_{92}$ à $^{230}Th_{90} + a$
        Choice (C)

31. K_a and K_b x-rays are emitted when there is a transition of electron –

Ans: K series end in $n = 1$
        Choice (A)

32. A certain radioactive material $_ZX^A$ starts emitting a and b particles successively such that the end product –

Ans: $_ZX^A$ à $_{Z-3}Y^{A-8} + 2a + 1b$
        Choice (B)

33. In the circuit shown above, an input of 1 V is fed into the inverting input of an ideal Op-amp A. The output signal –

Ans: $-\dfrac{R_f}{R_i} = -10$ (negative feedback)
        Choice (B)

34. When a solid with a band gap has a donor level just below its empty energy band, -

Ans: Knowledge based
        Choice (D)

35. A p – n junction has acceptor impurity concentration of $10^{17} cm^{-3}$ in the P side and donor impurity concentration of $10^{16} cm^{-3}$ in the N side. What is the contact potential at the –

Ans: $V_{contact} = \dfrac{kT}{e} \ln \dfrac{n_a n_d}{n_i^2}$
        Choice (A)

36. A zener diode has a contact potential of 1 V in the absence of biasing. It undergoes zener breakdown for an electric field of 10^6 V/m at the depletion region of p-n junction. If the width –

Ans: $V = Ed$
        Choice (B)

37. In Colpitt oscillator the feedback network –

Ans: a-c equivalent circuit.
        Choice (B)

38. The reverse saturation of p-n diode

Ans: Knowledge based

Choice (D)

39. A radio station has two channels. One is AM at 1020 kHz and the other FM at 89.5 MHz. –

Ans: Knowledge based
           Choice (A)

40. The communication using optical fibers is –

Ans: Optic fibre uses T.I.R.
           Choice (A)

PART – II [CHEMISTRY]

41. The oxidation number of oxygen ¾

Ans: KO_3: $+ 1 + 3x = 0$, $x = \dfrac{-1}{3}$
          Na_2O_2: $+ 2 + 2x = 0$, $x = - 1$
          Choice (D)

42. Reaction of ICl_3 and $PhMgBr$ ¾

Ans: Triphenyl phosphene
           $3C_6H_5MgBr + PCl_3 \circledR (C_6H_5)_3P + 3MgClBr$
           Choice (C)

43. ……. not a characteristic of transition elements?

Ans: Choice (D)

44. Cl - P - Cl bond ¾

Ans: Arial bonds are $90°$ and Equatorial bonds are $120°$.
           Choice (A)

45. --- magnetic moment ¾
Ans: No unpaired electron.
           Choice (A)

46. The number of Formula units of calcium fluoride CaF_2 ¾

Ans: Number of moles = $\dfrac{146.4}{78.08}$

           Number of formula units = $\dfrac{146.4}{78.08} \times 6.023$
                                                                   $\times 10^{23}$
                                       $= 1.129 \times 10^{24}$
           Choice (A)

47. The IUPAC name of the given ¾

Ans: Choice (C)

48. When SCN^- is added to an aqueous ¾

Ans: $Fe^{3+} + SCN^- + H_2O \circledR [Fe(H_2O)_5SCN]^{2+}$
Choice(B)

49. Hair dyes contain

Ans: Choice (C)

50. Schottky defects occurs ¾

Ans: Schottky defect occurs when the ions have almost the same size
Choice (B)

51. The number of unpaired electron ¾

Ans: $[Co(NH_3)_6]^{3+}$ - Inner orbital complex
　　　　　　　　- No unpaired electron
$[CoF_6]^{3-}$　- Outer orbital complex
　　　　　　　　- 4 unpaired electrons
Choice (D)

52. The standard free energy change of a reaction ¾

Ans: $- D G° = 2.303\ RT \log K_p$

$\dfrac{115 \times 10^3}{2.303 \times 8.314 \times 298} \log K_p$

$0.02016 \times 10^3 = \log K_p$

$= \log K_p = 20.16$

Choice (A)

53. If an endothermic reaction occurs spontaneously at ¾

Ans: For an endothermic reaction $D H$ is positive, the reaction occurs spontaneously when $D S > 0$
Choice (C)

54. If a plot of log10 C versus t fives a straight line ¾

Ans: $t = \dfrac{2.303}{K} \log\left(\dfrac{C_0}{C}\right)$

$t \times \left(\dfrac{K}{2.303}\right) = \log C_0 - \log C$

$\log C = \log C_0 - t \times \left(\dfrac{K}{2.303}\right)$

$\log C$ is t in a stline with slope $\left(-\dfrac{K}{2.303}\right)$
Choice (B)

55. A spontaneous process is one in which ¾

Ans: For a spontaneous process ΔG is negative.
        Choice (B)

56. The half life period of a first order reaction ¾

Ans: $t_{1/2} = 100$ sec.

For a first order reaction $t_{1/2} = \dfrac{0.693}{K}$

$K = \dfrac{0.693}{t_{1/2}} = \dfrac{0.693}{100} = 6.93 \times 10^{-3}$ sec^{-1}
Choice (B)

57. The molar conductivities of KCl, NaCl and KNO$_3$ are ¾

Ans: $\lambda_{NaNO_3} = \lambda_{NaCl} + \lambda_{KNO_3} - \lambda_{KCl}$

$= 128 + 111 - 152 = 87$ S cm^2 mol^{-1}
Choice (B)

58. The electrochemical cell stops working ¾

Ans: When both the electrode potentials become equal cell reactions stops.
        Choice (B)

59. The amount of electricity required to produce ¾

Ans: 1 mole of copper is 2 equivalents
        Current required = 2 Faraday
        Choice (C)

60. Dipping iron article into a strongly alkaline ¾

Ans: Choice (C)

61. Hydroboration oxidation of 4-methyl-octene ¾

Ans: Hydroboration – oxidation of alkenes give alcohols containing the same number of carbon atoms. Net reaction involves addition of H$_2$O against Markownikoff's rule.
        Choice (A)

62. When ethyl alcohol is heated

Ans: Ethanol undergoes dehydration when heated with conc.H$_2$SO$_4$ to form ethylene.
        Choice (D)

63. Anisole is the product obtained from ¾

Ans: Anisole is phenyl methyl ether.
        Choice (B)

64. Ethylene glycol gives oxalic acid ¾
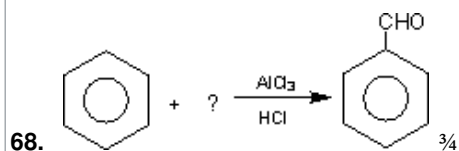
   Ans: Choice (C)

65. Diamond is hard ¾

   Ans: Choice (A)

66. A Wittig reaction with an aldehyde ¾

   Ans: Carbonyl compounds react with phosphorous yields to form alkenes. This is known as Witting reaction.
         Choice (C)

67. Cannizzaro reaction is ¾

   Ans: HCHO does not contain a -hydrogen atom. So it undergoes Cannizzaro reaction.
         Choice (A)

68.

   Ans: $C_6H_6 + CO \xrightarrow[HCl]{AlCl_3} C_6H_5 - CHO$
         This is known as Gattermann-Koch aldehyde synthesis.
         Choice (C)

69. Maleic acid and Fumaric acids ¾

   Ans: Maleic acid is the cis-isomer and fumaric acid is the trans-isomer.
         Choice (B)

70. The gas evolved on heating ¾

   Ans: $HCOONa + NaOH \xrightarrow[\Delta]{CaO}$
                              $H_2 + Na_2CO_3$.
         Choice (C)

71. $CH_3CH_3 + HNO_3$ ¾

   Ans: Choice (B)

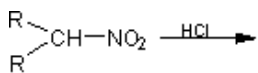**72.** When acetamide is hydrolysed by ¾

Ans: Choice (A)

73. Which will not go for diazotization?

   Ans: Choice (B)

74. Secondary nitroalkanes can be ¾

   Ans:

   Choice(A)

75. ………. Stephen reduction to ¾

   Ans: Alkyl cyanides on reduction with $SnCl_2$ and HCl will give aldehyde.
          Choice (A)

76. The continuous phase contains ¾

   Ans: Choice (C)

77. The number of hydrogen atoms present in ¾

   Ans: $\dfrac{25.6 \times 6.023 \times 10^{23} \times 22}{342.3}$ = 9.91 ´ 10^{23}

          Choice (B)

78. Milk changes after digestion ¾

   Ans: Choice (C)

79. ……… essential amino acids?

   Ans: Choice (B)

80. ….. is a Ketohexose?

   Ans: Choice (C)

PART – III [MATHEMATICS]

81. The system of equations -

   Ans: $\begin{vmatrix} 1 & 1 & 1 \\ 2 & 3 & 1 \\ 1 & 2 & 0 \end{vmatrix}$

          = 1(1 - 3) - 2(1 - 2) = - 2 + 2 = 0

Choice (B)

82. $\begin{bmatrix} 0 & a \\ b & 0 \end{bmatrix}^4 = I$, then -

Ans: $\begin{bmatrix} 0 & a \\ b & 0 \end{bmatrix}^4 = I$

$A^4 = I$

$A^3 = I A^{-1}$

$A^2 = I A^{-2}$

$\begin{pmatrix} 0 & a \\ b & 0 \end{pmatrix}\begin{pmatrix} 0 & a \\ b & 0 \end{pmatrix}$

$= \begin{pmatrix} ab & 0 \\ 0 & ba \end{pmatrix}$

$A^{-1} = \dfrac{1}{-ab}\begin{pmatrix} 0 & -a \\ -b & 0 \end{pmatrix}$

$= \begin{pmatrix} 0 & \dfrac{1}{b} \\ \dfrac{1}{a} & 0 \end{pmatrix}$

$A^{-2} = \begin{pmatrix} 0 & \dfrac{1}{b} \\ \dfrac{1}{a} & 0 \end{pmatrix}\begin{pmatrix} 0 & \dfrac{1}{b} \\ \dfrac{1}{a} & 0 \end{pmatrix} = \begin{pmatrix} \dfrac{1}{ab} & 0 \\ 0 & \dfrac{1}{ab} \end{pmatrix}$

$\begin{pmatrix} ab & 0 \\ 0 & ba \end{pmatrix} = \begin{pmatrix} \dfrac{1}{ab} & 0 \\ 0 & \dfrac{1}{ab} \end{pmatrix}$

$ab = \dfrac{1}{ab}$

Þ $a^2 b^2 = 1$

Þ $ab = 1$

Choice (D)

83. If D = diag ($d_1, d_2, \ldots\ldots, d_n$) where -

Ans: Choice (D)

84. If *x, y, z* are different from zero and D = -

Ans: $\begin{vmatrix} a & b-y & c-z \\ a-x & b & c-z \\ a-x & b-y & c \end{vmatrix} = 0$

$xyz\begin{vmatrix} \dfrac{a}{x} & \dfrac{b}{y}-1 & \dfrac{c}{z}-1 \\ \dfrac{a}{x}-1 & \dfrac{b}{y} & \dfrac{c}{z}-1 \\ \dfrac{a}{x}-1 & \dfrac{b}{y}-1 & \dfrac{c}{z} \end{vmatrix} = 0$

$$\begin{vmatrix} \sum\dfrac{a}{x}-2 & \dfrac{b}{y}-1 & \dfrac{c}{z}-1 \\[2mm] \sum\dfrac{a}{x}-2 & \dfrac{b}{y} & \dfrac{c}{z}-1 \\[2mm] \sum\dfrac{a}{x}-2 & \dfrac{b}{y}-1 & \dfrac{c}{z} \end{vmatrix}$$

$$= \left(\sum\dfrac{a}{x}-2\right)\begin{vmatrix} 1 & \dfrac{b}{y}-1 & \dfrac{c}{z}-1 \\[2mm] 1 & \dfrac{b}{y} & \dfrac{c}{z}-1 \\[2mm] 1 & \dfrac{b}{y}-1 & \dfrac{c}{z} \end{vmatrix}$$

Choice (D)

85. Probability of getting positive integral roots of the equation, -

Ans: $x = \pm \sqrt{n}$

$n = 1, 4, 9, 16, 25, 36$

Probability $= \dfrac{6}{40} = \dfrac{3}{20}$

Choice (C)

86. The number of real roots of equation -

Ans: $\sqrt{x^4 + 20} = 22 - x^4$

$x^4 + 20 = (22 - x^4)^2$

$= 484 + x^8 - 44x^4$

$x^8 - 45x^4 + 464 = 0$

$x^4 = \dfrac{45 \pm \sqrt{169}}{2}$

$= \dfrac{45 \pm 13}{2} = \dfrac{58}{2}, \dfrac{32}{2}$

$= 29, 16$

$x^4 = 29$ is not admissible

$\Rightarrow x^4 = 16$

Choice (B)

87. Let a, b be the roots of the equation -

Ans: $a^2 - aa + b = 0$

$A_{n+1} - aA_n + bA_{n-1}$

$= a^{n+1} + b^{n+1} - a(a^n + b^n) + b(a^{n-1} + b^{n-1})$

$= a^{n-1}(a^2 - aa + b) + b^{n-1}(b^2 - ab + b)$

$= 0$

Choice (C)

88. If the sides of a right – angle triangle -

Ans: $b, c, a \to AP$

$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

$$a = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\sin B = \frac{b}{a}$$

Choice (A)

89. The plane through the point -

Ans: $x + 3y - z = 0$
$y + 2z = 0$
Let the plane be
$A(x + 1) + B(y + 1) + C(z + 1) = 0$
Plane passes through the origin
$A + B + C = 0$
Choice (A)

90. $\bar{a} = \hat{i} - \hat{j} + \hat{k}$ and $\bar{b} + 2\hat{j} + 4\hat{j} + 3\hat{k}$ are one of the sides -

Ans:

$$\begin{vmatrix} \bar{i} & \bar{j} & \bar{k} \\ 1 & 1 & 1 \\ 2 & 4 & 3 \end{vmatrix}$$

$$= -7\bar{i} - \bar{j} + 6\bar{k}$$

Area = $\sqrt{49 + 1 + 36}$

$$= \sqrt{86}$$

Choice (D)

91. If $\bar{a}, \bar{b}, \bar{c}$ be three unit vectors such that -

Ans : $\bar{a} \times (\bar{b} \times \bar{c})$ $= (\bar{a}.\bar{b})\bar{b} - (\bar{a}.\bar{b})\bar{c}$

$$= (\cos\theta_2)\bar{b} - (\cos\theta_1)\hat{i}$$

$$= \frac{1}{2}\bar{b}$$

$$\cos q_2 = \frac{1}{2} \qquad \text{Þ } q_2 = \frac{\pi}{3}$$

$$\cos q_1 = 0 \qquad \text{Þ } q_1 = \frac{\pi}{2}$$

Choice (C)

92. The equation $\bar{r}^2 - 2\bar{r} . \bar{c} + h = 0$ -

Ans: Equation is
$x^2 + y^2 + z^2 - 2xc_1 - 2yc_2 - 2zc_3 + h = 0$

Choice (D)

93. The simplified expression of -

Ans:

Let $\tan^{-1} x$ be $a \Rightarrow \tan a = x$

Then from the figure $\sin a = \dfrac{x}{\sqrt{1+x^2}}$

$\Rightarrow \sin(\tan^{-1} x)\qquad \sin^{-1}\left(\dfrac{x}{\sqrt{1+x^2}}\right) = \alpha$

$= \sin\left(\sin^{-1}\dfrac{x}{\sqrt{1+x^2}}\right) = \dfrac{x}{\sqrt{1+x^2}}$

Choice (B)

94. If $\left|\dfrac{z-25}{z-1}\right| = 5$, -

Ans: $\left|\dfrac{z-25}{z-1}\right| = 5 \Rightarrow |z - 25| = 5|z - 1|$

$\Rightarrow z$ lies on the line perpendicular to the real axis and divides the line segment between 1 and 25 in the ratio 1 : 5 $\Rightarrow$ z = (5, 0) $\Rightarrow$ |z| = 5
    Choice (C)

95. Argument of the complex number -

Ans: $\left|\dfrac{-1-3i}{2+i}\right| = \dfrac{-(1+3i)\times(2-i)}{(2+i)(2-i)}$

$= \dfrac{-(5+5i)}{5}$

$= -(1+i)$

$\backslash$ Arg $\left(\dfrac{-1-3i}{2+i}\right) = 225°$
Choice (C)

96. In a triangle ABC, the sides b and c are -

Ans: $x^2 - 61x + 820 = 0$

$x^2 - 41x - 20x + 820 = 0$

$\Rightarrow x_{1,2} = 41, 20$

$A = \tan^{-1}\left(\dfrac{4}{3}\right)$

$\Rightarrow \cos A = \dfrac{3}{5}$

\ By Cosine formula,

$a^2 = b^2 + c^2 - 2bc \cos A$

$a^2 = 41^2 + 20^2 - 2(41)(20)\left(\dfrac{3}{5}\right)$

$= 2081 - 984 = 1097$

Choice (C)

97. The shortest distance between the straight lines through -

Ans: $\bar{r}_1 = 6i + 2j + 2\bar{k}$ $\bar{r}_2 = -4i - k$

$\bar{u} = \bar{i} - 2j + 2k$ $\bar{v} = 3i - 2j - 2k$

\ Shortest distance $= \left| \dfrac{\left(\bar{r}_2 - \bar{r}_1\right)\left(\bar{u} \times \bar{v}\right)}{\left|u \times v\right|} \right|$

$= \left| \dfrac{\left(-10i = 2j - 3k\right).\left(8i + 8j + 4k\right)}{\sqrt{64 + 64 + 16}} \right|$

$= \left| \dfrac{-108}{12} \right| = 9$

Choice (D)

98. The center and radius of the sphere -

Ans: Centre is at $\left(\dfrac{-3}{2},\ 0,\ 2\right)$

Choice (C)

99. Let A and B are two fixed points in a plane then locus of another -

Ans: Ellipse

Choice (B)

100.   The directrix of the parabola -

Ans: $y^2 = -4x - 3$

$= -4\left(x + \dfrac{3}{4}\right)$

Equation of the directrix is

$x = \dfrac{1}{4}$

Choice (D)

101.   If g(x) is a polynomial satisfying g(x) -

Ans: $g(x) \cdot g(y) = g(x) + g(y) + g(xy) - 2$ ¾ (1)

      $g(2) \cdot g(y) = g(x) + g(y) + g(xy) - 2$

      $5 \cdot g(y) = 5 + g(y) + g(xy) - 2$

      Þ $4g(y) = 3 + g(xy)$

      \ $g(0) = 1$

      $g(x)$ is given in a polynomial, and by the relation given $g(x)$ cannot be linear.

      Let $g(x) = x^2 + k$

      Since $g(0) = 1$ Þ $g(x) = x^2 + 1$

      Verifying (1) Þ

      $(x^2 + 1)(y^2 + 1)$

               $= x^2 + 1 + y^2 + 1 + x^2y^2 + 1 - 2$

      (1) is satisfied by $g(x) = x^2 + 1$

      $\lim_{x \to 3} g(x) = g(3)$ (Q $g(x)$ in a polynomial)

        $= 10$

      Choice (B)

102.   The value of f(0) so that -

Ans: $\lim_{x \to 0} \dfrac{2^x - \ell^x}{x} \left(\dfrac{0}{0} \right)$

    $= \lim_{x \to 0} \dfrac{2^x \ell n 2 - \ell^x}{1}$

    $= 2^0 ? n 2 - 1 = \ln 2 - 1$

    $= f(0)$

    Choice (D)

103.   Let [ ] denote the greatest integer -

Ans :

$$\begin{cases} \vdots \\ 1, & \tan^{-1}\left(-\sqrt{2}\right) < x \le -\dfrac{\pi}{4} \\ 0, & -\pi/4 < x \le 0 \\ 0, & 0 < x \le \pi/4 \\ 1, & \pi/4 < x \le \tan^{-1}\left(\sqrt{2}\right) \\ \vdots \end{cases}$$

    f(x) is continuous at x = 0

    Choice (B)

104.   A spherical balloon is expanding -

Ans : Let r be the radius and V be the volume

    \ $\dfrac{dr}{dt} = 2$ r = 5

    \ $V = \dfrac{4}{3} p r^3$

$$\frac{dV}{dt} = 4\pi r^2 \left(\frac{dr}{dt} \right)$$
$$= 4p (5)^2 \times (2)$$
$$= 200 \, p$$
Choice (C)

105. The length of the parabola -

Ans :

$$\text{Length} = 2\int_0^3 \sqrt{1 + \left(\frac{dy}{dx} \right)^2} \, dx$$

$$= 2\int_0^3 \sqrt{1 + \left(\frac{6}{y} \right)^2} \, dx$$

$$= 2\int_0^3 \sqrt{\frac{y^2 + 36}{y^2}} \, dx$$

$$= 2\int_0^3 \sqrt{\frac{12x + 36}{12x}} \, dx$$

$$= 2\int_0^3 \sqrt{\frac{x + 3}{x}} \, dx$$

$$= 2\int_0^3 \frac{x + 3}{\sqrt{x^2 + 3x}} \, dx$$

$$= 2\int_0^3 \frac{\tfrac{1}{2}(2x + 3) + \tfrac{3}{2}}{\sqrt{\left(x + \tfrac{3}{2}\right)^2 - \tfrac{9}{4}}} \, dx$$

$$= 2\left\{ \sqrt{x^2 + 3x} + \tfrac{3}{2} \log\left(x + \tfrac{3}{2} + \sqrt{x^2 + 3x} \right) \right\}_0^3$$

$$= 2 \left\{ \sqrt{18} + \tfrac{3}{2} \log\left(\frac{9}{2} + \sqrt{18} \right) \right.$$
$$\left. - \tfrac{3}{2} \log \left(\tfrac{3}{2} \right) \right\}$$

$$= 2\left\{ 3\sqrt{2} + \tfrac{3}{2} \log\left(\frac{9}{2} + 3\sqrt{2} \right) - \tfrac{3}{2} \log \left(\tfrac{3}{2} \right) \right\}$$

$$= 2\left\{ 3\sqrt{2} + \frac{3}{2} \log\left[\left(\frac{9 + 6\sqrt{2}}{2} \right) \times \frac{2}{3} \right] \right\}$$

$$= 2\left\{ 3\sqrt{2} + \frac{3}{2} \log \left(3 + 2\sqrt{2} \right) \right\}$$

$$= 2\left\{3\sqrt{2} + \frac{3}{2}\log\left(\sqrt{2}+1\right)^2\right\}$$

$$= 2\left\{3\sqrt{2} + 3\log\left(\sqrt{2}+1\right)\right\}$$

Choice (A)

106.   If $I = \displaystyle\int \frac{x^5}{\sqrt{1+x^3}}\,dx$ -

Ans : $I = \displaystyle\int \frac{x^5\,dx}{\sqrt{1+x^3}} = \int \frac{x^3 \cdot x^2\,dx}{\sqrt{1+x^3}}$

Put $1 + x^3 = t$ Þ $x^2\,dx = \dfrac{dt}{3}$

$$\therefore I = \int \frac{(t-1)\frac{dt}{3}}{\sqrt{t}}$$

$$= \frac{1}{3}\int\left(\sqrt{t} - \frac{1}{\sqrt{t}}\right)dt$$

$$= \frac{1}{3}\left(\frac{2}{3}\left(1+x^3\right)^{3/2} - 2\left(1+x^3\right)^{1/2}\right) + C$$

$$= \frac{2}{9}\left(1+x^3\right)^{3/2} - \frac{2}{3}\left(1+x^3\right)^{1/2} + C$$

Choice (D)

107.   Area enclosed by the curve -

Ans : $4\left(x - \sqrt{2}\right)^2 + y^2 = \dfrac{8}{\pi}$

Þ $\dfrac{\left(x - \sqrt{2}\right)^2}{\left(\frac{2}{\pi}\right)} + \dfrac{y}{\left(\frac{8}{\pi}\right)} = 1$

$\therefore$ Area of ellipse = p ab

$$= p \times \frac{\sqrt{2}}{\sqrt{\pi}} \times \frac{2\sqrt{2}}{\sqrt{\pi}}$$

$= 4$

Choice (D)

108. The value of -

Ans : $\displaystyle\int_0^a \sqrt{\frac{a-x}{x}}\,dx$

$x = a\sin^2 q$

$dx = 2a\sin q\cos q\,dq$

$x = 0$ ® $q = 0$

$x = a$ ® $q = \dfrac{\pi}{2}$

$$\int_0^a = \int_0^{\pi/2} \sqrt{\frac{\cos^2\theta}{\sin^2\theta}} \times 2a\sin\theta\cos\theta\,d\theta$$

$$= \int_0^{\pi/2} 2a\cos^2\theta\,d\theta$$

$$= 2a \times \frac{1}{2} \times \frac{\pi}{2} = \frac{\pi a}{2}$$

Choice (C)

109. Let y be the number of people -

Ans : $\dfrac{dy}{dt} = -ky$ where k is > 0

$\dfrac{dy}{y} = -kdt$

$\ln y = -kt + c$

$y = ce^{-kt},\ c > 0$

$\qquad k \geq 0$

Choice (B)

110. The differential equation of -

Ans: $x \cos q + y \sin q = a$ ¾ (1)

differentiating $\cos q + y' \sin q = 0$ ¾ (2)

Eliminating $\sin q$ and $\cos q$ from (1) and (2)

$\cos q = \dfrac{ay'}{xy' - y}$

$\sin q = \dfrac{-a}{xy' - y}$

$\sin^2 q + \cos^2 q = 1$

Þ $\dfrac{a^2 y'^2 + a^2}{(xy' - y)^2} = 1$

Þ $a^2 y' + a^2 = (xy' - g)^2$

Þ $\left(y - x\dfrac{dy}{dx}\right)^2 = a^2\left(1 + \left(\dfrac{dy}{dx}\right)^2\right)$

Choice (B)

111. The differential equation $\left|\dfrac{dy}{dx}\right| + |y| + 3 = 0$ admits -

Ans: $\left|\dfrac{dy}{dx}\right| + |y| + 3 = 0$

$\left|\dfrac{dy}{dx}\right| > 0$, $|y| > 0$, $3 > 0$

Three positive quantities cannot add to give zero.

\ No solution.

Choice (B)

112. Solution of the differential equation xdy -

Ans : $\dfrac{dy}{dx} = \sqrt{\dfrac{x^2 + y^2 + y}{x}}$ ¾ (1)

which is homogeneous put $y = v_x$

$$\backslash \frac{dy}{dx} = v + x\frac{dv}{dx}$$

$$\backslash (1) \text{Þ} \quad v + x\frac{dv}{dx} = \frac{\sqrt{x^2 + v^2x^2} + v_x}{x}$$

$$\backslash x\frac{dv}{dx} = \sqrt{1 + v^2}$$

$$\backslash \frac{dv}{\sqrt{1 + v^2}} = \frac{dx}{x}$$

Integrating

$$\int \frac{dv}{\sqrt{1 + v^2}} = \int \frac{dx}{x}$$

$$\log\left(v + \sqrt{1 - 1v^2}\right) = \log x + \log c$$

$$\log\left(\frac{y}{x} + \sqrt{1 + \frac{y}{x^2}} = \log Cx\right)$$

$$\frac{y}{x} + \sqrt{\frac{x^2 + y^2}{x}} = Cx$$

$$\backslash y + \sqrt{x^2 + y^2} = Cx^2$$

Choice (B)

113.　　Let P, Q, R and S be statements and suppose-

　　Ans:　p ® G ® R R ® p and ~ S ® R
　　　　Þ (C) and (D) are not true also ~ S ® R .
　　　　\ (A) is not true
　　　　Choice (B)

114. In how many number of ways -

　　　　　　　　　Ans :　Required number of ways = $\dfrac{10!}{4!\,3!\,3! \times 2!}$
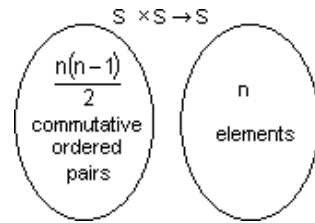
　　　　　　　= 2100

　　　　　　　　　　　　　Choice (D)

115.　　If *R* be a relation defined -

　　Ans :　　Relation is symmetric and transitive
　　　　　Choice (D)

116.　　Let S be a finite set containing n elements.
　　Then -

　　Ans:　　For commutative binary operations, there are $\dfrac{n(n-1)}{2}$ pairs available. For each of there pairs the result of the Binary operation should be among the n elements of S.

$$S \times S \to S$$

$\dfrac{n(n-1)}{2}$ commutative ordered pairs → n elements

\ Total number of required operations

$$= \dfrac{\overbrace{n \times \; n \times \;.........\times n}^{\frac{n(n-1)}{2}\text{times}}}{}$$

$$= \dfrac{n(n-1)}{2}$$

Choice (B)

117. A manufacturer of cotter pins knows that-

Ans: Probability of a cotter pin to be defective

$$= \dfrac{5}{100}$$

Average number of defective cotter pins in a box of 100 is $= 100 \times \dfrac{5}{100}$

$$= 5$$

We use Poisson distribution with parameter m = 5

Choice (B)

118. The probability that a certain kind -

Ans : $p = \dfrac{3}{4}, q = \dfrac{1}{4}, n = 4$

$$P(X = x) = {}^{4}C_{x}\left(\dfrac{3}{4}\right)^{x}\left(\dfrac{1}{4}\right)^{4-x}$$

$$\backslash p(X = 2) = {}^{4}C_{2}\left(\dfrac{3}{4}\right)^{2}\left(\dfrac{1}{4}\right)^{2}$$

$$= \dfrac{27}{128}$$

Choice (D)

119. Mean and standard deviation -

Ans : For best performance & $\dfrac{\sigma}{\bar{x}} \times 100$ is less

Which true for $\bar{x} = 75, s = 5$

Choice (B)

120. A random variable X follows -

Ans : For Binomial distribution

$$0 < \text{variance} < \text{mean}$$

$$0 < b < a$$

Choice (B)

PART – IV [BIOLOGY]

121. Photosynthetic protozoan –

    Ans :   *Euglena* is a photosynthetic protozoan.
           Choice   (D)

122. Compound eyes –

    Ans :   Arthropods possess compound eyes.
           Choice   (D)

123. Golden age –

    Ans :   Reptiles were evolved and flourished in Mesozoic era.
           Choice   (D)

124. Match the following –

    Ans :   Genera plantarum – Bentham and Hooker
           Species plantarum – Linnaeus
         Historia Generalis plantarum – John ray
          Scala Naturae – Aristotle
           Choice   (D)

125. Wings of mosquito, bat and bird –

    Ans :   Wings in mosquito, bat and bird show convergent evolution.
           Choice   (A)

126. Not important for evolution –

    Ans :   Somatic variation never influence evolution.
           Choice   (D)

127. Pre-zygotic isolating –

    Ans: Hybrid sterility is not a prezygotic isolation.
           Choice   (D)

128. Evolutionary process giving rise to new species –

    Ans :   Adaptive radiation means the evolutionary process giving rise to new species adapted to new habitats.
           Choice   (A)

129. The principle that gives –

    Ans :   Hardy-Weinberg' principle explains evolutionary process.
           Choice   (B)

130. Polymorphic cell organelle –

    Ans :   Lysosome shows primary, secondary and residual forms, hence polymorphic.
           Choice   (B)

131. Primary oocyte on meiosis –

    Ans :   Each primary oocyte on meiosis produces one ovum.
           Choice   (A)

132. Network of protein cables –

    Ans :   Spindle fibres consist protein cables.
           Choice (A)

133. Micelle microfibril –

    Ans :   Micelle consist 100 cellulose molecules and microfibril shows 20 micelles.
            Choice   (D)

134. In human height –

    Ans :   Human height is determined by many genes, hence it is polygenic.
            Choice   (C)

135. Cell containing multiples of 2n genomes –

    Ans :   Multiples of 2n genomes result endopolyploidy.
            Choice   (D)

136. Substitutes one purine base with another purine –

    Ans :   Transition is a kind of mutation which shows the replacement of a purine by another purine.
            Choice   (C)

137. Chargaff's rule –

    Ans :   The sum of purines is equal to the sum pyramidines ie., (A)+(G) = (T)+(C).
            Choice   (C)

138. Lysogenic cycle –

    Ans :   Temperate phages show lysogenic cyclic.
            Choice   (B)

139. Rennet –

    Ans :   Rennet is used in cheese making.
            Choice   (C)

140. Abundant immunoglobulin –

    Ans : I_gG is the most abundant immunoglobulin.
            Choice   (A)

141. Antiviral proteins –

    Ans :   Viral attack results the release of interferons.
            Choice   (B)

142. Syngenesious –

    Ans ;   Stamens of asteraceae are syngenasious, which shows anther lobes fusion and free filaments.
            Choice   (A)

143. Types of gametes are –

    Ans ;   Two types of gametes result from TTRr.
            Choice   (B)

144. Cross between a pure tall pea –

    Ans :   In F_2, the number of short plants formed are of 4.
            Choice   (C)

145. Shaft of cilia contains –

Ans :   Axoneme is the supporting structure of cilia shaft.
         Choice   (C)

146. Disease caused by –

Ans :   Mercury poisoning causes minamata diseases.
         Choice   (B)

147. Starting point of –

Ans ;   Ribulose biphosphate is CO_2 acceptor, hence is the starting point of Calvin cycle.
         Choice   (B)

148. Valve between the left atrium –

Ans :   Valve between the left atrium and the ventricle is the mitral valve.
         Choice   (B)

149. Collecting duct of the nephron –

Ans :   Collecting duct of nephron mainly recover water.
         Choice   (C)

150. Multiple sclerosis –

Ans :   Multiple sclerosis is an autoimmune disease.
         Choice   (B)

151. Urinary bladder can hold –

Ans :   Urinary bladder can holds 500ml of urine, but urination desire comes when the urine is 150ml.
         Choice   (A)

152. Chemical knives –

Ans ;   Chemical knife, Ligase is an endonuclease enzyme.
         Choice   (A)

153. Nucleotide arrangement –

Ans :   X-ray Crystallography revealed the chemical constitution and arrangement of nucleotide in DNA.
         Choice   (A)

154. Common indicator organism –

Ans :   *Escherichia coli* grows abundantly in polluted H_2O.
         Choice   (D)

155. Concentration of ozone –

Ans :   CFCs accumulation over north and south poles result less concentration of O_3.
         Choice   (A)

156. Reservoir of the nutrient exist –

Ans :   Phosphorus minerals exist as sedimentary.
         Choice   (B)

157. Important fiber yielding –

Ans :   Jute fibre is obtained from *Corchorus olitorius*.
         Choice   (D)

158. Karyopsis –

Ans :   Karyopsis is an one seeded dry indehiscent simple fruit.
        Choice (A)

159. Viruses enter –

Ans :   Wounds in the plant body facilitate the entry of viruses.
        Choice (B)

160. Honey –

Ans :   Honey is acidic because of the presence of large number of amino acids. Average pH of honey is 3.1-6.1
        Choice (A)

CHAPTERWISE DISTRIBUTION OF QUESTIONS FOR PHYSICS

Sl.No.	Chapter Name	No. of Questions	Difficulty Level		
			No. of E	No. of M	No. of D
1	Electrostatics	7	3	3	1
2	Current Electricity	6	4	2	
3	Magnetic Effects of Current				
4	Magnetism				
5	EMI & AC	4	4		
6	Ray Optics	2	2		
7	Wave Optics	4	2	1	1
8	Modern Physics	8	5	3	
9	Electronics	6	5		1
10	Communications	2	2		

EMD ANALYSIS - MATHEMATICS

TOPICS	Easy	Medium	Difficult	Total Marks	% of Marks
ALGEBRA	9	5	1	15	38%
Theory of Equations	1	1		2	5%
Sequences & Series	1			1	3%
Complex Numbers	1	1		2	5%
Permutations & Combinations		1		1	3%
Theory of Probability & Statistics	4	1		5	13%

Matrices & Determinants	2	1	1	4	10%
ANALYTICAL GEOMETRY	2			2	5%
DIFFERENTIAL CALCULUS	3	2	1	6	15%
TRIGONOMETRY	1	1	0	2	5%
Trigonometric Functions, Inverse trig.func., Trig.Equations	1			1	3%
Properties of Triangles		1		1	3%
VECTORS, 3-D, MATRICES & DETERMINANTS	3	3		6	15%
INTEGRAL CALCULUS	0	3	5	8	20%
Integral Calculus		1	3	4	10%
Differential Equations		2	2	4	10%
DISCRETE MATHEMATICS	1			1	3%
	19	14	7	40	1

CHAPTERWISE DISTRIBUTION OF QUESTIONS FOR BIOLOGY

Sl.No.	Chapter Name	No. of Questions	Difficulty Level		
			No. of E	No. of M	No. of D
1.	Biological Classification	1			1
2.	Plant Kingdom	1		1	
3.	Animal Kingdom	2	2		
4.	Morphology of Flowering Plants	3		3	
5.	Anatomy of Flowering Plants	1			1
6.	Cell: The Unit of Life	3		1	2

7.	Biomolecules	1			1
8.	Photosynthesis in Higher Plants	1	1		
9.	Body Fluids and Circulation	1	1		
10.	Excretory Products and their Elimination	2		2	
11.	Human Reproduction	1		1	
12.	Genetics	7		3	4
13.	Evolution	6		4	2
14.	Human Health and Disease	3	1	2	
15.	Microbes in Human Welfare	1		1	
16.	Biotechnology	1	1		
17.	Ecosystem	1		1	
18.	Environmental Issues	3		3	
19.	Plant Pathology	1		1	

AREAWISE DISTRIBUTION OF QUESTIONS FOR BIOLOGY

Sl. No.	Name of the Area	No. of Questions	Difficulty Level			Percentage
			No. of E	No. of M	No. of D	
1	Living World	4	2	1	1	10%
2	Structural Organisation in Plants and Animals	4		3	1	10%
3	Cell: The Unit of Life	4		1	3	10%
4	Plant Physiology	1	1			2.5%
5	Animal Physiology	3	1	2		7.5%
6	Reproduction in Organism	1		1		2.5%
7	Genetics	7		3	4	17.5%
8	Biology and human welfare	5	1	4		12.5%

9	Biotechnology	1	1			2.5%
10	Ecology	4		4		10%
11	Evolution	6		4	2	15%
	Total:	**40**	**6**	**23**	**11**	**100%**