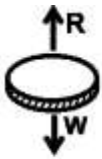


PHYSICS

1. When a body falls in air, the resistance of air depends to a great extent on the shape of the body. Three different shapes are given



(I) Disc



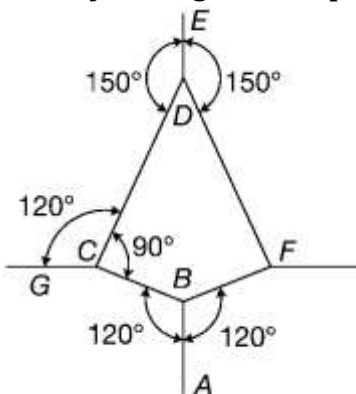
(II) Ball



(III) Cigar shaped

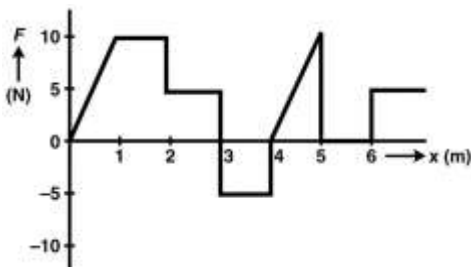
Identify the combination of air resistances which truly represents the physical situation. (The cross-sectional areas are the same.)

- (a) $I < II < III$ (b) $II < III < I$
(c) $III < II < I$ (d) $III < I < II$
2. The adjacent figure is the part of a horizontally stretched net. Section AB is stretched with a force of 10 N .



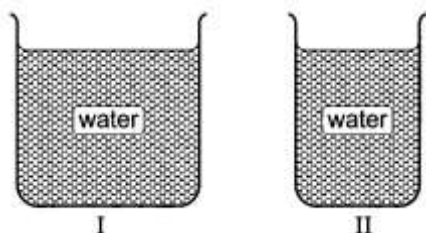
The tensions in the sections BC and BF are

- (a) 10 N, 11 N
(b) 10 N, 6 N
(c) 10 N, 10 N
(d) Can't calculate due to insufficient data
3. Out of the following four dimensional quantities, which one qualifies to be called a dimensional constant?
- (a) Acceleration due to gravity
(b) Surface tension of water
(c) Weight of a standard kilogram mass
(d) Velocity of light in vacuum
4. The relationship between the force F and position x of a body is as shown in the figure. The work done in displacing the body from $x = 1$ m to $x = 5$ m will be

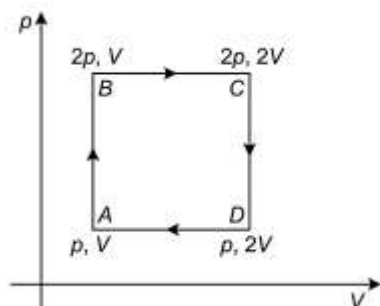


- (a) 30J (b) 15J
(c) 25J (d) 20J
5. From the top of a tower, two stones whose masses are in the ratio 1:2 are thrown - one straight up with an initial speed u and the second straight down with the same speed u . Then, neglecting air resistance
- (a) the heavier stone hits the ground with a higher speed
(b) the lighter stone hits the ground with a higher speed
(c) Both the stones will have the same speed when they hit the ground
(d) the speed can't be determined with the given data

6. If M is the mass of the earth and R its radius, the ratio of the gravitational acceleration and the gravitational constant is
- (a) $\frac{R^2}{M}$ (b) $\frac{M}{R^2}$
 (c) MR^2 (d) $\frac{M}{R}$
7. A student unable to answer a question on Newton's laws of motion attempts to pull himself up by tugging on his hair. He will not succeed
- (a) as the force exerted is small
 (b) the frictional force, while gripping is small
 (c) Newton's law of inertia is not applicable to living beings
 (d) as the force applied is internal to the system
8. From the adjacent figure, the correct observation is



- (a) the pressure on the bottom of tank(I) is greater than at the bottom of (II)
 (b) the pressure on the bottom of tank(I) is smaller than at the bottom of (II)
 (c) the pressure depend on the shape of the container
 (d) the pressure on the bottom of (I) and (II) is the same
9. Which one of the following is not a unit of Young's modulus?
- (a) Nm^{-1} (b) Nm^{-2}
 (c) dyne cm^{-2} (d) Mega pascal
10. A piece of blue glass heated to a high temperature and a piece of red glass at room temperature are taken inside a dimly lit room.
- Then
- (a) the blue piece will look blue and red will look as usual
 (b) red will look brighter red and blue will look ordinary blue
 (c) blue will shines like brighter red compared to the red piece
 (d) Both the pieces will look equally red
11. The wavelength of the radiation emitted by a body depends upon
- (a) the nature of the surface
 (b) the area of the surface
 (c) the temperature of the surface
 (d) All of the above
12. An ideal monoatomic gas is taken around the cycle ABCDA as shown in the $p - V$ diagram. The work done during the cycle is given by



- (a) $\frac{1}{2}pV$ (b) pV
 (c) $2pV$ (d) $4pV$

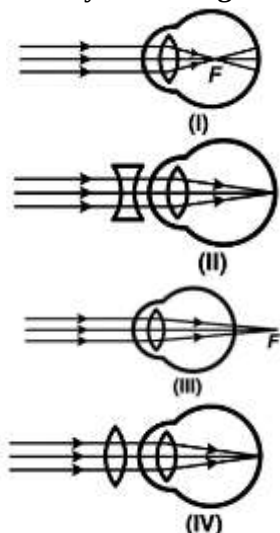
13. Which mirror is to be used to obtain a parallel beam of light from a small lamp?

- (a) Plane mirror (b) Convex mirror
(c) Concave mirror (d) Any one of the above

14. Which of the following is a wrong statement?

- (a) $D = \frac{1}{f}$, where f is the focal length and D is called the refractive power of a lens.
(b) Power is called a dioptre when f is in metres.
(c) Power is called a dioptre and does not depend on the system of unit used to measure f .
(d) D is positive for convergent lens and negative for divergent lens.

15. Identify the wrong description of the below figures.



- (a) I represents far - sightedness
(b) II correction for short-sightedness
(c) III represents far - sightedness
(d) IV correction for far - sightedness

16. Infrared radiation was discovered in 1800 by

- (a) William Wollaston
(b) William Herschel
(c) Wilhelm Roentgen
(d) Thomas Young

17. A particle on the trough of a wave at any instant will come to the mean position after a time (T = time period)

- (a) $\frac{T}{2}$ (b) $\frac{T}{4}$
(c) T (d) $2T$

18. The disc of a siren containing 60 holes rotates at a constant speed of 360 rpm. The emitted sound is in unison with a tuning-fork of frequency

- (a) 10 Hz (b) 360 Hz
(c) 216 kHz (d) 6 Hz

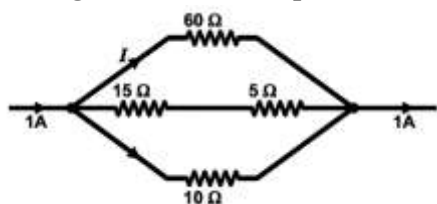
19. The ratio of velocity of sound in hydrogen and oxygen at STP is

- (a) 16: 1 (b) 8: 1
(c) 4: 1 (d) 2: 1

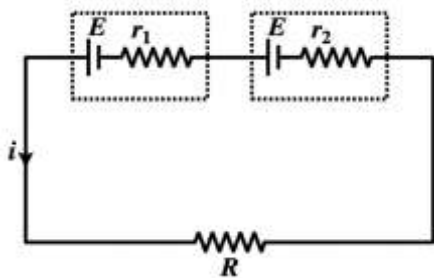
20. In an experiment with sonometer a tuning fork of frequency 256 Hz resonates with a length of 25 cm and another tuning fork resonates with a length of 16 cm . Tension of the string remaining constant the frequency of the second tuning fork is

- (a) 163.84 Hz (b) 400 Hz
(c) 320 Hz (d) 204.8 Hz

21. The apparent frequency of a note is 200 Hz . When a listener is moving with a velocity of 40 ms^{-1} towards a stationary source. When he moves away from the same source with the same speed, the apparent frequency of the same note is 160 Hz . The velocity of sound in air (in m/s) is
 (a)340 (b)330
 (c)360 (d)320
22. The wave theory of light, in its original form, was first postulated by
 (a)Isaac Newton
 (b)Christian Huygens
 (c)Thomas Young
 (d)Augustin Jean Fresnel
23. If a liquid does not wet glass, its angle of contact is
 (a)zero (b)acute
 (c)obtuse (d)right angle
24. The magnitude of I in ampere unit is



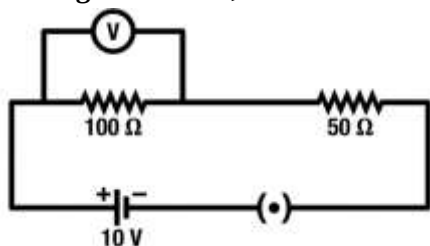
- (a)0.1 (b)0.3
 (c)0.6 (d)None of these
25. Electron of mass m and charge q is travelling with a speed v along a circular path of radius r at right angles to a uniform magnetic field of intensity B . If the speed of the electron is doubled and the magnetic field is halved, then the resulting path would have a radius
 (a) $2r$ (b) $4r$
 (c) $\frac{r}{4}$ (d) $\frac{r}{2}$
26. If the potential difference across the internal resistance r_1 is equal to the emf E of the battery, then



- (a) $R = r_1 + r_2$ (b) $R = \frac{r_1}{r_2}$
 (c) $R = r_1 - r_2$ (d) $R = \frac{r_2}{r_1}$
27. By using only two resistance coils-singly, in series, or in parallel-one should be able to obtain resistances of 3, 4, 12 and 16 ohms. The separate resistances of the coil are
 (a)3 and 4 (b)4 and 12
 (c)12 and 16 (d)16 and 3
28. The electrons in the beam of a television tube move horizontally from South to North. The vertical component of the earth's magnetic field points down. The electron is deflected towards
 (a)West (b)no deflection
 (c)East (d)North to South
29. A tangent galvanometer has a reduction factor of 1 A and it is placed with the plane of its coil perpendicular to the magnetic meridian. The deflection produced when a current of 1 A is passed through it is

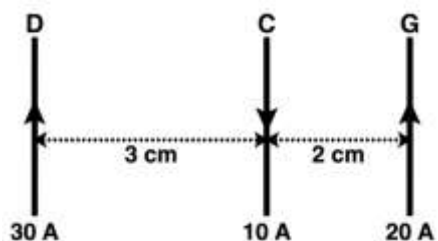
- (a) 60° (b) 45°
(c) 30° (d) None of these

30. In the given circuit, the voltmeter records 5 V . The resistance of the voltmeter (in ohms) is



- (a) 200 (b) 100
(c) 10 (d) 50

31. Three long, straight and parallel wires, carrying current, are arranged as shown in figure.



The force experienced by a 25 cm length of wire C is

- (a) 10^{-3} N (b) 25×10^{-3} N
(c) Zero (d) 15×10^{-3} N

32. A 5.0 A current is setup in an external circuit by a 6.0 V storage battery for 6.0 min . The chemical energy of the battery is reduced by

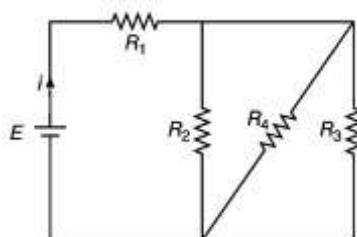
- (a) 1.08×10^4 J (b) 1.08×10^4 V
(c) 1.8×10^4 J (d) 1.8×10^4 V

33. The current in a simple series circuit is 5.0 A . When an additional resistance of 2.0Ω is inserted, the current drops to 4.0 A . The original resistance of the circuit (in Ω) is

- (a) 1.25 (b) 8
(c) 10 (d) 20

34. In the circuit given $E = 6.0$ V, $R_1 = 100\Omega$, $R_2 = R_3 = 50\Omega$ and $R_4 = 75\Omega$.

The equivalent resistance of the circuit (in Ω) is



- (a) 11.875 (b) 26.31
(c) 118.75 (d) None of these

35. Two resistances are connected in two gaps of a meterbridge. The balance point is 20 cm from the zero end. A resistance of 15Ω is connected in series with the smaller of the two. The null point shifts to 40 cm . The value of the smaller resistance (in Ω) is

- (a) 3 (b) 6
(c) 9 (d) 12

36. An electric field of 1500 V/m and a magnetic field of 0.40 Wb/m² act on a moving electron. The minimum uniform speed along a straight line the electron could have is

- (a) 1.6×10^{15} m/s (b) 6×10^{-16} m/s
(c) 3.75×10^3 m/s (d) 3.75×10^2 m/s

37. In an ammeter 10% of main current is passing through the galvanometer. If the resistance of the galvanometer is G , then the shunt resistance (in Ω) is

- (a) $9G$ (b) $\frac{G}{9}$
(c) $90G$ (d) $\frac{G}{90}$

38. Among the following properties describing diamagnetism identify the property that is wrongly stated.

- (I) Diamagnetic material do not have permanent magnetic moment.
(II) Diamagnetism is explained in terms of electromagnetic induction.
(III) Diamagnetic materials have a small positive susceptibility.
(IV) The magnetic moment of individual electrons neutralise each other.

- (a) (I) (b) (II)
(c) (III) (d) (IV)

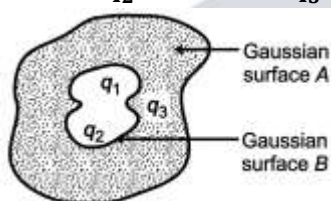
39. The induction coil works on the principle of

- (a) self-induction
(b) mutual induction
(c) Ampere's rule
(d) Fleming's right hand rule

40. The square root of the product of inductance and capacitance has the dimension of

- (a) length (b) mass
(c) time (d) no dimension

41. The electric flux for Gaussian surface A that enclose the charged particles in free space is (Given, $q_1 = -14\text{nC}$, $q_2 = 7885\text{nC}$, $q_3 = -56\text{nC}$)



- (a) $10^3 \text{ N} - \text{m}^2 \text{C}^{-1}$
(b) $10^3 \text{ CN}^{-1} \text{ m}^{-2}$
(c) $6.32 \times 10^3 \text{ N} - \text{m}^2 \text{C}^{-1}$
(d) $6.32 \times 10^3 \text{ CN}^{-1} \text{ m}^{-2}$

42. Four metal conductors having different shapes a sphere, cylindrical, pear, lightning conductor are mounted on insulating stands and charged. The one which is best suited to retain the charges for a longer time is

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

43. The potential to which a conductor is raised, depends on

- (a) the amount of charge
(b) geometry and size of the conductor
(c) Both (a) and (b)
(d) None of the above

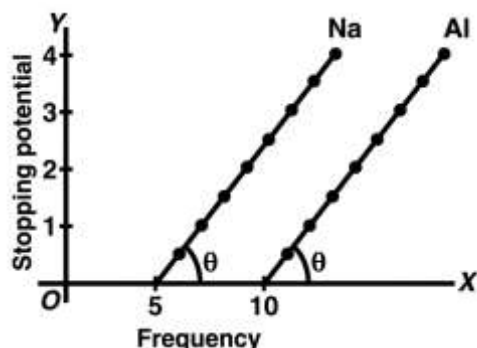
44. The work done in carrying a charge q once round a circle of radius r with a charge Q at the centre is

- (a) $\frac{qQ}{4\pi\epsilon_0 r}$ (b) $\frac{qQ}{4\pi\epsilon_0^2 r^2}$
(c) $\frac{qQ}{4\pi\epsilon_0 r^2}$ (d) None of these

45. An air filled parallel plate condenser has a capacity of 2 pF. The separation of the plates is doubled and the interspace between the plates is filled with wax. If the capacity is increased to 6 pF, then the dielectric constant of wax is

- (a) 2 (b) 3
(c) 4 (d) 6

46. Identify the wrong statement in the following. Coulomb's law correctly describes the electric force that
- binds the electrons of an atom to its nucleus.
 - binds the protons and neutrons in the nucleus of an atom.
 - binds atoms together to form molecules.
 - binds atoms and molecules to form solids.
47. A single slit of width a is illuminated by violet light of wavelength 400 nm and the width of the diffraction pattern is measured as y . When half of the slit width is covered and illuminated by yellow light of wavelength 600 nm, the width of the diffraction pattern is
- the pattern vanishes and the width is zero
 - $\frac{y}{3}$
 - $3y$
 - None of the above
48. At Kavalur in India, the astronomers using a telescope whose objective had a diameter of one metre started using a telescope of diameter 2.54 m. This resulted in
- the increase in the resolving power by 2.54 times for the same λ
 - the increase in the limiting angle by 2.54 times for the same λ
 - decrease in the resolving power
 - no effect on the limiting angle
49. When unpolarised light beam is incident from air onto glass ($n = 1.5$) at the polarising angle
- reflected beam is polarised 100 percent
 - reflected and refracted beams are partially polarised
 - the reason for (a) is that almost all the light is reflected
 - All of the above
50. Select the correct statement from the following.
- Christian Huygens, a contemporary of Newton established the wave theory of light by assuming that light waves were transverse.
 - Maxwell provided the compelling theoretical evidence that light is a transverse wave.
 - Thomas Young experimentally proved the wave behaviour of light and Huygens assumption.
 - All three statements given above, correctly answers the question 'what is light'?
51. Two coherent light beams of intensity I and $4I$ are superposed. The maximum and minimum possible intensities in the resulting beam are
- $9I$ and I
 - $9I$ and $3I$
 - $5I$ and I
 - $5I$ and $3I$
52. From the figure describing photoelectric effect we may infer correctly that



- Na and Al both have the same threshold frequency
 - Maximum kinetic energy for both the metals depend linearly on the frequency
 - The stopping potentials are different for Na and Al for the same change in frequency
 - Al is a better photo sensitive material than Na
53. The electron in a hydrogen atom makes a transition from $n = n_1$ to $n = n_2$ state. The time period of the electron in the initial state n_1 is eight times that in the final state n_2 . The possible values of n_1 and n_2 are

- (a) $n_1 = 8, n_2 = 1$ (b) $n_1 = 4, n_2 = 2$
 (c) $n_1 = 2, n_2 = 4$ (d) $n_1 = 1, n_2 = 8$

54. If the forward voltage in a diode is increased, then the width of the depletion region

- (a) increases (b) decreases
 (c) fluctuates (d) no change

55. Two nucleons are at a separation of one Fermi. Protons have a charge of $+1.6 \times 10^{-19} \text{C}$. The net nuclear force between them is F_1 , if both are neutrons, F_2 if both are protons and F_3 if one is proton and the other is neutron. Then,

- (a) $F_1 = F_2 > F_3$ (b) $F_1 = F_2 = F_3$
 (c) $F_1 < F_2 < F_3$ (d) $F_1 > F_2 > F_3$

56. The energy that should be added to an electron to reduce its de-Broglie wavelength from 1 nm to 0.5 nm is

- (a) four times the initial energy
 (b) equal to the initial energy
 (c) twice the initial energy
 (d) thrice the initial energy

57. Mean life of a radioactive sample is 100 s. Then, its half-life (in min) is

- (a) 0.693 (b) 1
 (c) 10^{-4} (d) 1.155

58. Consider two nuclei of the same radioactive nuclide. One of the nuclei was created in a supernova explosion 5 billion years ago. The other was created in a nuclear reactor 5 min ago. The probability of decay during the next time is

- (a) different for each nuclei
 (b) nuclei created in explosion decays first
 (c) nuclei created in the reactor decays first
 (d) independent of the time of creation

59. Bohr's atom model assumes

- (a) the nucleus is of infinite mass and is at rest
 (b) electrons in a quantised orbit will not radiate energy
 (c) mass of the electron remains constant
 (d) All of the above

60. Identify the property which is not characteristic for a semi-conductor.

- (a) At a very low temperatures it behaves like an insulator.
 (b) At higher temperatures two types of charge carriers will cause conductivity.
 (c) The charge carriers are electrons and holes in the valance band at higher temperatures.
 (d) The semiconductor is electrically neutral.

CHEMISTRY

61. The correct order in which the first ionisation potential increases is

- (a) Na, K, Be (b) K, Na, Be
 (c) K, Be, Na (d) Be, Na, K

62. 10 cm^3 of 0.1 N monobasic acid requires 15 cm^3 of sodium hydroxide solution whose normality is

- (a) 1.5 N (b) 0.15 N
 (c) 0.066 N (d) 0.66 N

63. The IUPAC name for tertiary butyl iodide is

- (a) 4-iodobutane
 (b) 2-iodobutane
 (c) 1-iodo, 3-methyl propane
 (d) 2-iodo, 2-methyl propane

64. When sulphur dioxide is passed in an acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution, the oxidation state of sulphur is changed from

- (a)+4 to 0 (b)+4 to +2
(c)+4 to +6 (d)+6 to +4
65. Mass of 0.1 mole of methane is
(a)lg (b)16 g
(c)1.6 g (d)0.1 g
66. Methoxy methane and ethanol are
(a)position isomers (b)chain isomers
(c)functional isomers (d)optical isomers
67. When the azimuthal quantum number has the value of 2 , the number of orbitals possible are
(a)7 (b)5
(c)3 (d)0
68. For the reaction, $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$, the volume of carbon monoxide required to reduce one mole of ferric oxide is
(a)224dm³ (b)44.8dm³
(c)67.2dm³ (d)11.2dm³
69. The monomers of buna- S rubber are
(a)vinyl chloride and sulphur
(b)butadiene
(c)styrene and butadiene
(d)isoprene and butadiene
70. An element with atomic number 21 is a
(a)halogen
(b)representative element
(c)transition element
(d)alkali metal
71. The maximum number of hydrogen bonds that a molecule of water can have is
(a)1 (b)2
(c)3 (d)4
72. A gas deviates from ideal behaviour at a high pressure because its molecules
(a)attract one another
(b)show the Tyndall effect
(c)have kinetic energy
(d)are bound by covalent bonds
73. The reagent used to convert an alkyne to alkene is
(a)Zn/HCl (b)Sn/HCl
(c)Zn – Hg/HCl (d)Pd/H₂
74. When, compared to ΔG° for the formation of Al_2O_3 , the ΔG° for the formation of Cr_2O_3 is
(a)higher (b)lower
(c)same (d)unpredicted
75. In order to increase the volume of a gas by 10%, the pressure of the gas should be
(a)increased by 10% (b)increased by 1%
(c)decreased by 10% (d)decreased by 1%
76. Catalytic dehydrogenation of a primary alcohol gives a/an
(a)secondary alcohol (b)aldehyde
(c)ketone (d)ester
77. Excess of PCl_5 reacts with conc. H_2SO_4 giving
(a)chlorosulphonic acid
(b)thionyl chloride

- (c)sulphuryl chloride
(d)sulphurous acid
78. If one mole of ammonia and one mole of hydrogen chloride are mixed in a closed container to form ammonium chloride gas, then
(a) $\Delta H > \Delta U$
(b) $\Delta H = \Delta U$
(c) $\Delta H < \Delta U$
(d)there is no relationship
79. The compound on dehydrogenation gives a ketone. The original compound is
(a)primary alcohol (b)secondary alcohol
(c)tertiary alcohol (d)carboxylic acid
80. Which is the most easily liquefiable rare gas?
(a)Xe (b)Kr
(c)Ar (d)Ne
81. Mesomeric effect involves delocalisation of
(a) π -electrons (b) σ -electrons
(c)protons (d)None of these
82. Which of the following has the maximum number of unpaired d-electrons?
(a) Zn^{2+} (b) Fe^{2+}
(c) Ni^{3+} (d) Cu^+
83. One mole of which of the following has the highest entropy?
(a)Liquid nitrogen (b)Hydrogen gas
(c)Mercury (d)Diamond
84. Which of the following species does not exert a resonance effect?
(a) $C_6H_5NH_2$ (b) $C_6H_5\overset{+}{N}H_3$
(c) C_6H_5OH (d) C_6H_5Cl
85. A complex compound in which the oxidation number of a metal is zero, is
(a) $K_4[Fe(CN)_6]$ (b) $K_3[Fe(CN)_6]$
(c) $[Ni(CO)_4]$ (d) $[Pt(NH_3)_4]Cl_2$
86. Three moles of PCl_5 , three moles of PCl_3 and two moles of Cl_2 are taken in a closed vessel. If at equilibrium the vessel has 1.5 moles of PCl_5 , the number of moles of PCl_3 present in it is
(a)5 (b)3
(c)6 (d)4.5
87. How many optically active stereomers are possible for butan-2, 3-diol?
(a)1 (b)2
(c)3 (d)4
88. An octahedral complex is formed when hybrid orbitals of the following type are involved
(a) sp^3 (b) dsp^2
(c) d^2sp^3 (d) sp^2d^2
89. For the reaction, $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$; $-Q$ kJ, the equilibrium constant depends upon
(a)temperature (b)pressure
(c)catalyst (d)volume
90. The angle strain in cyclobutane is
(a) $24^\circ 44'$ (b) $29^\circ 16'$
(c) $19^\circ 22'$ (d) $9^\circ 44'$
91. The number of nodal planes present in σ^* s-antibonding orbital is
(a)1 (b)2
(c)0 (d)3

92. Which of the following electrolytic solution has the least specific conductance?
 (a) 0.02 N (b) 0.2 N
 (c) 2 N (d) 0.002 N
93. The overlapping of orbitals in benzene is of the type
 (a) $sp - sp$ (b) $p-p$
 (c) $sp^2 - sp^2$ (d) $sp^3 - sp^3$
94. The calculated bond order of superoxide ion (O_2^-) is
 (a) 2.5 (b) 2
 (c) 1.5 (d) 1
95. Which of the following can be measured by the Ostwald-Walker dynamic method?
 (a) Relative lowering of vapour pressure
 (b) Lowering of vapour pressure
 (c) Vapour pressure of the solvent
 (d) All of the above
96. n-propyl bromide on treating with alcoholic KOH produces
 (a) propane (b) propene
 (c) propyne (d) propanol
97. Mercury is a liquid metal because
 (a) it has a completely filled s-orbital
 (b) it has a small atomic size
 (c) it has a completely filled d-orbital that prevents d - d overlapping of orbitals
 (d) it has a completely filled d-orbital that causes d - d overlapping
98. A compound is formed by elements A and B. This crystallises in the cubic structure, where the A atoms are at the corners of the cube and B atoms are at the body centres.
 (a) AB (b) A_6B
 (c) A_8B_4 (d) AB_6
99. Anisole can be prepared by the action of methyl iodide on sodium phenate. The reaction is called
 (a) Wurtz's reaction
 (b) Williamson's reaction
 (c) Fittig's reaction
 (d) Etard's reaction
100. Malleability and ductility of metals can be accounted due to
 (a) the presence of electrostatic force
 (b) the crystalline structure in metal
 (c) the capacity of layers of metal ions to slide over the other
 (d) the interaction of electrons with metal ions in the lattice
101. An ionic compound is expected to have tetrahedral structure if r_+/r_- lies in the range of
 (a) 0.414 to 0.732 (b) 0.225 to 0.414
 (c) 0.155 to 0.225 (d) 0.732 to 1
102. Among the following, which is least acidic?
 (a) phenol (b) o-cresol
 (c) p-nitrophenol (d) p-chlorophenol
103. A ligand can also be regarded as
 (a) Lewis acid (b) Bronsted base
 (c) Lewis base (d) Bronsted acid
104. The colour of sky is due to
 (a) transmission of light
 (b) wavelength of scattered light

- (c) absorption of light by atmospheric gases
(d) All of the above

105. Which of the following organic compounds answers to both iodoform test and Fehling's test?

- (a) Ethanol (b) Methanol
(c) Ethanal (d) Propanone

106. Helium is used in balloons in place of hydrogen because it is

- (a) incombustible
(b) lighter than hydrogen
(c) radioactive
(d) more abundant than hydrogen

107. The basic principle of Cottrell's precipitator is

- (a) Le-Chatelier's principle
(b) peptisation
(c) neutralisation of charge on colloidal particles
(d) scattering of light

108. When carbon monoxide is passed over solid caustic soda heated to 200°C , it forms

- (a) Na_2CO_3 (b) NaHCO_3
(c) HCOONa (d) CH_3COONa

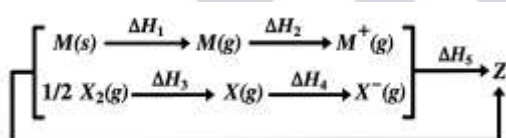
109. $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3 + \text{Heat}$. What is the effect of the increase of temperature on the equilibrium of the reaction?

- (a) Equilibrium is shifted to the left
(b) Equilibrium is shifted to the right
(c) Equilibrium is unaltered
(d) Reaction rate does not change

110. Hydrogen gas is not liberated when the following metal is added to dil. HCl

- (a) Ag (b) Zn
(c) Mg (d) Sn

111. Consider the Born-Haber cycle for the formation of an ionic compound, given below and identify the compound (Z) formed.



- (a) M^+X^- (b) $\text{M}^-\text{X}^-(\text{s})$
(c) MX (d) $\text{M}^+\text{X}^-(\text{g})$

112. In the brown ring test, the brown colour of the ring is due to

- (a) ferrous nitrate
(b) ferric nitrate
(c) a mixture of NO and NO_2
(d) nitrosoferrous sulphate

113. Amines behave as

- (a) Lewis acids (b) Lewis base
(c) aprotic acid (d) neutral compound

114. Dalda is prepared from oils by

- (a) oxidation (b) reduction
(c) hydrolysis (d) distillation

115. The chemical name of anisole is

- (a) ethanoic acid (b) methoxy benzene
(c) propanone (d) acetone

116. The number of disulphide linkages present in insulin are
 (a)1 (b)2
 (c)3 (d)4
117. 80 g of oxygen contains as many atoms as in
 (a)80 g of hydrogen (b)1 g of hydrogen
 (c)10 g of hydrogen (d)5 g of hydrogen
118. Which metal has a greater tendency to form metal oxide?
 (a)Cr (b)Fe
 (c)Al (d)Ca
119. Identify the reaction that does not take place in a blast furnace.
 (a) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
 (b) $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$
 (c) $2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$
 (d) $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$
120. Waxes are esters of
 (a)glycerol
 (b)long chain alcohols
 (c)glycerol and fatty acid
 (d)long chain alcohols and long chain fatty acids

MATHEMATICS

121. Which of the following is an even function?
 (a) $\sqrt{x}$ (b) $x^2 + \sin^2 x$
 (c) $\sin^3 x$ (d)None of these
122. If $A = \{x: x^2 - x + 2 > 0\}$ and $B = \{x: x^2 - 4x + 3 \leq 0\}$, then $A \cap B$ is
 (a) $[1, 3]$ (b) $(-\infty, \infty)$
 (c) $(1, 3)$ (d) $(-\infty, 1) \cup (3, \infty)$
123. If $*$ be a binary operation on a set A and e be the identity element w.r.t. $*$, then $b \in A$ is said to be inverse of $a \in A$ w.r.t. $*$, if
 (a) $a * e = b * e$ (b) $a = b$
 (c) $a * a = b * b$ (d) $a * b = b * a = e$
124. If in a $\triangle ABC$, $\angle C = \frac{\pi}{2}$, then $\tan^{-1}\left(\frac{a}{b+c}\right) + \tan^{-1}\left(\frac{b}{c+a}\right) =$
 (a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$
 (c) $\frac{\pi}{3}$ (d)None of these
125. The sides a, b, c of a triangle are in AP. If $\cos \alpha = \frac{a}{b+c}$, $\cos \beta = \frac{b}{c+a}$, $\cos \gamma = \frac{c}{a+b}$ then $\tan^2 \frac{\alpha}{2} + \tan^2 \frac{\gamma}{2} =$
 (a) (b) $\frac{1}{2}$
 (c) $\frac{1}{3}$ (d) $\frac{2}{3}$
126. The value of $\cos(35^\circ + A)\cos(35^\circ - B) + \sin(35^\circ + A)\sin(35^\circ - B)$ is equal to
 (a) $\sin(A + B)$ (b) $\sin(A - B)$
 (c) $\cos(A + B)$ (d) $\cos(A - B)$
127. The value of $2\operatorname{cosec} 2x + \operatorname{cosec} x$ is equal to
 (a) $\tan x \cdot \sec(x/2)$ (b) $\sec x \cdot \cot(x/2)$
 (c) $\sec x \cdot \tan(x/2)$ (d) $\tan x \cdot \cot(x/2)$
128. The value of $\cot 2x \cot x - \cot 3x \cot 2x - \cot 3x \cot x$ is equal to
 (a)3 (b)0
 (c)-1 (d)1

129. The value of $\cos\left(\frac{\pi}{4} - x\right) \cos\left(\frac{\pi}{4} - y\right) - \sin\left(\frac{\pi}{4} - x\right) \sin\left(\frac{\pi}{4} - y\right)$ is equal to
 (a) $\sin(x + y)$ (b) $\sin(x - y)$
 (c) $\cos(x + y)$ (d) $\cos(x - y)$
130. For all $n \in \mathbb{N}$, $2 \cdot 4^{2n+1} + 3^{3n+1}$ is divisible by
 (a) 2 (b) 9
 (c) 3 (d) 11
131. The statement $P(n)$: ' $1 \times 1! + 2 \times 2! + 3 \times 3! + \dots + n \times n! = (n + 1)! - 1$ ' is
 (a) true for all $n > 1$ (b) not true for any n
 (c) true for all $n \in \mathbb{N}$ (d) None of these
132. If $z = re^{i\theta}$, then $|e^{iz}| =$
 (a) 1 (b) $e^{2r \sin \theta}$
 (c) $e^{r \sin \theta}$ (d) $e^{-r \sin \theta}$
133. If $(\sqrt{5} + \sqrt{3}i)^{33} = 2^{49}z$, then modulus of the complex number z is equal to
 (a) 1 (b) $\sqrt{2}$
 (c) $2\sqrt{2}$ (d) 4
134. The modulus of $[1 - \cos \theta + i \sin \theta]^{-1}$ is
 (a) $\frac{1}{2} \operatorname{cosec} \frac{\theta}{2}$ (b) $\operatorname{cosec} \frac{\theta}{2}$
 (c) $\frac{1}{2} \left| \operatorname{cosec} \frac{\theta}{2} \right|$ (d) $\left| \operatorname{cosec} \frac{\theta}{2} \right|$
135. If a, b, c are real numbers and ω is a complex cube root of unity such that $a + b\omega + c\omega^2 = 0$, then
 (a) $b = -c$ (b) $a = 0, b = c$
 (c) $a = 1, b = c$ (d) $a = b = c$
136. If the cube roots of unity are $1, \omega, \omega^2$, then the roots of the equation $(x - 1)^3 + 8 = 0$ are
 (a) $-1, -1, -1$
 (b) $-1, -1 + 2\omega, -1 - 2\omega^2$
 (c) $-1, 1 + 2\omega, 1 + 2\omega^2$
 (d) $-1, 1 - 2\omega, 1 - 2\omega^2$
137. Let α, β be the roots of the equation $ax^2 + bx + c = 0$. A root of the equation $a^3x^2 + abcx + c^3 = 0$ is
 (a) $\alpha + \beta$ (b) $\alpha^2 + \beta$
 (c) $\alpha^2 - \beta$ (d) $\alpha^2 \beta$
138. The sum of all 4-digit numbers that can be formed by using the digits 2, 4, 6, 8 (repetition of digits is not allowed) is
 (a) 133320 (b) 123330
 (c) 113230 (d) 323430
139. In how many ways can 4 red, 3 yellow and 2 green discs be arranged in a row, if the discs of the same colour are indistinguishable?
 (a) 1200 (b) 1220
 (c) 1240 (d) 1260
140. Find the number of ways of choosing 4 face cards from a pack of 52 playing cards.
 (a) 495 (b) 493
 (c) 490 (d) 492
141. Given, the positive integers $r > 1, n > 2$ and the coefficients of $(3r)$ th and $(r + 2)$ th terms in the expansion of $(1 + x)^{2n}$ are equal, then $n =$
 (a) $2r$ (b) $2r - 1$
 (c) $2r + 1$ (d) $3r$

142. Let the HM and GM of two positive numbers a and b be in the ratio 4: 5, then $a: b$ is
 (a) 1: 2 (b) 2: 3
 (c) 3: 4 (d) 1: 4
143. If 2, 7, 9, 5 are subtracted respectively from four numbers forming a GP, the resulting numbers are in AP, then the smallest of the four numbers is
 (a) -24 (b) 12
 (c) 6 (d) 3
144. $\frac{1}{3!} + \frac{2}{5!} + \frac{3}{7!} + \dots$ to ∞ is equal to
 (a) e (b) $2e$
 (c) $\frac{1}{2e}$ (d) $\frac{e}{2}$
145. Let PQR be a right angled isosceles triangle, right angled at $P(2, 1)$. If the equation of QR is $2x + y = 3$, then the combined equation of the lines PQ and PR is
 (a) $3x^2 - 3y^2 + 8xy + 20x + 10y + 25 = 0$
 (b) $3x^2 - 3y^2 + 8xy - 20x - 10y + 25 = 0$
 (c) $3x^2 - 3y^2 + 8xy + 10x + 15y + 20 = 0$
 (d) $3x^2 - 3y^2 - 8xy - 10x - 15y - 20 = 0$
146. The sides of a triangle are $x = 2$, $y + 1 = 0$ and $x + 2y = 4$. Its circumcentre is
 (a) (4, 0) (b) (2, -1)
 (c) (0, 4) (d) (2, 3)
147. Find the coordinates of the foci and the length of the latusrectum of the hyperbola.
 $\frac{x^2}{9} - \frac{y^2}{16} = 1$
 (a) $(0, \pm 2), \frac{32}{3}$ (b) $(0, \pm 5), \frac{32}{3}$
 (c) $(\pm 5, 0), \frac{32}{3}$ (d) $(0, \pm 5), \frac{3}{32}$
148. The line $21x + 5y = 116$ is a tangent to the hyperbola $7x^2 - 5y^2 = 232$. Its point of contact is
 (a) $(-6, -2)$ (b) $(6, 2)$
 (c) $(6, -2)$ (d) $(-6, 2)$
149. Chords of the circle $x^2 + y^2 = r^2$ touch the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. The locus of the mid-points of the chords is
 (a) $(x^2 + y^2)^2 = a^2x^2 - b^2y^2$
 (b) $(x^2 + y^2)^2 = a^2x^2 + b^2y^2$
 (c) $x^2 + y^2 = a^2x^2 - b^2y^2$
 (d) $x^2 + y^2 = a^2x^2 + b^2y^2$
150. If the latusrectum of a hyperbola subtends a right angle at the other focus, then its eccentricity is
 (a) $\sqrt{3} + 1$ (b) $\sqrt{2} + 1$
 (c) $\sqrt{3} + \sqrt{2}$ (d) 2
151. From the point $(0, 1)$ two tangents are drawn to the hyperbola $2x^2 - y^2 = 1$. If θ is the angle between them, then $\tan \theta =$
 (a) $\frac{4}{3}$ (b) $\frac{3}{4}$
 (c) $\frac{3}{2}$ (d) $\frac{2}{3}$
152. Let $(3, 4, -1)$ and $(-1, 2, 3)$ be the end points of a diameter of a sphere. Then, the radius of the sphere is equal to
 (a) 2 units (b) 3 units
 (c) 6 units (d) 7 units

153. Differentiate $\cos^{-1}\left(\frac{1-x}{1+x}\right)$ w.r.t. x .

- (a) $\frac{1}{1+x}$ (b) $\frac{1}{x(1+x)}$
 (c) $\frac{1}{(1+x)\sqrt{x}}$ (d) $\frac{-1}{(1+x)\sqrt{x}}$

154. $(x) = \left(\frac{5}{x} + 7\right)$, where $x \neq 0$ is decreasing for

- (a) $x \in \mathbb{R}$ (b) $x \in \mathbb{R} - \{0\}$
 (c) $x \in \mathbb{R} - \{1\}$ (d) $x \in \mathbb{R} - \{-1, 1\}$

155. Find the approximate value of $(15)^{\frac{1}{4}}$.

- (a) 1.9688 (b) 0.9687
 (c) 2.0312 (d) 0.1968

156. Find the point on the curve $y = x^2$, where the slope of the tangent is equal to the x coordinate of the point.

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

157. Find the equations of the tangent and the normal to the curve $y = \frac{x^3}{4-x}$ at (2, 4).

- (a) $8x + y - 12 = 0; x + 8y + 34 = 0$
 (b) $8x - y - 12 = 0; x - 8y - 34 = 0$
 (c) $8x + 4y + 12 = 0, x - 8y + 34 = 0$
 (d) $8x - y - 12 = 0, x + 8y - 34 = 0$

158. If $y = \log_a x + \log_x a + \log_x x + \log_a a$, then $\frac{dy}{dx}$ is equal to

- (a) $\frac{1}{x} + x \log a$ (b) $\frac{\log a}{x} + \frac{x}{\log a}$
 (c) $\frac{1}{x \log a} + x \log a$ (d) $\frac{1}{x \log a} - \frac{\log a}{x(\log x)^2}$

159. Evaluate $\int \frac{1}{\sin x + \sqrt{3} \cos x} dx$.

- (a) $\log \left| \tan \left(\frac{x}{2} \right) \right| + C$
 (b) $-\frac{1}{2} \log \left| \tan \left(\frac{x}{2} + \frac{\pi}{6} \right) \right| + C$
 (c) $\frac{1}{2} \log \left| \tan \left(\frac{x}{2} + \frac{\pi}{6} \right) \right| + C$
 (d) None of the above

160. The value of $\int e^{2x}(2\sin 3x + 3\cos 3x) dx$ is

- (a) $e^{2x} \sin 3x + C$ (b) $e^x \operatorname{cosec} x + C$
 (c) $e^{2x} + C$ (d) $e^{2x}(\sin 3x) + C$

161. Evaluate $\int_1^2 \frac{dx}{x^2}$.

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

162. Evaluate $\int_0^{\pi/2} \frac{\cos x}{(\cos^2 x + \sin^2 x)^3} dx$.

- (a) $2 - \sqrt{2}$ (b) $2 + \sqrt{2}$
 (c) $3 + \sqrt{3}$ (d) $3 - \sqrt{3}$

163. To area bounded by the lines $|x| + |y| = 1$

- (a) 1 sq. unit (b) 2 sq. units
 (c) $2\sqrt{2}$ sq. units (d) 4 sq. units

164. The value of $\int \frac{dx}{\sqrt{x} + \sqrt[3]{x}}$ is

- (a) $3\sqrt{x} + 3(\sqrt[3]{x}) - 6\sqrt[6]{x} + \log(\sqrt[6]{x} + 1) + C$

- (b) $2\sqrt{x} + 6(\sqrt[6]{x}) - 6\log(\sqrt[6]{x} + 1) + C$
 (c) $2\sqrt{x} - 3(\sqrt[3]{x}) + 6\sqrt[6]{x} - 6\log(\sqrt[6]{x} + 1) + C$
 (d) None of the above

165. If $\int_a^b \frac{x^n}{x^n + (16-x)^n} dx = 6$, then

- (a) $a = 4, b = 12, n \in \mathbb{R}$
 (b) $a = 2, b = 14, n \in \mathbb{R}$
 (c) $a = -4, b = 20, n \in \mathbb{R}$
 (d) $a = 2, b = 8, n \in \mathbb{R}$

166. $\int_{-\pi/4}^{\pi/4} \frac{dx}{1 + \cos 2x}$ is equal to

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

167. The differential equation of $y = ae^{hx+c}$ is

- (a) $y_2 = y_1 + y$ (b) $y_2^2 = yy_1$
 (c) $y_1^2 = yy_2$ (d) $y^2 = y_1y_2$

168. If $\mathbf{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\mathbf{b} = 3\hat{i} + 2\hat{j} - \hat{k}$, then find $(\mathbf{a} + 3\mathbf{b}) \cdot (2\mathbf{a} - \mathbf{b})$.

- (a) -15 (b) 12
 (c) 13 (d) -10

169. The value of $[a - bb - cc - a]$, where $|a| = 1, |b| = 5|c| = 3$, is

- (a) 0 (b) 1
 (c) 6 (d) None of these

170. If $A = \begin{bmatrix} 2 & -3 \\ 5 & -7 \end{bmatrix}$, then $A + A^{-1} =$

- (a) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} -5 & 0 \\ 0 & -5 \end{bmatrix}$
 (c) $\begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$ (d) $\begin{bmatrix} 4 & 0 \\ 0 & -5 \end{bmatrix}$

171. If $A = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then minor and cofactor of a_{32} are

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

172. An anti-aircraft gun can take a maximum of 4 shots at an enemy plane moving away from it. The probabilities of hitting the plane at the first, second, third and fourth shot are 0.4, 0.3, 0.2, 0.1 respectively. The probability that the gun hits the plane is

- (a) 0.6972 (b) 0.6875
 (c) 0.64 (d) 0.6976

173. The negation of the statement "If I become a teacher, then I will open a school", is

- (a) Neither I will become a teacher nor I will open a school.
 (b) I will not become a teacher or I will open a school.
 (c) I will become a teacher and I will not open a school.
 (d) Either I will not become a teacher or I will not open a school.

174. Maximize $Z = 7x_1 - 3x_2$ subject to, $x_1 + 2x_2 \leq 2, 2x_1 + 4x_2 \geq 8, x_1 \geq 0, x_2 \geq 0$.

- (a) Unique solution
 (b) Unbounded solution
 (c) Infeasible solution
 (d) Infinite number of solutions

175. Find the transformed equation of the straight line $xy - x - y + 1 = 0$, when the origin is shifted to the point (1, 1) after translation of axes.

- (a) $xy = 5$ (b) $xy = 2$

(c) $xy = 0$ (d) $xy = 8$

176. If $\log_6 a + \log_6 b + \log_6 c = 6$, where a, b and c are positive integers that form an increasing GP and $b - a$ is a square of an integer, then $a + b + c =$

- (a) 95 (b) 99
(c) 105 (d) 111

177. A random variable X has the following probability distribution :

X	0	1	2	3
$P(X = x)$	0.5	0.2	0.18	0.12

Find the c.d.f. of X

(a)

$X = x$	0	1	2	3
$F(x)$	0.12	0.18	0.2	0.5

(b)

$X = x$	0	1	2	3
$F(x)$	0.5	0.88	1	0.7

(c)

$X = x$	0	1	2	3
$F(x)$	0.5	0.7	0.88	1

(d)

$X = x$	0	1	2	3
$F(x)$	1	0.5	0.88	0.7

178. From a lot of 20 items containing 4 defective items, 2 items are drawn at random. If X denotes the number of defective items, then find the mean of the probability distribution of X .

- (a) $\frac{3}{8}$ (b) $\frac{1}{95}$
(c) $\frac{2}{5}$ (d) $\frac{28}{57}$

179. The total number of subsets of a finite set A has 56 more elements than the total number of subsets of another finite set B . What is the number of elements in the set A ?

- (a) 5 (b) 6
(c) 7 (d) 8

180. If $\log_4 2 + \log_4 4 + \log_4 x + \log_4 16 = 6$, then the value of x is

- (a) 64 (b) 4
(c) 8 (d) 32