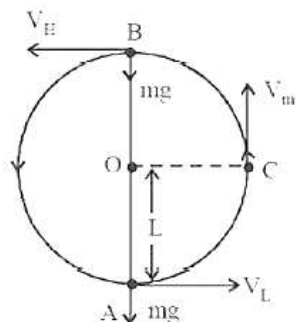


PART – I PHYSICS

- Force between two point charges q_1 and q_2 placed in vacuum at ' r ' cm apart is F . Force between them when placed in a medium having dielectric $K = 5$ at ' $r/5$ ' cm apart will be:
 - $F/25$
 - $5 F$
 - $F/5$
 - $25 F$
- A parallel plate capacitor has $1 \mu F$ capacitance. One of its two plates is given $+2 \mu C$ charge and the other plate, $+4 \mu C$ charge. The potential difference developed across the capacitor is :
 - 3 V
 - 1 V
 - 5 V
 - 2 V
- A body of mass M at rest explodes into three pieces, in the ratio of masses 1: 1: 2. Two smaller pieces fly off perpendicular to each other with velocities of 30 ms^{-1} and 40 ms^{-1} respectively. The velocity of the third piece will be :
 - 15 ms^{-1}
 - 25 ms^{-1}
 - 35 ms^{-1}
 - 50 ms^{-1}
- A charge particle moving in magnetic field B , has the components of velocity along B as well as perpendicular to B . The path of the charge particle will be
 - helical path with the axis perpendicular to the direction of magnetic field B
 - straight along the direction of magnetic field B
 - helical path with the axis along magnetic field B
 - circular path
- In meter bridge or Wheatstone bridge for measurement of resistance, the known and the unknown resistance are interchanged. The error so removed is
 - end correction
 - index error
 - due to temperature effect
 - random error
- Spherical insulating ball and a spherical metallic ball of same size and mass are dropped from the same height. Choose the correct statement out of the following {Assume negligible air friction}
 - Time taken by them to reach the earth's surface will be independent of the properties of their materials
 - Insulating ball will reach the earth's surface earlier than the metal ball
 - Both will reach the earth's surface simultaneously
 - Metal ball will reach the earth's surface earlier than the insulating ball.
- Two objects A and B are placed at 15 cm and 25 cm from the pole in front of a concave mirror having radius of curvature 40 cm . The distance between images formed by the mirror is
 - 60 cm
 - 40 cm
 - 160 cm
 - 100 cm
- A bob of mass ' m ' is suspended by a light string of length ' L '. It is imparted a minimum horizontal velocity at the lowest point A such that it just completes half circle reaching the top most position B . The ratio of kinetic energies $\frac{(K.E.)_A}{(K.E.)_B}$ is:



- 3: 2
- 5: 1
- 2: 5
- 1: 5

- Considering a group of positive charges, which of the following statements is correct?

- (a) Net potential of the system cannot be zero at a point but net electric field can be zero at that point.
 (b) Net potential of the system at a point can be zero but net electric field can't be zero at that point.
 (c) Both the net potential and the net field can be zero at a point.
 (d) Both the net potential and the net electric field cannot be zero at a point.

10. The work function of a substance is 4.0 eV . The longest wavelength of light that can cause photoelectron emission from this substance is approximately

- (a) 310 nm (b) 400 nm
 (c) 540 nm (d) 220 nm

11. Magnetic field at the centre of a circular coil of radius r , through which a current I flows is

- (a) directly proportional to r
 (b) inverseley proportional to I
 (c) directly proportional to I
 (d) directly propotional to I^2

12. The refractive index of a prism with apex angle A is $\cot A/2$. The angle of minimum deviation is :

- (a) $\delta_m = 180^\circ - 4A$
 (b) $\delta_m = 180^\circ - 3A$
 (c) $\delta_m = 180^\circ - 2A$
 (d) $\delta_m = 180^\circ - A$

13. If $\vec{A} = 4\hat{i} + 3\hat{j}$ and $\vec{B} = 3\hat{i} + 4\hat{j}$ then cosine of angle between $\vec{A}$ and $\vec{A} + \vec{B}$ is

- (a) $\frac{9\sqrt{2}}{5}$ (b) $\frac{7}{5\sqrt{2}}$
 (c) $\frac{5\sqrt{2}}{49}$ (d) $\frac{5\sqrt{2}}{28}$

14. Two light beams of intensities in the ratio of 9: 4 are allowed to interfere. The ratio of the intensity of maxima and minima will be :

- (a) 2: 3 (b) 16: 81
 (c) 25: 169 (d) 25: 1

15. A heavy box of mass 50 kg is moving on a horizontal surface. If co-efficient of kinetic friction between the box and horizontal surface is 0.3 then force of kinetic friction is:

- (a) 14.7 N (b) 147 N
 (c) 1.47 N (d) 1470 N

16. When unpolarized light is incident at an angle of 60° on a transparent medium from air. The reflected ray is completely polarized. The angle of refraction in the medium is

- (a) 30° (b) 60°
 (c) 90° (d) 45°

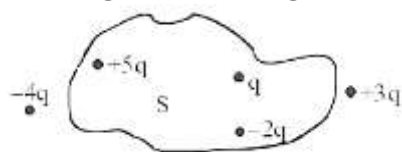
17. The waves emitted when a metal target is bombarded with high energy electrons are

- (a) Microwaves (b) X-rays
 (c) Infrared rays (d) Radio waves

18. Two bodies of mass 4 g and 25 g are moving with equal kinetic energies. The ratio of magnitude of their linear momentum is :

- (a) 3: 5 (b) 5: 4
 (c) 2: 5 (d) 4: 5

19. Five charges $+q, +5q, -2q, +3q$ and $-4q$ are situated as shown in the figure. The electric flux due to this configuration through the surface S is :



- (a) $\frac{5q}{\epsilon_0}$ (b) $\frac{4q}{\epsilon_0}$
 (c) $\frac{3q}{\epsilon_0}$ (d) $\frac{q}{\epsilon_0}$

20. Mass numbers of two nuclei are in the ratio of 4: 3. Their nuclear densities will be in the ratio of

- (a) 4:3 (b) $\left(\frac{3}{4}\right)^{\frac{1}{3}}$
(c) 1:1 (d) $\left(\frac{4}{3}\right)^{\frac{1}{3}}$

21. Under the same load, wire A having length 5.0 m and cross section $2.5 \times 10^{-5} \text{ m}^2$ stretches uniformly by the same amount as another wire B of length 6.0 m and a cross section of $3.0 \times 10^{-5} \text{ m}^2$ stretches. The ratio of the Young's modulus of wire A to that of wire B will be:

- (a) 1:4 (b) 1:1
(c) 1:10 (d) 1:2

22. A current of 10 A exists in a wire of cross-sectional area of 5 mm^2 with a drift velocity of $2 \times 10^{-3} \text{ ms}^{-1}$. The number of free electrons in each cubic meter of the wire is

- (a) 2×10^{25} (b) 2×10^{23}
(c) 625×10^{25} (d) 2×10^6

23. A long straight wire of circular cross-section (radius a) is carrying steady current I.

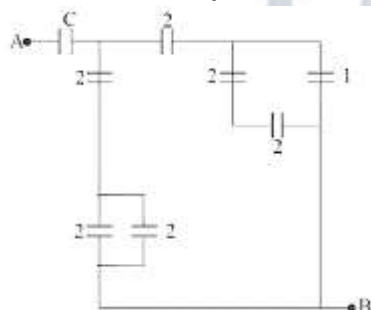
The current I is uniformly distributed across this cross-section. The magnetic field is

- (a) Zero in the region $r < a$ and inversely proportional to r in the region $r > a$
(b) Inversely proportional to r in the region $r < a$ and uniform throughout in the region $r > a$
(c) Directly proportional to r in the region $r < a$ and inversely proportional to r in the region $r > a$
(d) Uniform in the region $r < a$ and inversely proportional to distance r from the axis, in the region $r > a$

24. A small ball of mass M and density ρ is dropped in a viscous liquid of density ρ_0 . After some time, the ball falls with a constant velocity. What is the viscous force on the ball?

- (a) $F = Mg \left(1 - \frac{\rho_0}{\rho}\right)$ (b) $F = Mg \left(1 + \frac{\rho}{\rho_0}\right)$
(c) $F = Mg \left(1 + \frac{\rho_0}{\rho}\right)$ (d) $F = Mg(1 \pm \rho\rho_0)$

25. In the circuit shown, find C if the effective capacitance of the whole circuit is to be $0.5 \mu\text{F}$. All values in the circuit are in μF .



- (a) $\frac{7}{11} \mu\text{F}$ (b) $\frac{6}{5} \mu\text{F}$
(c) $4 \mu\text{F}$ (d) $\frac{7}{10} \mu\text{F}$

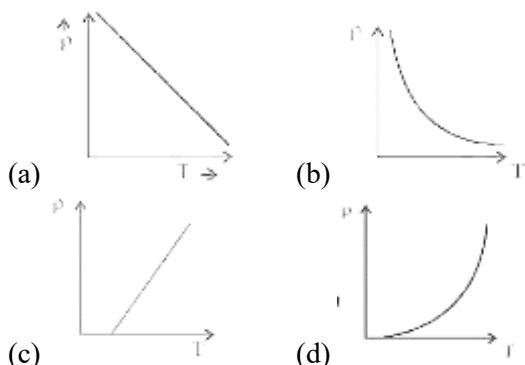
26. Choose the correct option from the following options given below :

- (a) In the ground state of Rutherford's model electrons are in stable equilibrium. While in Thomson's model electrons always experience a net-force.
(b) An atom has a nearly continuous mass distribution in a Rutherford's model but has a highly non-uniform mass distribution in Thomson's model
(c) A classical atom based on Rutherford's model is doomed to collapse.
(d) The positively charged part of the atom possesses most of the mass in Rutherford's model but not in Thomson's model.

27. A cylinder of height 20 m is completely filled with water. The velocity of efflux of water (in ms^{-1}) through a small hole on the side wall of the cylinder near its bottom is

- (a) 10 (b) 20
(c) 25.5 (d) 5

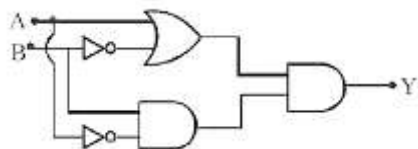
28. The resistivity (ρ) of semiconductor varies with temperature. Which of the following curve represents the correct behaviour



29. Two parallel, long wires are kept 0.20 m apart in vacuum, each carrying current of x A in the same direction. If the force of attraction per meter of each wire is 2×10^{-6} N, then the value of x is approximately:

- (a) 1 (b) 2.4
(c) 1.4 (d) 2

30. The output Y of following circuit for given inputs is :



- (a) $A \cdot B(A + B)$ (b) $A \cdot B$
(c) 0 (d) $\bar{A} \cdot B$

31. If you are provided a set of resistances 2Ω , 4Ω , 6Ω and 8Ω . Connect these resistances so as to obtain an equivalent resistance of $\frac{46}{3}\Omega$.

- (a) 4Ω and 6Ω are in parallel with 2Ω and 8Ω in series
(b) 6Ω and 8Ω are in parallel with 2Ω and 4Ω in series
(c) 2Ω and 6Ω are in parallel with 4Ω and 8Ω in series
(d) 2Ω and 4Ω are in parallel with 6Ω and 8Ω in series

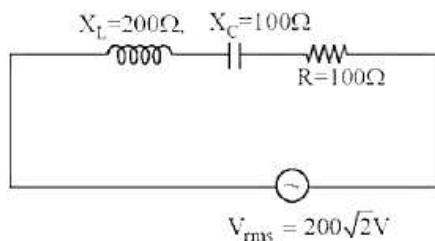
32. Two cells of same emf but different internal resistances r_1 and r_2 are connected in series with a resistance R . The value of resistance R , for which the potential difference across second cell is zero, is

- (a) $r_2 - r_1$ (b) $r_1 - r_2$
(c) r_1 (d) r_2

33. A cylinder of fixed capacity of 44.8 litres contains helium gas at standard temperature and pressure. The amount of heat needed to raise the temperature of gas in the cylinder by 20.0°C will be : (Given gas constant $R = 8.3\text{ J K}^{-1} - \text{mol}^{-1}$)

- (a) 249 J (b) 415 J
(c) 498 J (d) 830 J

34. In the given circuit, rms value of current (I_{rms}) through the resistor R is :



- (a) 2 A (b) $\frac{1}{2}$ A
(c) 20 A (d) $2\sqrt{2}$ A

35. At what temperature a gold ring of diameter 6.230 cm be heated so that it can be fitted on a wooden bangle of diameter 6.241 cm ? Both the diameters have been measured at room temperature (27°C). (Given: coefficient of linear thermal expansion of gold $\alpha_1 = 1.4 \times 10^{-5} \text{ K}^{-1}$)

- (a) 125.7°C (b) 91.7°C
(c) 425.7°C (d) 152.7°C

PART – II CHEMISTRY

36. The wavelength (in cm) of second line in the Lyman series of hydrogen atomic spectrum is (Rydberg constant = $R\text{cm}^{-1}$)

- (a) $\left(\frac{8R}{9}\right)$ (b) $\left(\frac{9}{8R}\right)$
(c) $\left(\frac{4}{3R}\right)$ (d) $\left(\frac{3R}{4}\right)$

37. Polarisability of halide ions increases in the order

- (a) $\text{F}^-, \text{I}^-, \text{Br}^-, \text{Cl}^-$ (b) $\text{Cl}^-, \text{Br}^-, \text{I}^-, \text{F}^-$
(c) $\text{I}^-, \text{Br}^-, \text{Cl}^-, \text{F}^-$ (d) $\text{F}^-, \text{Cl}^-, \text{Br}^-, \text{I}^-$

38. The statement that is not correct for periodic classification of elements is:

- (a) the properties of elements are periodic function of their atomic numbers.
(b) non-metallic elements are less in number than metallic elements.
(c) for transition elements, the 3d-orbitals are filled with electrons after 3p-orbitals and before 4s-orbitals.
(d) the first ionisation enthalpies of elements generally increase with increase in atomic number as we go along a period.

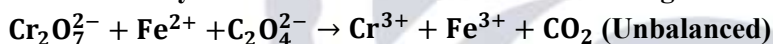
39. PCl_5 is dissociating 50% at 250°C at a total pressure of P atm. If equilibrium constant is K_p , then which of the following relation is numerically correct?

- (a) $K_p = 3P$ (b) $P = 3K_p$
(c) $P = \frac{2K_p}{3}$ (d) $K_p = \frac{2P}{3}$

40. Which of the following statement is false?

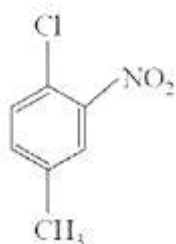
- (a) Cannizzaro reaction is given by aldehydes in presence of alkali.
(b) Aldol condensation is given by aldehydes in presence of alkali.
(c) Aldol condensation is given by aldehydes and ketones in presence of acids.
(d) None of the above.

41. How many electrons are involved in the following redox reaction?



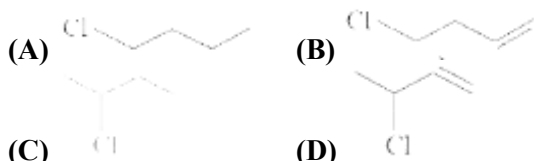
- (a) 3 (b) 4
(c) 6 (d) 5

42. The IUPAC name for



- (a) 1-chloro-2-nitro-4-methylbenzene
(b) 1-chloro-4-methyl-2-nitrobenzene
(c) 2-chloro-1-nitro-5-methylbenzene
(d) m-nitro-p-chlorotoluene

43. The decreasing order of reactivity towards dehydrohalogenation (E_1) reaction of the following compounds is:



- (a) $D > B > C > A$ (b) $B > D > A > C$
(c) $B > D > C > A$ (d) $B > A > D > C$

44. Specific conductance of 0.1M HNO_3 is $6.3 \times 10^{-2} \text{ohm}^{-1} \text{cm}^{-1}$. The molar conductance of the solution is

- (a) $100\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$
 (b) $515\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$
 (c) $630\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$
 (d) $6300\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$

45. Which of the following compounds does not show Lassaigne's test for nitrogen ?

- (a) Urea (b) Hydrazine
 (c) Phenylhydrazine (d) Azobenzene

46. The strongest acid among the following is –

- (a) Salicylic acid
 (b) *m*-hydroxybenzoic acid
 (c) *p*-hydroxybenzoic acid
 (d) Benzoic acid

47. At 25°C and 1 atm pressure, the enthalpy of combustion of benzene (l) and acetylene (g) are -3268 kJ mol^{-1} and -1300 kJ mol^{-1} , respectively. The change in enthalpy for the reaction $3\text{C}_2\text{H}_2(\text{g}) \rightarrow \text{C}_6\text{H}_6(\text{l})$, is

- (a) $+324\text{ kJ mol}^{-1}$ (b) $+632\text{ kJ mol}^{-1}$
 (c) -632 kJ mol^{-1} (d) -732 kJ mol^{-1}

48. How many conformations are possible for ethane?

- (a) 2 (b) 3
 (c) infinite (d) one

49. For which one of the following sets of four quantum numbers, an electron will have the highest energy?

- | | n | l | m | s |
|-----|---|---|----|------|
| (a) | 3 | 2 | 1 | 1/2 |
| (b) | 4 | 2 | -1 | 1/2 |
| (c) | 4 | 1 | 0 | -1/2 |
| (d) | 5 | 0 | 0 | -1/2 |

50. Using VSEPR theory, predict the species which has square pyramidal shape

- (a) SnCl_2 (b) CCl_4
 (c) SO_3 (d) BrF_5

51. Which of the following relation is not correct?

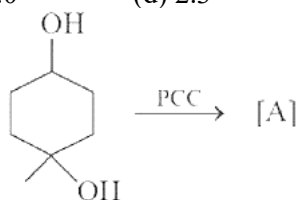
- (a) $\Delta H = \Delta U - P\Delta V$ (b) $\Delta U = q + W$
 (c) $\Delta S_{\text{sys}} + \Delta S_{\text{surr}} \geq 0$ (d) $\Delta G = \Delta H - T\Delta S$

52. The acidic, basic and amphoteric oxides, respectively, are:

- (a) Na_2O , SO_3 , Al_2O_3
 (b) Cl_2O , CaO , P_4O_{10}
 (c) N_2O_3 , Li_2O , Al_2O_3
 (d) MgO , Cl_2O , Al_2O_3

53. 100 mL of 0.04 N HCl aqueous solution is mixed with 100 mL of 0.02 N NaOH solution. The pH of the resulting solution is:

- (a) 1.0 (b) 1.7
 (c) 2.0 (d) 2.3



54. [A] will show

- (a) Br_2 water test
 (b) Tollen's test
 (c) Victor maeyer test
 (d) Lucas test

55. The value of van't Hoff factors for KCl, NaCl and K_2SO_4 respectively are.....

- (a) 2, 2 and 2 (b) 2, 2 and 3
 (c) 1, 1 and 2 (d) 1, 1 and 1

56. A first order reaction is half completed in 45 minutes. How long does it need 99.9% of the reaction to be completed

- (a) 5 hours (b) 7.5 hours
(c) 10 hours (d) 20 hours

57. The greater the valence of the flocculating ion added, the greater is its power to cause precipitation of a colloid. This rule is

- (a) Hund's rule (b) Pauling rule
(c) Henry's rule (d) Hardy-Schulze rule

58. The number of hydrogen bonds formed by a water molecule at normal conditions is

- (a) 1 (b) 2
(c) 3 (d) 4

59. Element not showing variable oxidation state is :

- (a) Bromine (b) Iodine
(c) Chlorine (d) Fluorine

60. Which of the following arrangements does not represent the correct order of the property stated against it ?

- (a) $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour
(b) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size
(c) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution
(d) $Sc < Ti < Cr < Mn$: number of oxidation states

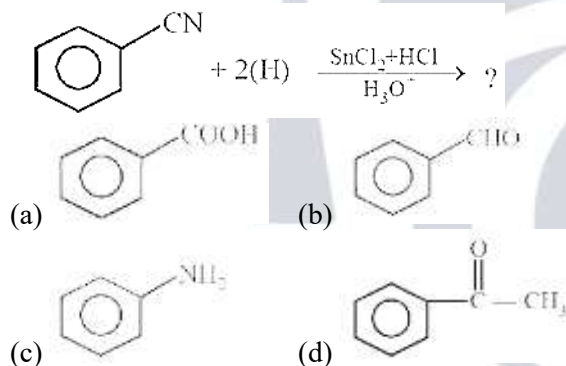
61. Lanthanoid which has the smallest size in +3 state is

- (a) Tb (b) Er
(c) Ce (d) Lu

62. 'Oxidation number of H in NaH, CaH₂ and LiH, respectively is

- (a) +1, +1, -1 (b) -1, +1, +1
(c) +1, +1, +1 (d) -1, -1, -1

63. Product of the following reaction is



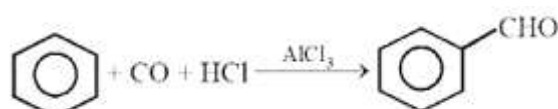
64. Which of the following alkyl halides will undergo S_N1 reaction most readily?

- (a) (CH₃)₃C - F (b) (CH₃)₃C - Cl
(c) (CH₃)₃C - Br (d) (CH₃)₃C - I

65. Phenol does not undergo nucleophilic substitution reaction easily due to:

- (a) acidic nature of phenol
(b) partial double bond character of C - OH bond
(c) partial double bond character of C - C bond
(d) instability of phenoxide ion

66. The reaction



- (a) Rosenmund's reaction
(b) Stephen's reaction
(c) Cannizzaro's reaction
(d) Gatterman-Koch reaction

67. Hoffmann bromamide degradation reaction is shown by

- (a) ArNH_2 (b) ArCONH_2
(c) ArNO_2 (d) ArCH_2NH_2

68. Which of the following acids is a vitamin?

- (a) Aspartic acid (b) Ascorbic acid
(c) Adipic acid (d) Saccharic acid

69. Intermolecular forces in nylon-6, 6 are

- (a) dipole-dipole interactions
(b) hydrogen bonding
(c) van der Waal's forces
(d) ionic bonds

70. Which of the following does not form a chelate?

- (a) EDTA (b) Oxalate
(c) Pyridine (d) Ethylenediamine

PART – III MATHEMATICS

71. Let $n(A) = m$ and $n(B) = n$, if the number of subsets of A is 56 more than of subsets of B , then $m + n$ is equal to

- (a) 9 (b) 13
(c) 8 (d) 10

72. If $f(x) = \cos^{-1}\left(\frac{\sqrt{2x^2+1}}{x^2+1}\right)$, then range of $f(x)$ is

- (a) $[0, \pi]$ (b) $\left(0, \frac{\pi}{4}\right]$
(c) $\left(0, \frac{\pi}{3}\right]$ (d) $\left[0, \frac{\pi}{2}\right)$

73. A, P, B are 3×3 matrices. If $|-B| = 5$, $|BA^T| = 15$, $|P^TAP| = -27$, then one of the values of $|P|$ is

- (a) 3 (b) -5
(c) 9 (d) 6

74. If $f(x)$ defined as given below, is continuous on R , then the value of $a + b$ is equal to

$$f(x) = \begin{cases} \sin x, & x \leq 0 \\ x^2 + a, & 0 < x < 1 \\ bx + 3, & 1 \leq x \leq 3 \\ -3, & x > 3 \end{cases}$$

- (a) 0 (b) 2
(c) -2 (d) 3

75. Let $f(x) = \begin{cases} 3-x & \text{if } x < -3 \\ 6 & \text{if } -3 \leq x \leq 3 \\ 3+x & \text{if } x > 3 \end{cases}$. Let α be the number of points of discontinuity of f

and β be the number of points where f is not differentiable. Then $\alpha + \beta =$

- (a) 6 (b) 3
(c) 2 (d) 0

76. $\frac{d}{dx} \left\{ \sin^2 \left(\cot^{-1} \sqrt{\frac{1+x}{1-x}} \right) \right\}$ is equal to

- (a) 0 (b) $\frac{1}{2}$
(c) $-\frac{1}{2}$ (d) -1

77. The number of students who take both the subjects mathematics and chemistry is 30. This represents 10% of the enrolment in mathematics and 12% of the enrolment in chemistry. How many students take at least one of these two subjects?

- (a) 520 (b) 490
(c) 560 (d) 480

78. If A and B are the two real values of k for which the system of equations $x + 2y + z = 1$, $x + 3y + 4z = k$, $x + 5y + 10z = k^2$ is consistent, then $A + B =$

- (a) 3 (b) 4
(c) 5 (d) 7

79. The radius of the base of a cone is increasing at the rate of 3 cm/ minute and the altitude is

decreasing at the rate of 4 cm/ minute. The rate of change of lateral surface when the radius = 7 cm and altitude = 24 cm, is

- (a) $54\pi \text{ cm}^2/\text{min}$ (b) $7\pi \text{ cm}^2/\text{min}$
(c) $27\pi \text{ cm}^2/\text{min}$ (d) None of these

80. The maximum area of a right angled triangle with hypotenuse h is

- (a) $h^2/2\sqrt{2}$ (b) $h^2/2$
(c) $h^2/\sqrt{2}$ (d) $h^2/4$

81. If $f(x)$ is continuous and $\int_0^9 f(x)dx = 4$, then the value of the integral $\int_0^3 x \cdot f(x^2)dx$ is

- (a) 2 (b) 18
(c) 16 (d) 4

82. The area bounded by $y - 1 = -|x|$ and $y + 1 = |x|$ is

- (a) $\frac{1}{2}$ (b) 1
(c) 2 (d) 0

83. Let the vectors $\overrightarrow{AB} = 2\hat{i} + 2\hat{j} + \hat{k}$ and $\overrightarrow{AC} = 2\hat{i} + 4\hat{j} + 4\hat{k}$ be two sides of a triangle ABC . If G is the centroid of $\triangle ABC$, then $\frac{22}{7}(\overrightarrow{AG})^2 + 5 =$

- (a) 25 (b) 38
(c) 47 (d) 52

84. If the two lines $l_1: \frac{x-2}{3} = \frac{y+1}{-2}, z = 2$ and $l_2: \frac{x-1}{1} = \frac{2y+3}{\alpha} = \frac{z+5}{2}$ perpendicular, then an angle between the lines l_2 and $l_3: \frac{1-x}{3} = \frac{2y-1}{-4} = \frac{z}{4}$ is :

- (a) $\cos^{-1}\left(\frac{29}{4}\right)$ (b) $\sec^{-1}\left(\frac{29}{4}\right)$
(c) $\cos^{-1}\left(\frac{2}{29}\right)$ (d) $\cos^{-1}\left(\frac{2}{\sqrt{29}}\right)$

85. If $f(x) = \ln\left(\frac{x^2+e}{x^2+1}\right)$, then range of $f(x)$ is

- (a) $(0,1)$ (b) $(0,1]$
(c) $[0,1)$ (d) $\{0,1\}$

86. $f(x) = \frac{\log(\pi+x)}{\log(e+x)}$ is

- (a) increasing in $[0, \infty)$
(b) decreasing in $[0, \infty)$
(c) decreasing in $\left[0, \frac{\pi}{e}\right]$ and increasing in $\left[\frac{\pi}{e}, \infty\right)$
(d) increasing in $\left[0, \frac{\pi}{e}\right]$ and decreasing in $\left[\frac{\pi}{e}, \infty\right)$

87. $\int_{-\pi}^{\pi} x^2(\sin x)dx =$

- (a) π^2 (b) $\frac{\pi^2}{2}$
(c) 0 (d) $2\pi^2$

88. The solution of the differential equation $x^4 \frac{dy}{dx} + x^3 y + \operatorname{cosec}(xy) = 0$ is equal to :

- (a) $2\cos(xy) + x^{-2} = c$
(b) $2\cos(xy) + y^{-2} = c$
(c) $2\sin(xy) + x^{-2} = c$
(d) $2\sin(xy) + y^{-2} = c$

89. If the solution of $\left(1 + 2e^{\frac{x}{y}}\right)dx + 2e^{\frac{x}{y}}\left(1 - \frac{x}{y}\right)dy = 0$ i $\left(x + \lambda ye^{\frac{x}{y}}\right) = c$; (c is an arbitrary constant), then λ is

- (a) 1 (b) 2
(c) 3 (d) None of these

90. The probability distribution of a random variable is given below

$X = x$	0	1	2	3	4	5	6	7
$P(X = x)$	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2 + K$

Then, $P(0 < x < 5)$ is equal to

- (a) $\frac{1}{10}$ (b) $\frac{3}{10}$
(c) $\frac{8}{10}$ (d) $\frac{7}{10}$

91. The length of the perpendicular from the point $(1, -2, 5)$ on the line passing through $(1, 2, 4)$ and parallel to the line

$$x + y - z = 0 \text{ and } x - 2y$$

$$+ 3z - 5 = 0 \text{ is:}$$

- (a) $\sqrt{\frac{21}{2}}$ (b) $\sqrt{\frac{9}{2}}$
(c) $\sqrt{\frac{73}{2}}$ (d) 1

92. The range of $2|\sin x + \cos x| - \sqrt{2}$ is

- (a) $[-\sqrt{2}, \sqrt{2}]$ (b) $[-3\sqrt{2}, \sqrt{2}]$
(c) $(-3\sqrt{2}, \sqrt{2})$ (d) None of these

93. $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \left(\frac{x + \frac{\pi}{4}}{2 - \cos 2x} \right) dx$ is equal to

- (a) $\frac{8\pi\sqrt{3}}{5}$ (b) $\frac{2\pi\sqrt{3}}{9}$
(c) $\frac{4\pi^2\sqrt{3}}{9}$ (d) $\frac{\pi^2}{6\sqrt{3}}$

94. A and B are independent events of a random experiment if and only if

- (a) $P(A | B) \neq P(A \cap B)$
(b) $P(A | B) = P(B | A)$
(c) $P(A | B) \neq P(A | B^c)$
(d) $P(A | B) = P(A | B^c)$

95. The equation of a common tangent to the parabolas $y = x^2$ and $y = -(x - 2)^2$ is

- (a) $y = 4(x - 2)$ (b) $y = 4(x - 1)$
(c) $y = 4(x + 1)$ (d) $y = 4(x + 2)$

96. Negation of the statement $(p \wedge r) \rightarrow (r \vee q)$ is

- (a) $\sim (p \wedge r) \rightarrow \sim (r \vee q)$
(b) $(\sim p \vee \sim r) \vee (r \vee q)$
(c) $(p \wedge r) \wedge (r \wedge q)$
(d) $(p \wedge r) \wedge (\sim r \wedge \sim q)$

97. The number of different permutations of all the letters of the word 'PERMUTATION' such that any two consecutive letters in the arrangement are neither both vowels nor both identical is

- (a) $63 \times 6! \times 5!$ (b) $57 \times 5! \times 5!$
(c) $33 \times 6! \times 5!$ (d) $7 \times 7! \times 5!$

98. The coefficients of x^{50} in $(1 + x)^{101} (1 - x + x^2)^{100}$ is.....

- (a) 1 (b) -1
(c) 0 (d) 2

99. $\frac{1}{q+r}, \frac{1}{r+p}, \frac{1}{p+q}$ are in A.P. then,

- (a) p, q, r are in A.P.
(b) p^2, q^2, r^2 are in A.P.
(c) $\frac{1}{p}, \frac{1}{q}, \frac{1}{r}$ are in A.P.
(d) $p + q + r$ are in A.P.

100. The coordinates of the foot of perpendicular from the point $(2, 3)$ on the line $y = 3x + 4$ is given by

- (a) $\left(\frac{37}{10}, \frac{-1}{10}\right)$ (b) $\left(\frac{-1}{10}, \frac{37}{10}\right)$
(c) $\left(\frac{10}{37}, -10\right)$ (d) $\left(\frac{2}{3}, -\frac{1}{3}\right)$

101. The circle touching the y -axis at a distance 4 units from the origin and cutting off an intercept 6 from x -axis is

- (a) $x^2 + y^2 + 10x - 8y + 16 = 0$
 (b) $x^2 + y^2 + 5x - 8y + 16 = 0$
 (c) $x^2 + y^2 + 5x - 2y - 8 = 0$
 (d) $x^2 + y^2 + 2x - y - 12 = 0$

102. The points A(4, -2, 1), B(7, -4, 7), C(2, -5, 10) and D(-1, -3, 4) are the vertices of a

- (a) tetrahedron (b) parallelogram
 (c) rhombus (d) square

103. If A, B, C, D are the angles of a quadrilateral, then

$$\frac{\tan A + \tan B + \tan C + \tan D}{\cot A + \cot B + \cot C + \cot D} =$$

- (a) $\cot A \cot B \cot C \cot D$
 (b) $\tan A \tan B \tan C \tan D$
 (c) $-\tan A \tan B \tan C \tan D$
 (d) $-\cot A \cot B \cot C \cot D$

104. Let $z \neq 1$ be a complex number and let $\omega = x + iy, y \neq 0$. If $\frac{\omega - \bar{\omega}z}{1 - z}$ is purely real, then $|z|$ is equal to

- (a) $|\omega|$ (b) $|\omega|^2$
 (c) $\frac{1}{|\omega|^2}$ (d) 1

105. If the roots of $(a^2 + b^2)x^2 - 2(bc + ad)x + c^2 + d^2 = 0$ are equal, then

- (a) $\frac{a}{b} = \frac{c}{d}$ (b) $\frac{a}{c} + \frac{b}{d} = 0$
 (c) $\frac{a}{d} = \frac{b}{c}$ (d) $a + b = c + d$

106. $\lim_{x \rightarrow 0} \frac{35^x - 7^x - 5^x + 1}{(e^x - e^{-x}) \ln(1 - 3x)} =$

- (a) $\frac{\ln 35}{6}$ (b) $-\frac{\ln 35}{6}$
 (c) $-\frac{\ln 2}{6}$ (d) $\frac{\ln(5) \cdot \ln 7}{-6}$

107. If $z_r = \cos \frac{r\alpha}{n^2} + i \sin \frac{r\alpha}{n^2}$, where $r = 1, 2, 3, \dots, n$, then the value of $\lim_{n \rightarrow \infty} z_1 z_2 z_3 \dots z_n$ is

- (a) 0 (b) $e^{-\frac{i\alpha}{2}}$
 (c) $e^{\frac{i\alpha}{2}}$ (d) $e^{i\alpha}$

108. Let $f(x)$ be a polynomial function satisfying $f(x) \cdot f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$. If $f(4) = 65$ and l_1, l_2, l_3 are in GP, then $f'(l_1), f'(l_2), f'(l_3)$ are in

- (a) AP (b) GP
 (c) Both (d) None of these

109. In four schools B_1, B_2, B_3, B_4 the percentage of girls students is 12, 20, 13, 17 respectively.

From a school selected at random, one student is picked up at random and it is found that the student is a girl.

The probability that the school selected is B_2 , is

- (a) $\frac{6}{31}$ (b) $\frac{10}{31}$
 (c) $\frac{13}{62}$ (d) $\frac{17}{62}$

110. For real numbers x and y , we define xRy iff $x - y + \sqrt{5}$ is an irrational number. Then, relation R is

- (a) reflexive (b) symmetric
 (c) transitive (d) None of these

PART - IV

APTITUDE TEST

These questions are to be answered on the basis of the pie chart given below showing how a person's monthly salary is distributed over different expense heads.



111. For a person, whose monthly salary is Rs 6,000 p.m., how many items are there on which he has to spend more than ₹ 1,000 p.m?

- (a) 1 (b) 2
(c) 3 (d) 4

112. The annual saving for such a person will be approximately:

- (a) ₹ 5,000 (b) ₹ 10,000
(c) ₹ 15,000 (d) ₹ 16,560

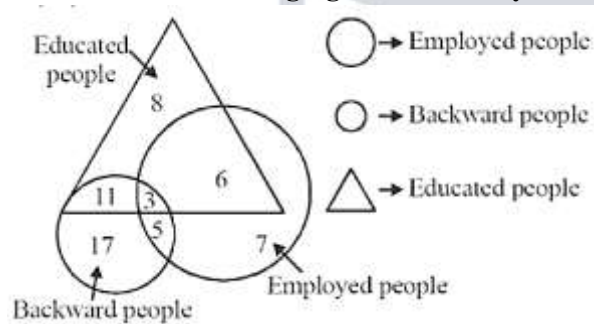
113. The monthly salary for a person who follows the same expense pattern, but has a petrol expense of Rs 500 p.m., is

- (a) ₹ 2,500 (b) ₹ 3,000
(c) ₹ 5,000 (d) ₹ 6,500

114. If NATION is coded as 467234 and EARN be coded as 1654 then ATTENTION should be coded as :-

- (a) 432769561 (b) 956143654
(c) 766412743 (d) 677147234

115. In the following figure, how many educated people are employed ?



- (a) 18 (b) 20
(c) 15 (d) 9

116. A man is facing west. He runs 45° in the clockwise direction and then another 180° in the same direction and then 270° in the anticlockwise direction. Which direction is he facing now?

- (a) South (b) North-west
(c) West (d) South-west

117. A is the brother of B . A is the brother of C . To find what is the relation between B and C.

What minimum information from the following is necessary?

- (i) Gender of C (ii) Gender of B
(a) Only (i) (b) Only (ii)
(c) Either (i) or (ii) (d) both (i) and (ii)

118. In a class of 20 students, Alisha's rank is 15th from the top. Manav is 4 ranks above Alisha. What is Manav's rank from the bottom?

- (a) 10th (b) 11th
(c) 9th (d) 12th

119. In this question, there are three statements followed by conclusions numbered I and II. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and then decide which of the given conclusions logically follow from the three statements.

Statements: All books are ledgers.

All pens are keys.

Some pens are books.

Conclusions: I Some ledgers are keys.

II. Some keys are books.

(a) if only conclusion I follows.

(b) if only conclusion II follows.

(c) if neither I nor II follows.

(d) if both I and II follow.

120. If it was a Friday on 1 January 2016, what was the day of the week on 31 December 2016?

(a) Saturday

(b) Friday

(c) Monday

(d) Sunday

PART – V ENGLISH

Read the passage carefully and choose the best answer to each question out of the four alternatives.

"People very often complain that poverty is a great evil and that it is not possible to be happy unless one has a lot of money. Actually, this is not necessarily true. Even a poor man, living in a small hut with none of the comforts and luxuries of life, may be quite contented with his lot and achieve a measure of happiness. On the other hand, a very rich man, living in a palace and enjoying everything that money can buy, may still be miserable, if, for example, he does not enjoy good health or his only son has taken to evil ways. Apart from this, he may have a lot of business worries which keep him on tenterhooks most of the time. There is a limit to what money can buy and there are many things which are necessary for a man's happiness and which money cannot procure.

Real happiness is a matter of the right attitude and the capacity of being contented with whatever you have is the most important ingredient of this attitude".

121. The phrase "on tenterhooks" means:

(a) in a state of thoughtfulness

(b) in a state of anxiety

(c) in a state of sadness

(d) in a state of forgetfulness

122. It is true that:

(a) money alone can give happiness

(b) money always gives happiness

(c) money seldom gives happiness

(d) money alone cannot give happiness

123. A rich man's life may become miserable if he:

(a) has evil son, bad health and business worries

(b) does not enjoy good health

(c) has business worries

(d) has business worries and his only son has taken to evil ways

124. Which of the following is the most appropriate title to the passage?

(a) Poverty, a great evil

(b) The key of happiness

(c) Contentment, the key of happiness

(d) Money and contentment

125. Which of the following statement is true?

(a) Only a poor but contented man can be happy

(b) A poor but contented man can never be happy

(c) A poor but contented man can be happy

(d) A poor but contented man is always happy