

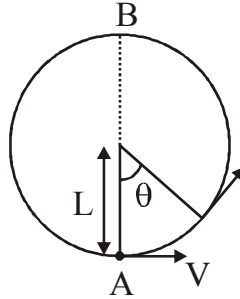
Dual Degree B.Sc. (Hons.) Chemistry-M.Sc. Chemistry with
Mathematics at 10 + 2 level Entrance Test, 2022

PHYSICS

1. A baseband signal of 3.5 MHz frequency is modulated with a carrier signal of 3.5 GHz frequency using amplitude modulation method. What should be the minimum size of antenna required to transmit the modulated signal ?
(A) 21.4 m (B) 42.8 mm
(C) 21.4 mm (D) 42.8 m
2. If surface tension (S), Moment of inertia (I) and Planck's constant (h), were to be taken as the fundamental units, the dimensional formula for linear momentum would be :
(A) $S^{1/2} I^{1/2} h^0$ (B) $S^{3/2} I^{1/2} h^0$
(C) $S^{1/2} I^{1/2} h^{-1}$ (D) $S^{1/2} I^{3/2} h^{-1}$
3. The diameter of a cylinder is measured using a Vernier Calipers with no zero error. It is found that the zero of the Vernier scale lies between 5.10 cm and 5.15 cm of the main scale. The Vernier scale has 50 divisions equivalent to 2.45 cm. The 24th division of the Vernier scale exactly coincides with one of the main scale divisions. The diameter of the cylinder is :
(A) 5.148 cm (B) 5.136 cm
(C) 5.124 cm (D) 5.112 cm

4. During the padding of a bicycle, the force of friction exerted by the ground on the two wheels is such that it acts :
- (A) in the forward direction on the front wheel and in the backward direction on the rear wheel
 - (B) in the backward direction on both the front and the rear wheels
 - (C) in the forward direction on both the front and the rear wheels
 - (D) in the backward direction on the front wheel and in the forward direction on the rear wheel
5. The position of a particle as a function of time t , is given by $x(t) = at + bt^2 - ct^3$ where a , b and c are constants. When the particle attains zero acceleration, then its velocity will be :
- (A) $a + \frac{b^2}{4c}$
 - (B) $a + \frac{b^2}{2c}$
 - (C) $a + \frac{b^2}{c}$
 - (D) $a + \frac{b^2}{3c}$
6. An ideal spring with spring constant k is hung from the ceiling and a block of mass M is attached to its lower end. The mass is released with the spring initially unstretched. Then the maximum extension in the spring is :
- (A) $\frac{4Mg}{k}$
 - (B) $\frac{2Mg}{k}$
 - (C) $\frac{Mg}{k}$
 - (D) $\frac{Mg}{2k}$

7. A bob of mass M is suspended by a massless string of length L . The horizontal velocity V at position A is just sufficient to make it reach the point B. The angle θ at which the speed of the bob is half of that at A, satisfies :



- (A) $\theta = \frac{\pi}{4}$
- (B) $\frac{\pi}{4} < \theta < \frac{\pi}{2}$
- (C) $\frac{\pi}{2} < \theta < \frac{3\pi}{4}$
- (D) $\frac{3\pi}{4} < \theta < \pi$
8. A satellite of mass M is in a circular orbit of radius R about the centre of the earth. A meteorite of the same mass falling towards the earth collides with the satellite completely inelastically. The speeds of the satellite and the meteorite are the same, just before the collision. The subsequent motion of the combined body will be :
- (A) in the same circular orbit of radius R
- (B) in an elliptical orbit
- (C) such that it escape to infinity
- (D) in a circular orbit of a different radius

9. If resultant of all the external forces acting on a system of particles is zero, then from an inertial frame of reference, one can say surely that :
- (A) angular momentum of the system does not change with time
 - (B) kinetic energy of the system does not change with time
 - (C) potential energy of the system does not change with time
 - (D) linear momentum of the system does not change with time
10. From a solid sphere of mass M and radius R a cube of maximum possible volume is cut. Moment of inertia of cube about an axis passing through its centre and perpendicular to one of its faces is :
- (A) $\frac{MR^2}{32\sqrt{2}\pi}$
 - (B) $\frac{4MR^2}{3\sqrt{3}\pi}$
 - (C) $\frac{4MR^2}{9\sqrt{3}\pi}$
 - (D) $\frac{MR^2}{16\sqrt{2}\pi}$
11. A cylinder rolls up an inclined plane, reaches some height and then rolls down (without slipping through these motion). The direction of the frictional force acting on cylinder are :
- (A) up the incline while ascending and down the incline while descending.
 - (B) up the incline while ascending as well as descending.
 - (C) down the incline while ascending as well as descending.
 - (D) down the incline while ascending and up the incline while descending.

12. A satellite is revolving in a circular orbit at a height h from the earth's surface, such that $h \ll R$, where R is the radius of the earth. Assuming that the effect of earth's atmosphere can be neglected, what is the minimum increase in speed required so that the satellite could escape from the gravitational field of earth ?

(A) $\sqrt{gR} (\sqrt{2} - 1)$ (B) \sqrt{gR}
(C) $\sqrt{2gR}$ (D) $\sqrt{\frac{gR}{2}}$

13. A thin uniform cylindrical shell, closed at both ends, is partially filled with water. It is floating vertically in water in half-submerged state. If ρ_c is the relative density of the material of the shell with respect to water, then the correct statement is that the shell is :

- (A) more than half-filled if ρ_c is less than 0.5
(B) more than half-filled if ρ_c is more than 1.0
(C) half-filled if ρ_c is more than 0.5
(D) less than half-filled if ρ_c is less than 0.5

14. A particle of mass m is executing oscillations about the origin on the X-axis. Its potential energy is $V(x) = k|x|^3$, where k is a positive constant. If the amplitude of oscillation is a , then its time period T is :

- (A) Proportional to $\frac{1}{\sqrt{a}}$ (B) Independent of a
(C) Proportional to \sqrt{a} (D) Proportional to $a^{3/2}$

15. Two rods of different materials having coefficient of thermal expansion α_1 , α_2 and Young's moduli Y_1 , Y_2 respectively are fixed between two rigid massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of rods. If $\alpha_1 : \alpha_2 = 2 : 3$, the thermal stresses developed in the two rods are equal provided $Y_1 : Y_2$ is equal to :
- (A) 2 : 3 (B) 3 : 2
(C) 1 : 1 (D) 4 : 9
16. When a capillary is immersed in a liquid, then liquid of mass M rises in the capillary tube. If capillary tube of double the radius is taken, then the mass of same liquid rising in the tube is :
- (A) M
(B) $4M$
(C) $2M$
(D) $\frac{M}{2}$
17. In a given process on an ideal gas, $dW = 0$ and $dQ < 0$. Then for the gas :
- (A) The temperature will increase
(B) The volume will increase
(C) The pressure will remain constant
(D) The temperature will decrease

18. In the experiment to determine the speed of sound using a resonance column :
- (A) In one of the two resonances observed, the length of the resonating air column is close to half of the wavelength of sound in air
 - (B) In one of the two resonances observed, the length of the resonating air column is close to the wavelength of sound in air
 - (C) Prongs of the tuning fork are kept in a horizontal plane
 - (D) Prongs of the tuning fork are kept in a vertical plane
19. Two vibrating strings of same material but lengths L and $2L$ have radii $2r$ and r respectively. They are stretched under the same tension and vibrate in their fundamental modes with frequencies f_1 and f_2 respectively. The ratio of f_1/f_2 is given by (strings are fixed at both ends) :
- (A) 1
 - (B) 2
 - (C) 4
 - (D) 8
20. A parallel plate capacitor of capacitance C is connected to a battery and is charged to a potential difference V . Another capacitor of capacitance $2C$ is similarly charged to a potential difference $2V$. The charging battery is now disconnected and the capacitors are connected in parallel to each other in such a way that the positive terminal of one is connected to the negative terminal of the other. The final energy of the configuration is :
- (A) Zero
 - (B) $\frac{3CV^2}{2}$
 - (C) $\frac{25CV^2}{6}$
 - (D) $\frac{9CV^2}{2}$

21. Which of the following statements is *false* ?
- (A) In a balanced Wheatstone bridge, if the cell and the galvanometer are exchanged, the null point is disturbed
 - (B) A rheostat can be used as a potential divider
 - (C) Kirchhoff's second law represents energy conservation
 - (D) Wheatstone bridge is the most sensitive when all the four resistances are of the same order of magnitude.
22. Mobility of electrons in a semiconductor is defined as the ratio of their drift velocity to the applied electric field. If, for an n -type semiconductor, the density of electrons is 10^{19} m^{-3} and their mobility is $1.6 \text{ m}^2\text{V}^{-1}\text{s}^{-1}$, then the resistivity of the semiconductor (since it is an n -type semiconductor contribution of holes is ignored) is close to :
- (A) $2 \Omega \text{ m}$
 - (B) $0.2 \Omega \text{ m}$
 - (C) $0.4 \Omega \text{ m}$
 - (D) $4 \Omega \text{ m}$
23. An ionized gas contains both positive and negative ions. If it is subjected simultaneously to an electric field along the +ve x -axis and a magnetic field along the $+z$ -direction, then :
- (A) Positive ions deflect towards $+y$ direction and negative ions towards $-y$ direction
 - (B) All ions deflect towards $-y$ direction
 - (C) All ions deflect towards $+y$ direction
 - (D) Positive ions deflect towards $-y$ direction and negative ions towards $+y$ direction.

24. A current I flows along the length of an infinitely long, straight, thin walled pipe.

Then :

(A) The magnetic field at all points inside the pipe is the same but not zero

(B) The magnetic field is zero only on the axis of the pipe

(C) The magnetic field is different at different points inside the pipe

(D) The magnetic field at any point inside the pipe is zero

25. The image of an object, formed by a plano-convex lens at a distance of 8 m behind the lens, is real and is one-third the size of the object. The wavelength of light inside the lens is $\frac{2}{3}$ times the wavelength in free space. The radius of the curved surface of the lens is :

(A) 3 m

(B) 1 m

(C) 2 m

(D) 4 m

26. In a double-slit experiment, instead of taking slits of equal width, one slit is made twice as wide as the other. Then in the interference pattern :

(A) the intensity of the maxima increases and the minima has zero intensity

(B) the intensities of both the maxima and the minima increases

(C) the intensity of maxima decreases and that of minima increases

(D) the intensity of maxima decreases and the minima has zero intensity

27. Two radioactive materials X_1 and X_2 have decay constants 10λ and λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be $1/e$ after a time :
- (A) $\frac{1}{10\lambda}$ (B) $\frac{1}{11\lambda}$
 (C) $\frac{11}{10\lambda}$ (D) $\frac{1}{9\lambda}$
28. During the propagation of electromagnetic waves in a medium :
- (A) Both electric and magnetic energy densities are zero
 (B) Electric energy density is double of the magnetic energy density
 (C) Electric energy density is half of the magnetic energy density
 (D) Electric energy density is equal to magnetic energy density
29. A strip of copper and another germanium are cooled from room temperature to 80 K. The resistance of :
- (A) each of these decreases
 (B) copper strip increases and that of germanium decreases
 (C) copper strip decreases and that of germanium increases
 (D) each of these increases.
30. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is 0.5 mm and there are 50 divisions on the circular scale. The reading on the main scale is 2.5 mm and that on the circular scale is 20 divisions. If the measured mass of the ball has a relative error of 2%, the relative percentage error in the density is :
- (A) 0.9% (B) 2.4%
 (C) 3.1% (D) 4.2%

31. If an emitter current is changed by 4 mA, the collector current changes by 3.5 mA. The value of β will be :
- (A) 0.875
(B) 0.5
(C) 3.5
(D) 7
32. An airplane is moving with a horizontal velocity v at a height h above a level plane. If a projectile is fired from a gun at an instant when the plane is vertically above the gun, what is the minimum initial velocity of the projectile in order to hit the plane ?
- (A) $\sqrt{v^2 + 2gh}$
(B) $\sqrt{2gh}$
(C) $\sqrt{v^2 - 2gh}$
(D) None of the above
33. Unpolarized light of intensity I_0 is incident on surface of a block of glass at Brewster's angle. In that case, which one of the following statements is *true* ?
- (A) Reflected light is completely polarized with intensity less than $I_0/2$.
(B) Transmitted light is completely polarized with intensity less than $I_0/2$
(C) Transmitted light is partially polarized with intensity $I_0/2$
(D) Reflected light is partially polarized with intensity $I_0/2$

CHEMISTRY

34. Bond angle of 120° is found in :
- (A) PH_3 (B) NCl_3
(C) ClF_3 (D) BCl_3
35. What is the pH of the resulting solution when equal volumes of 0.1 M NaOH and 0.01 M HCl are mixed ?
- (A) 7.0 (B) 1.04
(C) 12.65 (D) 2.0
36. In the exothermic reaction, the enthalpy of reaction is always :
- (A) Zero (B) Positive
(C) Negative (D) None of these
37. When is deviation more in the behaviour of a gas from the ideal gas equation $PV = nRT$?
- (A) At high temperature and low pressure
(B) At low temperature and high pressure
(C) At high temperature and high pressure
(D) At low temperature and low pressure
38. Electromagnetic radiation with maximum wavelength is :
- (A) Ultraviolet (B) Radiowave
(C) X-ray (D) Infrared

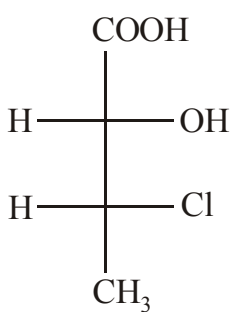
39. Which one of the following is the correct electronic configuration of gold (ground state) ?
- (A) $[\text{Xe}] 6s^2 4f^{14} 5d^9$ (B) $[\text{Xe}] 6s^1 4f^{14} 5d^{10}$
 (C) $[\text{Xe}] 6s^2 4f^{13} 5d^{10}$ (D) $[\text{Xe}] 6s^2 4f^{14} 5d^{10}$
40. Which one of the following is the correct order of increasing covalent character of halides of Al^{3+} ?
- (A) $\text{AlF}_3 < \text{AlCl}_3 < \text{AlBr}_3 < \text{AlI}_3$
 (B) $\text{AlI}_3 < \text{AlBr}_3 < \text{AlCl}_3 < \text{AlF}_3$
 (C) $\text{AlF}_3 < \text{AlBr}_3 < \text{AlCl}_3 < \text{AlI}_3$
 (D) $\text{AlCl}_3 < \text{AlF}_3 < \text{AlBr}_3 < \text{AlI}_3$
41. The correct geometry and hybridization for XeF_4 are :
- (A) Octahedral, sp^3d^2 (B) Trigonal bipyramidal, sp^3d
 (C) Planar triangle, sp^3d^3 (D) Square planar, sp^3d
42. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio C_p/C_v for the gas is :
- (A) 2 (B) $3/2$
 (C) $4/3$ (D) $5/3$
43. A metal crystallizes in a face centred cubic structure. If the edge length of its unit cell is ' a ', the closest approach between two atoms in metallic crystal will be :
- (A) $2a$ (B) $2\sqrt{2}a$
 (C) $\sqrt{2}a$ (D) $a/\sqrt{2}$

44. In the electrolytic cell, flow of electrons is from :
- (A) Cathode to anode in solution
 - (B) Cathode to anode through external supply
 - (C) Cathode to anode through internal supply
 - (D) Anode to cathode through internal supply
45. If 75% of a sample of pure ${}^3_1\text{H}$ decays in 24.6 years, what is the half-life of ${}^3_1\text{H}$?
- (A) 24.6 years
 - (B) 18.4 years
 - (C) 6.15 years
 - (D) 12.3 years
46. The right option for the statement “Tyndall effect is exhibited by” is :
- (A) Starch solution
 - (B) Urea solution
 - (C) NaCl solution
 - (D) Glucose solution
47. How many bridging oxygen atoms are present in P_4O_{10} ?
- (A) 6
 - (B) 4
 - (C) 5
 - (D) 2
48. Hydrogen peroxide in its reaction with KIO_4 and NH_2OH respectively, is acting as a :
- (A) reducing agent, oxidizing agent
 - (B) reducing agent, reducing agent
 - (C) oxidizing agent, reducing agent
 - (D) oxidizing agent, oxidizing agent

49. Among the following ions which one has the highest paramagnetism ?
- (A) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (B) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
 (C) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ (D) $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$
50. In the commercial electrochemical process for aluminium extraction, the electrolyte used is :
- (A) $\text{Al}(\text{OH})_3$ in NaOH
 (B) an aqueous solution of $\text{Al}_2(\text{SO}_4)_3$
 (C) a molten mixture of $\text{AlO}(\text{OH})$ and $\text{Al}(\text{OH})_3$
 (D) a molten mixture of Al_2O_3 and Na_3AlF_6
51. On heating ammonium dichromate, the gas evolved is :
- (A) Oxygen (B) Nitrogen
 (C) Ammonia (D) Nitrous oxide
52. How many isomers are possible for $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ complex ion ?
- (A) 1 (B) 2
 (C) 3 (D) 4
53. Arrange the decreasing order of the ionic radii of La^{3+} , Ce^{3+} , Yb^{3+} , Pm^{3+} .
- (A) $\text{La}^{3+} > \text{Ce}^{3+} > \text{Yb}^{3+} > \text{Pm}^{3+}$
 (B) $\text{Ce}^{3+} > \text{La}^{3+} > \text{Yb}^{3+} > \text{Pm}^{3+}$
 (C) $\text{La}^{3+} > \text{Ce}^{3+} > \text{Pm}^{3+} > \text{Yb}^{3+}$
 (D) $\text{Yb}^{3+} > \text{Pm}^{3+} > \text{Ce}^{3+} > \text{La}^{3+}$

54. The ratio of slopes of $\log P$ vs $\log V$ for reversible adiabatic process and reversible isothermal process of an ideal gas is equal to :

- (A) γ (B) $-\gamma$
(C) zero (D) -1

55. The absolute configuration of  is :

- (A) (2S, 3R) (B) (2S, 3S)
(C) (2R, 3R) (D) (2R, 3S)

56. Among the following compounds the one that is most reactive towards electrophilic nitration is :

- (A) Benzoic acid (B) Nitrobenzene
(C) Toluene (D) Benzene

57. In a S_N1 reaction on chiral centres, there is :

- (A) Inversion more than retention leading to partial racemisation
(B) 100% retention
(C) 100% inversion
(D) 100% racemisation

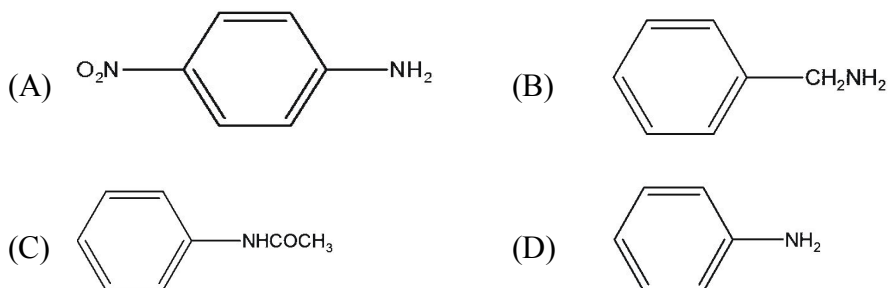
58. An unknown alcohol is treated with the Lucas reagent to determine the alcohol is primary, secondary or tertiary. Which alcohol reacts faster and by what mechanism ?

- (A) Secondary alcohol by S_N1 (B) Tertiary alcohol by S_N1
 (C) Secondary alcohol by S_N2 (D) Primary alcohol by S_N1

59. Nitrobenzene on reaction with conc. HNO_3/H_2SO_4 at $80-100^\circ C$ forms which one of the following products ?

- (A) 1, 4-Dinitrobenzene (B) 1, 2, 4-Trinitrobenzene
 (C) 1, 2-Dinitrobenzene (D) 1, 3-Dinitrobenzene

60. Which of the following compounds is more basic ?



61. An organic compound 'A' has the molecular formula C_3H_6O . It undergoes iodoform test. When saturated with dil. HCl it gives 'B' of molecular formula $C_9H_{14}O$. A and B respectively are :

- (A) Propanal and mesitylene
 (B) Propanone and mesityl oxide
 (C) Propanone and 2, 6-dimethyl -2, 5-heptadien-4-one
 (D) Propanone and mesitylene oxide

62. Two forms of D-glucopyranose are called :
- (A) Enantiomers (B) Anomers
(C) Epimers (D) Diastereomers
63. Among the following, the one that is *not* a Greenhouse gas, is :
- (A) Methane
(B) Nitrous oxide
(C) Ozone
(D) Sulphur dioxide
64. Which of the following Vitamins is water-soluble ?
- (A) Vitamin A (B) Vitamin K
(C) Vitamin B (D) Vitamin E
65. Aspirin is an acetylation product of :
- (A) *o*-hydroxybenzoic acid
(B) *o*-dihydroxybenzene
(C) *m*-hydroxybenzoic acid
(D) *p*-dihydroxybenzene
66. The S in buna-S refers to :
- (A) Sulphur (B) Styrene
(C) Sodium (D) Salicylate

MATHEMATICS

67. Given two sets P and Q such that $P = (-3, 2]$ and $Q = (-1, 5)$, then $P - Q$ is :

(A) $P - Q = (-3, -1]$

(B) $P - Q = [-3, -1]$

(C) $P - Q = [-3, -1)$

(D) $P - Q = (-3, -2]$

68. For what values of x the inequality $(x - 1)(x - 2)(1 - 2x) > 0$ is satisfied :

(A) $\left(-\infty, \frac{1}{2}\right) \cup (1, 2]$

(B) $\left(-\infty, \frac{1}{2}\right) \cup [1, 2)$

(C) $\left(-\infty, \frac{1}{2}\right) \cup (1, 2)$

(D) $\left(-\infty, \frac{1}{2}\right) \cup [1, 2]$

69. The number of one to one mappings defined from set P to set Q, where set P has 6 elements and set Q has 8 elements are :

(A) 48

(B) 56

(C) 8

(D) 6

70. No. of solutions of the equation $z + |z|^2 = 0$ are :

(A) 1

(B) 2

(C) 3

(D) Infinitely many

71. Find the value of $(-1\sqrt{-1})^{4n-3}$, where n is a natural :

(A) i

(B) 1

(C) $-i$

(D) -1

72. The value of C in Rolle's theorem for the function $f(x) = \sin 2x$, $x \in \left[0, \frac{\pi}{2}\right]$ is equal to :

(A) $\frac{\pi}{3}$

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{5}$

(D) $\frac{\pi}{6}$

73. Let R be the relation on the set of natural numbers defined by nRm . If n divides m then R is :

(A) Reflexive, transitive but not symmetry

(B) Reflexive, symmetry but not transitive

(C) Symmetry, transitive but not reflexive

(D) Reflexive, transitive and symmetry

74. The matrix $M = \begin{bmatrix} 0 & 0 & 5 \\ 0 & 5 & 0 \\ 5 & 0 & 0 \end{bmatrix}$ is a :

(A) scalar matrix

(B) diagonal matrix

(C) square matrix only

(D) both square and symmetric matrix

75. Value of $\sin(2\sin^{-1}(0.6))$ is :

(A) 0.96

(B) 0.48

(C) 1.2

(D) None of these

76. If M is the square matrix of order 3, the number of minors of determinant of M are :
- (A) 27 (B) 9
(C) 3 (D) 6
77. How many numbers are there between 99 and 1000 having 7 in unit place ?
- (A) 252 (B) 152
(C) 900 (D) 90
78. Total numbers of terms in the expansion $(x + a)^{101} - (x - a)^{101}$:
- (A) 101 (B) 202
(C) 51 (D) None of these
79. In an examination there are 4 multiple choice questions and each question has 4 choices, then in how many ways a student can fail to get all answers correct are :
- (A) 4 (B) 64
(C) 256 (D) 255
80. If variance of data 2, 4, 5, 6, 8, 17 is 23.33, then variance of data 6, 12, 15, 18, 24, 51 is :
- (A) 23.33 (B) 46.66
(C) 69.99 (D) None of these
81. The coefficients of x^p and x^q (p and q are integers) in the expansion of $(1 + x)^{p+q}$ are :
- (A) Equal with opposite sign (B) Equal
(C) Reciprocal (D) None of these

82. M, N and R are three mutually exclusive and exhaustive events of an experiment such that $3P(M) = 2P(N) = P(R)$, where $P(M)$ denotes probability of event M.

Probability of event M is :

- (A) $\frac{2}{11}$ (B) $\frac{5}{11}$
(C) $\frac{6}{11}$ (D) $\frac{1}{11}$

83. If \vec{a} and \vec{b} are any two vectors such that $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$, then :

- (A) \vec{a} is parallel to \vec{b}
(B) \vec{a} is perpendicular to \vec{b}
(C) \vec{a} is equal to \vec{b}
(D) None of the above

84. The image of the point (1, 6, 3) in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ is :

- (A) (0, 7, 1) (B) (1, 0, 7)
(C) (7, 0, 1) (D) (1, 7, 0)

85. Let A and B be two events. If $p(A) = 0.6$, $p(B) = 0.2$, $p(A/B) = 0.5$, Then find $p(\text{not A} / \text{not B})$:

- (A) $\frac{1}{10}$ (B) $\frac{3}{10}$
(C) $\frac{6}{7}$ (D) $\frac{3}{8}$

86. If length of a rectangle is 3 times the breadth. If the minimum perimeter of rectangle is 160 cm, then :
- (A) breadth ≥ 20 cm (B) breadth > 20 cm
(C) length ≥ 20 cm (D) length > 20 cm
87. The function $f(x) = [2x]$, where $[x]$ denotes the greatest integer function, is continuous at :
- (A) $x = 4.5$ (B) $x = -2.5$
(C) $x = 1.3$ (D) $x = 1.5$
88. The set of points where the function $f(x) = |x-3|\cos x$ is *not* differentiable :
- (A) $\mathbb{R} - 3$, \mathbb{R} denotes set of real numbers
(B) \mathbb{R}
(C) $(0, \infty)$
(D) None of the above
89. If $f(x) = \frac{1}{1+2x+4x^2}$, then maximum value of $f(x)$ is :
- (A) 1 (B) $\frac{3}{4}$
(C) $\frac{4}{3}$ (D) None of these
90. The tenth common term between the series $3 + 7 + 11 + \dots$ and $1 + 6 + 11 + \dots$ is :
- (A) 190 (B) 211
(C) 193 (D) 191

91. The value of $\int_0^{\frac{\pi}{2}} \frac{\sin^n x}{\sin^n x + \cos^n x} dx$ is :
- (A) $\frac{\pi}{2}$ (B) $\frac{4}{\pi}$
 (C) $\frac{\pi}{4}$ (D) $\frac{1}{\pi}$
92. The area of the region bounded by the curve $x = 3 \cos t$, $y = 2 \sin t$ is :
- (A) 3π square units (B) 6π square units
 (C) 4π square units (D) 2π square units
93. The solution of differential equation $2x \frac{dy}{dx} - y = 3$ represents :
- (A) Parabola (B) Ellipse
 (C) Circle (D) Straight line
94. The function $f(x) = -\frac{x}{2} + \sin x$, x lies in the open interval $\left(-\frac{\pi}{3}, \frac{\pi}{3}\right)$ is :
- (A) Decreasing (B) Increasing
 (C) Constant (D) not monotonic
95. $\lim_{x \rightarrow 0} \frac{e^{\tan x} - e^x}{\tan x - x}$ is equal to :
- (A) $\frac{1}{2}$ (B) $\frac{1}{3}$
 (C) 1 (D) None of these

96. If the line $\frac{x}{a} + \frac{y}{b} = 2$ touches the curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ at the point (a, b) , then n is equal to :
- (A) 1
(B) all non-zero values
(C) 2
(D) 3
97. “if A then B” gives same conclusion as :
- (A) if not A then B (B) if A then not B
(C) if not B then not A (D) if not A then not B
98. The area of triangle formed by lines $x^2 - 4xy + y^2 = 0$ and $x + y + 4\sqrt{6} = 0$ is :
- (A) $8\sqrt{3}$ square units (B) $32\sqrt{3}$ square units
(C) $24\sqrt{3}$ square units (D) $16\sqrt{3}$ square units
99. Identify which of the differential equation is *not* linear ?
- (A) $\frac{dy}{dx} = \sin x$ (B) $\frac{dy}{dx} = e^y$
(C) $\frac{dy}{dx} = \cos x$ (D) $\frac{dy}{dx} = y$
100. In which ratio the line segment joining the points $(-1, 1)$ and $(5, 7)$ is divided by the line $x + y = 4$?
- (A) 1 : 2 (B) 3 : 2
(C) 2 : 1 (D) 2 : 3

GENERAL APTITUDE

101. Direction : Study the following information carefully and answer the question given below :

Eight points – A, B, C, D, E, F, G and H, are marked on different positions in a plane such that the ratio of the distances between points G and B, and points B and E is 2 : 3. C is 10 m to the North of F, which is 5 m to the West of A. D is 10 m to the South of B and 15 m to the East of F. The ratio of distances between points A and D and points G and B is 1 : 1. B is to the West of E. Point H is to the North of A and to the West of G.

What is the shortest distance between points G and F ?

- (A) 5 m
- (B) 10 m
- (C) 20 m
- (D) 25 m

102. Complete the series :

243 , ?, 252, 279, 343, 468

- (A) 244
- (B) 245
- (C) 246
- (D) 248

103. Direction : Study the following information carefully and answer the question given below :

In a combined family Mayank and Suresh are brothers. Both have one – one son and daughter each. Further information of their family is given below :

Amar is brother-in-law of Manjesh and husband of Amal's mother. Manjesh is unmarried son of Mayank. Vaishnavi's father, Vikram is son of Seema who is mother-in-law of Sakshi. Mainak's grandmother, Kavita is mother-in-law of Amar. Madhuri and Manjesh are children of Mayank and Vikram and Tanuja are their cousins. Sakshi has two daughters and Madhuri have two sons. Juhi and Vaishnavi are siblings.

How is Mainak related to Seema ?

- (A) Son of brother in law
- (B) Cousin of sister in law
- (C) Grandson's cousin
- (D) Grandson of brother in law

104. Direction : Read the information carefully and answer the question given below :

Four friends – Ram, Laxman, Bharat and Shatrughan were having a conversation. They were expressing their thoughts in a coded language—

Ram says, "le po ki ba" when he wants to convey that "friends make life live". Laxman says, "te ki mo ba" when he wants to convey that "without friends life impossible". Bharat says, "lo mo se te" when he wants to convey that "without trouble gain impossible". Shatrughan says, "st ba po lo" when he wants to convey that "life make trouble joy".

What is the code for "mission impossible" ?

- (A) mo fi
- (B) te fi
- (C) fi se
- (D) Either A or B

105. Turncoat : Traitor :: : Rogue.

- (A) Scamp (B) Pillow
(C) Blush (D) Tricky

106. How many triangles are there in the given figure ?



- (A) 11 (B) 13
(C) 15 (D) 17

107. **Direction** : Read the following information carefully and answer the question given below :

8 persons from A to H are sitting around a square table such that 4 persons sit at each of the corners while the rest 4 sit at the middle of the sides. The ones sitting at the corners are facing inside while the rest are facing outside. The persons whose name starts with consecutive letters do not sit adjacent. B sits second to the right of A, who is on the immediate left of C. F sits on the immediate right of D, who sits at one of the corners. At least one person sits between C and G.

Who sits on the immediate left of G ?

- (A) B (B) F
(C) D (D) A

108. Direction : In the question given below, on the basis of the information given in the statement, you have to assume everything in the statement to be true, then decide which of the suggested courses of action logically follow(s) for pursuing.
Give Answer :

- (a) if only I follows.
- (b) if only II follows.
- (c) if either I or II follows.
- (d) if neither I nor II follows.
- (e) if both I and II follow.

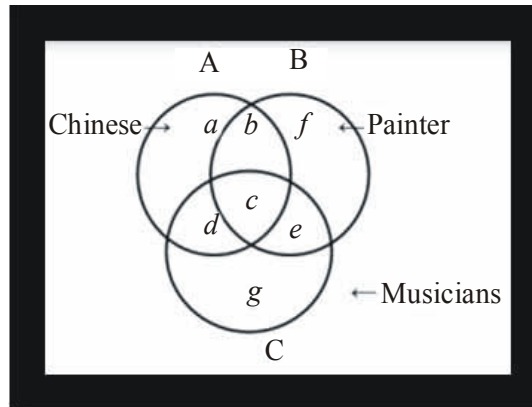
Statement—The management of the organization has issued a circular to all its employees stating that each employee must report for duty at 10.00 a.m. sharp and should remain in his/her work place till 5.30 p.m. everyday.

Courses of Action :

- I. The management should evolve a mechanism to identify such employees who may not adhere to the time schedule.
- II. All such employees who are found to be failing to maintain time schedule should be summarily suspended.

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

109. In the figure below there are three intersecting circles each represents certain section of people different region marked. Read the statement in question and choose the letter of the region which correctly represents the statement :



Chinese who are musicians but not painters ?

- (A) a
(B) b
(C) c
(D) d
110. Age of Naren is equal to Naveen as they are twins. Nakul is younger than Naren. Priyanka is younger than Balaji but elder than Naveen. Who is the eldest of all ?
- (A) Naren
(B) Balaji
(C) Nakul
(D) Naveen

GENERAL ENGLISH

111. Direction : Which of the phrases given below should replace the phrase given in bold in the following sentence to make the sentence grammatically correct ?

Although he had fewer supporters among the governing class, **but he was able** to get the popular vote.

- (A) he was able (B) and he was able
(C) else he was able (D) or he was able

112. The four sentences (labelled 1, 2, 3, 4) given below, when properly sequenced would yield a coherent paragraph. Decide on the proper sequence of the order of the sentences and key in the sequence of the four numbers as your answer.

1. If you've seen a little line of text on websites that says something like "customers who bought this also enjoyed that" you have experienced this collaborative filtering firsthand.
2. The problem with these algorithms is that they don't take into account a host of nuances and circumstances that might interfere with their accuracy.
3. If you just bought a gardening book for your cousin, you might get a flurry of links to books about gardening, recommended just for you! – the algorithm has no way of knowing you hate gardening and only bought the book as a gift.
4. Collaborative filtering is a mathematical algorithm by which correlations and co-occurrences of behaviors are tracked and then used to make recommendations.

- (A) 4132 (B) 4123
(C) 4321 (D) 4312

113. Fill in the blank :

They have set out.....a journey to a hill station.

- | | |
|--------|----------|
| (A) in | (B) with |
| (C) of | (D) on |

114. Direction : Select the option which contains the part of the sentence which has an error (spelling, grammatical or contextual) :

Only few (A)/customers come (B)/regularly (C)/to my shop. (D)

- | | |
|---------------|--------------------|
| (A) only few | (B) customers come |
| (C) regularly | (D) to my shop. |

115. Direction : The following question has two blanks, each blank indicating that something has been omitted. Choose the set of words for each blank that best fits in the context of the sentence :

The public sector has been called the private sector of politicians, used for creating patronage.....and.....

- (A) networks, kickbacks
- (B) buildings, hospitals
- (C) malls, complexes
- (D) relations, assets

116. Find the correctly spelt word :

- | | |
|------------|------------|
| (A) Foyere | (B) Foyer |
| (C) Foayer | (D) Fouyer |

117. In the following question, out of the four alternatives, select the alternative which best expresses the meaning of the idiom/phrase.

Flash in the pan

- (A) a trick one learn which makes their work easier
- (B) a thing or person whose sudden but brief success is not repeated
- (C) to build something good but it gets destroyed
- (D) to find something unpleasant inn food

118. Out of the four alternatives choose the one which can be substituted for the given words/sentence in the question :

A person who deliberately sets fire to a building

- (A) extortionist
- (B) hijacker
- (C) assassin
- (D) arsonist

119. Find the Antonym of WELTER :

- (A) Order
- (B) Freeze
- (C) Patron
- (D) Sustain

120. Find the synonym of FERVID :

- (A) Delightful
- (B) Difficult
- (C) Obstinate
- (D) Ardent