

PHYSICS

- Which of the following statements is not correct regarding conservation laws?
 - A conservation law is a hypothesis based on observations and experiments.
 - Conservation laws do not have a deep connection with symmetries of nature.
 - A conservation law cannot be proved.
 - Conservation of energy, linear momentum, angular momentum are considered to be fundamental laws of Physics.
- The increase in the height of the tower of height 200 m to get its coverage range tripled is
 - 800 m
 - 1600 m
 - 900 m
 - 700 m
- The value of g at a height equal to half the radius of the earth from the earth's surface is
 - $\frac{g}{2}$
 - $\frac{g}{3}$
 - $\frac{4g}{9}$
 - $\frac{g}{4}$
- The maximum and minimum distances of a comet from the sun are 1.4×10^{12} m and 7×10^{10} m. If its velocity nearest to the sun is 6×10^{14} ms⁻¹, what is its velocity in the farthest position? (Assume the comet to be spherical)
 - 1000 ms⁻¹
 - 2000 ms⁻¹
 - 3000 ms⁻¹
 - None of these
- The centre of mass of a system of two bodies of masses M and m , ($M > m$), separated by a distance d is
 - midway between the bodies
 - closer to the heavier body
 - closer to the lighter body
 - at the centre of the heavier body
- A pump on the ground floor of a building can pump up water to fill the tank of 30 m^3 in 15 min. If the tank is 40 m above the ground, and the efficiency of the pump is 30%, the power consumed by the pump is ($g = 10 \text{ ms}^{-2}$)
 - 4.4 Kw
 - 44 kW
 - 440 kW
 - 0.44 kW
- The resistance of a galvanometer is 2.5Ω and it requires 50 mA for full scale deflection. The value of shunt resistance required to convert it into an ammeter of range 0 to 5 A is
 - $2.5 \times 10^{-2} \Omega$
 - $0.25 \times 10^{-2} \Omega$
 - $0.025 \times 10^{-2} \Omega$
 - $0.0025 \times 10^{-2} \Omega$
- Zener diode is used to regulate the voltage supply because, while using a Zener diode
 - voltage remains constant, even when current varies much
 - Both voltage and current remain constant
 - voltage varies much, but current remains constant
 - Both voltage and current vary together
- In an inelastic collision, which of the following is true?
 - Momentum is conserved but not KE
 - KE is conserved, but not momentum
 - Both momentum and KE are conserved
 - Neither momentum nor KE are conserved
- If a change in current of 0.01 A in one coil produces a change in magnetic flux of 2×10^{-2} weber in another coil, then the mutual inductance between coils is
 - 0
 - 0.5 H
 - 2 H
 - 3 H
- An aeroplane is flying horizontally with a velocity of 360 km h^{-1} . The distance between the tips of the wings of the aeroplane is 50 m. The vertical component of the earth's magnetic field is $4 \times 10^{-4} \text{ Wbm}^{-2}$.

The induced emf is

- (a) 200 V (b) 20 V
(c) 2 V (d) 0.2 V

12. The inductance in a coil plays the same role as

- (a) inertia in mechanics
(b) energy in mechanics
(c) momentum in mechanics
(d) force in mechanics

13. The mutual inductance between two coils depends upon

- (a) the medium between the coils only
(b) the separation between the coils only
(c) Both the medium and the separation
(d) Neither the medium nor the separation

14. The normal magnetic flux passing through a coil changes with time according to the equation $\phi = 6t^2 - 5t + 1$. What is the magnitude of the induced current at $t = 0.253$ s and resistance 10Ω ?

- (a) 1.2 A (b) 0.8 A
(c) 0.6 A (d) 0.2 A

15. For an electromagnetic wave, which of the following statements is true?

- (a) Electric field is constant and magnetic field varies.
(b) Magnetic field is constant and electric field varies.
(c) Both electric and magnetic fields are constant.
(d) Both electric and magnetic fields vary.

16. If A is the angle of prism, r angle of refraction, then the condition for minimum deviation is

- (a) $A = r^2$ (b) $A = 2r$
(c) $A = \frac{r}{2}$ (d) $A = r$

17. A concave mirror forms an enlarged, erect, virtual image of an object, only when the object is placed

- (a) at focus
(b) between pole and focus
(c) at the centre of curvature
(d) between focus and centre of curvature

18. A man stands symmetrically between two large plane mirrors fixed to two adjacent walls of a rectangular room. The number of images formed are

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

19. A sinusoidal voltage of peak value 300 V and an angular frequency $\omega = 400\text{rad s}^{-1}$ is applied to series L – C – R circuit, in which $R = 3\Omega$, $L = 20\text{mH}$ and $C = 625\mu\text{F}$. The peak current in the circuit is

- (a) $30\sqrt{2}$ A (b) 60 A
(c) 100 A (d) $60\sqrt{2}$ A

20. A ray of light falls upon a 60° prism ($\mu = \sqrt{2}$) and it suffers minimum deviation. The angle of incidence for this ray must be

- (a) 30° (b) 45°
(c) 60° (d) 75°

21. A source of light of wavelength $5000\text{\AA}$ is placed at one end of a table 2 m long and 5 mm above its flat well polished top. The fringe width of the interference bands seen on a screen located at the end of the table is

- (a) 2×10^{-5} m (b) 2×10^{-4} m
(c) 2×10^{-3} m (d) 2×10^{-2} m

22. A screen is placed 2 m away from a narrow slit. If the first minimum lies 5 mm from either side of the central maxima, when plane waves of wavelength 5×10^{-7} m are used, the slit width is

- (a) 4.8×10^{-4} m (b) 2×10^{-4} m
(c) 5×10^{-4} m (d) 2.4×10^{-4} m
23. A galaxy moves with respect to the earth, so that sodium line of 589.0 nm is observed at 589.6 nm . The speed of the galaxy is
(a) 300 km s^{-1} (b) 306 km s^{-1}
(c) 400 km s^{-1} (d) 406 km s^{-1}
24. Newton's rings are observed normally in reflected light of wavelength $5000 \text{ \AA}$. The diameter of the 10th dark ring is 0.005 m . The radius of curvature of the lens is
(a) 1 m (b) 1.25 m
(c) 2 m (d) 0.5 m
25. The amount of energy required to separate a hydrogen atom into a proton and an electron is
(a) 1.36 eV (b) 13.6 eV
(c) 0.136 eV (d) 136 eV
26. The energy equivalent of 1 g of a substance is
(a) 4.5×10^{13} J (b) 9×10^{16} J
(c) 9×10^{13} J (d) 18×10^{13} J
27. Two small drops of mercury, each of radius r, coalesce to form a single large drop of radius R. The ratio of the total surface energies before and after the change is
(a) $1: 2^{1/3}$ (b) $2^{1/3}: 1$
(c) 2: 1 (d) 1: 2
28. Find the energy equivalent of one atomic mass unit in joules and in MeV.
(a) 1.66×10^{-10} J, 93.15 MeV
(b) 3×10^{-10} J, 9.315 MeV
(c) 15×10^{-10} J, 931.5 MeV
(d) 2.5×10^{-10} J, 931.5 MeV
29. Two amplifiers are connected one after the other in series (cascaded). The first amplifier has a voltage gain of 10 and the second has a voltage gain of 20 . If the input signal is 0.01 V , what is the output AC signal?
(a) 1.5 V (b) 2 V
(c) 2.5 V (d) 3.0 V
30. A transistor works as an amplifier when,
(a) emitter-base junction is forward biased and collector-base junction is reverse biased
(b) emitter-base junction is reverse biased and collector-base junction is forward biased
(c) Both junctions are forward biased
(d) Both junctions are reverse biased
31. In a common base circuit, collector base voltage changes by 0.6 V and collector current changes by 0.02 mA . Then, the output resistance is
(a) $6 \times 10^4 \Omega$ (b) $3 \times 10^4 \Omega$
(c) $9 \times 10^4 \Omega$ (d) $18 \times 10^4 \Omega$
32. A repeater in TV transmission is
(a) only a receiver
(b) only a transmitter
(c) a receiver and a transmitter
(d) demodulator
33. The waves suitable for transmission of radio signals are
(a) infrared
(b) waves longer than infrared
(c) waves shorter than infrared
(d) X-rays

34. A wire of length 2 m is made from 10 cm^3 of copper. A force F is applied so that its length increases by 2 mm. Another wire of length 8 m is made from the same volume of copper. If the force F is applied to it, its length will increase by
 (a) 0.8 cm (b) 1.6 cm
 (c) 2.4 cm (d) 3.2 cm
35. A tennis ball of mass m strikes a wall with a velocity v and retraces the same path. Calculate the change in momentum.
 (a) $+4mv$ (b) $-4mv$
 (c) $+2mv$ (d) $-2mv$
36. A monkey of mass 40 kg climbs up a rope which can stand a maximum tension of 600 N. The rope will break, when the monkey
 (a) climbs up with an acceleration 6 ms^{-2}
 (b) climbs down with an acceleration of 4 ms^{-1}
 (c) climbs up with uniform speed of 5 ms^{-1}
 (d) slides down the rope freely under gravity
37. A shell of mass 20 g is fired by a gun of mass 100 kg. If the shell leaves the gun with a speed of 80 ms^{-1} , then the speed of recoil of the gun is
 (a) 3.2 cms^{-1} (b) 1.6 cms^{-1}
 (c) 1 cms^{-1} (d) 2.4 cms^{-1}
38. Two boys are standing at ends A and B of a ground where $AB = 200 \text{ m}$. The boy at B starts running in a direction perpendicular to AB with a speed of 6 ms^{-1} . The boy at A starts simultaneously with a velocity of 10 ms^{-1} and catches the other at time, t where the time, t is
 (a) 50 s (b) 20 s
 (c) 25 s (d) 12.5 s
39. A car covers the first half distance between two places at 40 kmph and the other half at 60 kmph. The average speed of the car is
 (a) 48 kmph (b) 120 kmph
 (c) 50 kmph (d) 24 kmph
40. The dimensions of universal gravitational constant is
 (a) $[M^2 L^3 T^{-2}]$ (b) $[M^{-1} L^3 T^{-2}]$
 (c) $[M^{-2} L^3 T^{-2}]$ (d) $[M^2 L^{-3} T^{-2}]$
41. Which two of the following quantities are dimensionally equivalent?
 (i) Force
 (ii) Pressure
 (iii) Young's modulus
 (iv) Energy
 (a) (i) and (ii) (b) (i) and (iii)
 (c) (ii) and (iii) (d) (ii) and (iv)
42. The temperature of an object is 60°C . Its value in Fahrenheit scale is
 (a) 120°F (b) 130°F
 (c) 140°F (d) 110°F
43. A pan filled with hot food cools from 94°C to 86°C in 2 min, when the room temperature is 20°C . The time taken for the food to cool from 86°C to 74°C will be
 (a) 500 s (b) 420 s
 (c) 200 s (d) 210 s
44. A system containing a ball is oscillating on a frictionless horizontal plane. The position of the mass when its potential energy and its kinetic energy both are equal, is (let A is the amplitude of oscillation)
 (a) A (b) $A/\sqrt{2}$
 (c) $A/2$ (d) $A/\sqrt{3}$

45. The universal gas law ($\frac{pV}{T} = \text{constant}$) is applicable to
- isothermal changes only
 - adiabatic changes only
 - Both (a) and (b)
 - Neither (a) nor (b)
46. On an average, a human heart is found to beat 72 times a minute. Its frequency and period are
- 1.2 Hz, 0.83 s
 - 2.5 Hz, 1.2 s
 - 2 Hz, 1.2 s
 - 2.5 Hz, 0.83 s
47. A hospital uses an ultrasonic scanner to locate tumors in a tissue. The operating frequency of the scanner is 4.2 MHz. The speed of sound in a tissue is 1.7 km s^{-1} . The wavelength of sound in the tissue is
- $4 \times 10^{-3} \text{ m}$
 - $8 \times 10^{-3} \text{ m}$
 - $4 \times 10^{-4} \text{ m}$
 - $8 \times 10^{-4} \text{ m}$
48. A policeman on duty detects a drop of 15% in the pitch of the horn of a motor car as it crosses him. If the velocity of sound is 330 ms^{-1} , then calculate the speed of the car.
- 26.7 ms^{-1}
 - 27.6 ms^{-1}
 - 53.4 ms^{-1}
 - 54.3 ms^{-1}
49. An electric dipole placed in a non-uniform electric field experiences
- only torque
 - only force
 - Both (a) and (b)
 - Neither (a) nor (b)
50. For a polar molecule, which of the following statements is true?
- The centre of gravity of electrons and protons coincide.
 - The centre of gravity of electrons and protons do not coincide.
 - The charge distribution is always symmetrical.
 - The dipole moment is always zero.
51. A 10 mF capacitor has been charged to a potential of 100 V. Suddenly if it explodes, the energy given out is
- 50 J
 - 10^5 J
 - 50 mJ
 - 10^3 J
52. The region between the parallel plates of capacitor is filled with parallel layers of air and paper (of dielectric constant 4). The space between the plates is 1 mm and the thickness of paper is 0.75 mm. The ratio of the voltage across air and paper is
- $\frac{1}{2}$
 - $\frac{3}{4}$
 - $\frac{4}{3}$
 - $\frac{1}{3}$
53. Two copper wires, one of length 1 m and the other of length 9 m have the same resistance. The diameters are in the ratio
- 3:1
 - 1:3
 - 9:1
 - 1:9
54. Which of the following is a correct statement?
- Heat produced in a conductor varies directly as the current flowing.
 - Heat produced in a conductor varies inversely as the current flowing.
 - Heat produced in a conductor varies directly as the square of the current flowing.
 - Heat produced in a conductor varies inversely as the square of the current flowing.
55. A proton and an α -particle are projected with the same kinetic energy at right angles to a uniform magnetic field. The ratio of the radii of their paths is
- 2:1
 - 1:2
 - 1:1
 - 2:3

56. The magnetic properties of a magnet is lost at its

- (a) melting point (b) boiling point
(c) Curie point (d) triple point

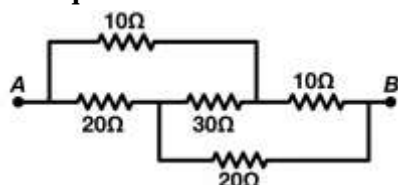
57. Electromagnets are made of soft iron because soft iron has

- (a) low susceptibility and low retentivity
(b) high susceptibility and low retentivity
(c) high susceptibility and high retentivity
(d) low susceptibility and high retentivity

58. Three charges $-q$, $+Q$ and $-q$ are placed at equal distances along a straight line. If the total PE of the system is zero, then the ratio Q/q becomes

- (a) $\frac{1}{8}$ (b) $\frac{1}{6}$
(c) $\frac{1}{4}$ (d) $\frac{1}{2}$

59. The equivalent resistance of the circuit between A and B is



- (a) 30Ω (b) 13.33Ω
(c) 10Ω (d) 8Ω

60. The TV signals have a bandwidth of 3.7 MHz. The number of TV channels that can be accommodated with a band of 3700 GHz is

- (a) 10^4 (b) 10^5
(c) 10^6 (d) 10^7

CHEMISTRY

61. Density of 3 M solution of NaCl is 1.25 g/mL. The mass of the solvent in the solution is

- (a) 1075.4 g (b) 10.745 g
(c) 10.754 g (d) 1074.5 g

62. An orbital with $n = 3, l = 1$ is designated as

- (a) 1s (b) 3s
(c) 3p (d) 3d

63. A 150 watt bulb emits light of wavelength $6600\text{\AA}$ and only 8% of the energy is emitted as light. How many photons are emitted by the bulb per second?

- (a) 4×10^{19} (b) 3.24×10^{19}
(c) 4.23×10^{20} (d) 3×10^{20}

64. In the following sets of ions, which one is not isoelectronic with the rest of the species?

$\text{O}^{2-}, \text{F}^-, \text{Na}, \text{Mg}^{2+}, \text{Al}^{3+}, \text{Ne}$

- (a) Mg^{2+} (b) Al^{3+}
(c) O^{2-} (d) Na

65. For all gases, at any given pressure, the graph of volume vs temperature (in celsius) is a straight line. This graph is called

- (a) isomer (b) isochore
(c) isobar (d) isotherm

66. Atomic numbers of vanadium, chromium, nickel and iron are 23, 24, 28 and 26 respectively. Which one of these is expected to have the highest second ionisation enthalpy?

- (a) Cr (b) V
(c) Fe (d) Ni

67. Which of these represents the correct order of their increasing bond order?

- (a) $\text{C}_2^{2-} < \text{He}_2^+ < \text{O}_2^+ < \text{O}_2^-$

- (b) $\text{He}_2^+ < \text{O}_2^- < \text{O}_2^+ < \text{C}_2^{2-}$
 (c) $\text{O}_2^- < \text{O}_2^+ < \text{C}_2^{2-} < \text{He}_2^+$
 (d) $\text{O}_2^+ < \text{C}_2^{2-} < \text{O}_2^- < \text{He}_2^+$

68. Pick up the incorrect statement.

- (a) Dipole moment of ammonia is due to orbital dipole and resultant dipole in the same direction.
 (b) In BF_3 bond dipoles are higher but dipole moment is zero.
 (c) Dipole moment is a vector quantity.
 (d) O_2 and H_2 show bond dipole due to polarisation.

69. The mole fraction of dioxygen in a neon-dioxygen mixture is 0.18 . If the total pressure of the mixture is 25 bar, the partial pressure of neon in the mixture would be

- (a) 25.18 bar (b) 25.82 bar
 (c) 4.5 bar (d) 20.5 bar

70. Standard molar enthalpies of formation of $\text{CaCO}_3(\text{s})$, $\text{CaO}(\text{s})$ and $\text{CO}_2(\text{g})$ are $-1206.92 \text{ kJ mol}^{-1}$, $-635.09 \text{ kJ mol}^{-1}$ and $-393.51 \text{ kJ mol}^{-1}$ respectively. The $\Delta_r H$, for decomposition of $\text{CaCO}_3(\text{s})$ is

- (a) $178.3 \text{ kJ mol}^{-1}$ (b) $-178.3 \text{ kJ mol}^{-1}$
 (c) $1448.5 \text{ kJ mol}^{-1}$ (d) $-1448.5 \text{ kJ mol}^{-1}$

71. $\Delta_r G^\circ$ for the conversion of O_2 to ozone, $\frac{3}{2}\text{O}_2(\text{g}) \rightarrow \text{O}_3(\text{g})$ at 298 K is (K_p for this conversion is 1×10^{-29})

- (a) $16.54 \text{ kJ mol}^{-1}$ (b) $165.4 \text{ kJ mol}^{-1}$
 (c) 1654 kJ mol^{-1} (d) $1.654 \text{ kJ mol}^{-1}$

72. In which of the following case, does the reaction go farthest to completion if

- (a) $K_C = 10^2$ (b) $K_C = 10$
 (c) $K_C = 10^{-2}$ (d) $K_C = 1$

73. One mole of PCl_5 is heated in a closed 2dm^3 vessel. At equilibrium 40% PCl_5 is dissociated. Calculate the equilibrium constant.

- (a) 0.066 (b) 0.154
 (c) 0.133 (d) 0.266

74. The non-existence of PbI_4 and PbBr_4 is due to

- (a) highly oxidising nature of Pb^{4+} ions
 (b) highly reducing nature of I^- and Br^- ions
 (c) larger size of Pb^{4+} , Br^- and I^- ions
 (d) Both (a) and (b)

75. Which of the following species do not show disproportionation reaction?

- (a) ClO^- (b) ClO_4^-
 (c) ClO_2^- (d) ClO_3^-

76. Sodium dissolves in liquid NH_3 to give a deep blue solution. This is due to

- (a) ammoniated Na^+
 (b) ammoniated Na^-
 (c) formation of Na^+/Na^- pair
 (d) ammoniated electrons

77. Fullerene with formula C_{60} has a structure where every carbon atom is

- (a) sp -hybridised (b) sp^2 -hybridised
 (c) sp^3 -hybridised (d) not hybridised

78. Maleic acid and fumaric acid are

- (a) optical isomers
 (b) geometrical isomers

- (c)functional isomers
(d)positional isomers
79. The IUPAC name of tertiary butyl chloride is
(a)2-chloro-2-methylpropane
(b)3-chlorobutane
(c)4-chlorobutane
(d)1, 2-dichloro-3-methylpropane
80. The compound which on ozonolysis produces a mixture of propanone and ethanal is
(a)2-methyl but-1-ene
(b)2-pentene
(c)2-pentyne
(d)2-methyl but-2-ene
81. When 2-bromopentane is heated with alcoholic solution of potassium hydroxide, the major product obtained is
(a)pent-1-ene (b)pent-2-ene
(c)pent-1-yne (d)pent-2-yne
82. Rain water is called acid rain when its pH
(a)falls below zero
(b)falls below 5.6
(c)is above 5.6 but less than 10
(d)is above 10
83. Schottky defect in crystals is observed when
(a)an ion leaves its normal site and occupies an interstitial site.
(b)unequal number of cations and anions are missing from the crystal lattice.
(c)equal number of cations and anions are missing from the crystal lattice.
(d)there is large difference in size of positive and negative ions.
84. A crystalline solid has A^- ions at the corners and face centres, whereas B^+ ions are at the body centre and edge centres of the unit cell. The simplest formula of the compound will be
(a) A_2B (b) AB_2
(c) AB_3 (d) AB
85. The radius of an atom is 300 pm . If it crystallises in a face-centered cubic lattice, the length of the edge of the unit cell is
(a)488.5 pm (b)848.5 pm
(c)884.5 pm (d)484.5 pm
86. When the concentration is expressed as the number of moles of solute per kilogram of the solvent, it is known as
(a)molarity (b)molality
(c)normality (d)mole fraction
87. van't Hoff factors of equimolal solutions of sodium chloride, barium chloride and glucose in water are
(a)2, 3, 0 respectively
(b)2, 3, 6 respectively
(c)2, 3, 4 respectively
(d)2,3,1 respectively
88. A one molal solution of sodium chloride in water has the same boiling point as
(a)1 m solution of magnesium sulphate
(b)1 m solution of magnesium chloride
(c)1 m solution of aluminium sulphate
(d)1 m solution of aluminium chloride

89. Vapour pressure of water at 293 K is 17.535 mm Hg . The vapour pressure of water at 293 K containing 25 g of glucose dissolved in 450 g of water is
 (a) 17.439 mm Hg (b) 17.535 mm Hg
 (c) 0.097 mm Hg (d) 34.973 mm Hg
90. In an electrochemical cell, the reaction will be feasible when
 (a) $\Delta G = -ve$, $E = +ve$
 (b) $\Delta G = +ve$, $E = -ve$
 (c) $\Delta G = 0$, $E = -ve$
 (d) $\Delta G = 0$, $E = 0$
91. The standard emf of the cell $Zn|Zn^{2+}||Ag^+|Ag$ is 1.56 V . If the standard reduction potential of Ag is 0.8 V , the standard oxidation potential of Zn is
 (a) -0.76 V (b) +0.76 V
 (c) -2.36 V (d) +2.36 V
92. The molar conductivities of NaOH, NaCl and $BaCl_2$ at infinite dilution are $2.481 \times 10^{-2} S m^2 mol^{-1}$, $1.265 \times 10^{-2} S m^2 mol^{-1}$ and $2.800 \times 10^{-2} S m^2 mol^{-1}$ respectively. The molar conductivity of $Ba(OH)_2$ at infinite dilution will be
 (a) $5.232 \times 10^{-2} S m^2 mol^{-1}$
 (b) $9.654 \times 10^{-2} S m^2 mol^{-1}$
 (c) $4.016 \times 10^{-2} S m^2 mol^{-1}$
 (d) $1.145 \times 10^{-2} S m^2 mol^{-1}$
93. The rate of a chemical reaction doubles for every $10^\circ C$ rise in temperature. If the temperature increases by $60^\circ C$, the rate of reaction increases
 (a) 20 times (b) 32 times
 (c) 64 times (d) 128 times
94. An endothermic reaction, $A \rightarrow B$ has an activation energy as x kJ/mol. If the energy change of the reaction is y kJ, the activation energy of the reverse reaction is
 (a) -x (b) x - y
 (c) x + y (d) y - x
95. $aP + bQ \rightarrow \text{products}$, when [P] is doubled keeping [Q] constant and rate increases 2 times, when [P] is constant and [Q] is doubled and rate increases four times. The overall order is
 (a) 1 (b) 2
 (c) 3 (d) 2.5
96. Semiconductors of very high purity are obtained by
 (a) liquation
 (b) vapour phase refining
 (c) zone refining
 (d) electrolysis
97. Sodium cyanide is added as a depressant in the froth floatation process when the ore contains a mixture of ZnS and PbS . This is because
 (a) $Pb(CN)_2$ gets precipitated without any effect on ZnS
 (b) ZnS forms soluble complex, while PbS forms froth.
 (c) PbS forms soluble complex, while ZnS forms froth.
 (d) $Zn(CN)_2$ gets precipitated without any effect on PbS
98. Solid A reacts with strong NaOH(aq) liberating a foul smelling gas B which spontaneously burn in air giving smoky rings. A and B are respectively.
 (a) p_{red} and PH_3 (b) p_{white} and PH_3
 (c) S and $H_2 S$ (d) p_{white} and $H_2 S$

99. $\text{SO}_2 + 2\text{H}_2\text{S} \rightarrow 3\text{S} + 2\text{H}_2\text{O}$. This equation represents preparation of sulphur sol by
 (a) hydrolysis (b) oxidation
 (c) reduction (d) double decomposition
100. Which of the following inert gas compounds is not formed?
 (a) XeOF_4 (b) XeO_3
 (c) XeF_2 (d) NeF_2
101. Nitrogen shows maximum covalency of 4 whereas, other heavier elements of the group show higher covalency because,
 (a) it has higher electronegativity
 (b) it has smaller size
 (c) it has only 4 -orbitals available in the valence shell
 (d) it prefers to form multiple bonds with atoms
102. The photographic industry relies on the special light sensitive properties of
 (a) NaI (b) NaBr
 (c) AgCl (d) AgBr
103. In acidic medium, potassium permanganate oxidises oxalic acid to
 (a) oxalate (b) carbon dioxide
 (c) acetate (d) acetic acid
104. The complex $[\text{PtCl}_2(\text{en})_2]^{2+}$ ion shows
 (a) structural isomerism only
 (b) optical isomerism only
 (c) geometrical and optical isomerism
 (d) geometrical isomerism only
105. The complex $[\text{Ag}(\text{NH}_3)_2][\text{Ag}(\text{CN})_2]$ has the IUPAC name
 (a) diamminesilver (I) dicyanosilver (I)
 (b) diamminesilver (I) dicyanoargentate (I)
 (c) dicyanosilver (I) diammineargentate (I)
 (d) diamminesilver (I) dicyanoargentate (I)
106. Molar conductance of a complex of cobalt is zero. Then its structure would be
 (a) $[\text{Co}(\text{NH}_3)_3]\text{Cl}_3$ (b) $[\text{Co}(\text{NH}_3)\text{Cl}]\text{Cl}_3$
 (c) $[\text{Co}(\text{NH}_3)_3\text{Cl}_2]\text{Cl}$ (d) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$
107. The reaction, $\text{CH}_3\text{CH}_2\text{I} + \text{KOH}(\text{aq}) \rightarrow \text{CH}_3\text{CH}_2\text{OH} + \text{KI}$ is classified as
 (a) electrophilic substitution
 (b) nucleophilic substitution
 (c) electrophilic addition
 (d) nucleophilic addition
108. For $\text{S}_\text{N}1$ reaction, the order of reactivity of haloalkanes is
 (a) tertiary halide < secondary halide < primary halide
 (b) tertiary halide < secondary halide > primary halide
 (c) tertiary halide > secondary halide > primary halide
 (d) tertiary halide > secondary halide < primary halide
109. The major product obtained when chlorobenzene is nitrated with $\text{HNO}_3 + \text{conc. H}_2\text{SO}_4$ is
 (a) 1-chloro-4-nitrobenzene
 (b) 1-chloro-2-nitrobenzene
 (c) 1-chloro-3-nitrobenzene
 (d) 1-chloro-1-nitrobenzene
110. The unstable intermediate dichlorocarbene $[\text{:CCl}_2]$ is formed during
 (a) Kolbe's reaction
 (b) Friedel-Crafts reaction

- (c) Williamson synthesis
(d) Reimer-Tiemann reaction
111. Phenols are highly acidic compared to alcohols due to
(a) the higher molecular mass of phenols
(b) the stronger hydrogen bonds in phenols
(c) alkoxide ion is a strong conjugate base
(d) phenoxide ion is resonance stabilised
112. Arrangement of following compounds based on their boiling points in the increasing order. n-butane, 1-butanol, ethoxyethane and 1-propanol will be
(a) 1-propanol > n-butane > ethoxyethane > 1-butanol
(b) n-butane < ethoxyethane < 1-propanol < 1-butanol
(c) n-butane < 1-propanol < ethoxyethane < 1-butanol
(d) 1-propanol < n-butane < ethoxyethane < 1-butanol
113. Among 2-chloropropanoic acid, 3-chloropropanoic acid, 2,2-dichloroacetic acid and propanoic acid the K_a values will be in the order,
(a) 2, 2-dichloroacetic acid > 2-chloropropanoic acid > 3-chloropropanoic acid > propanoic acid
(b) 3-chloropropanoic acid > 2-chloropropanoic acid > 2, 2-dichloroacetic acid > propanoic acid
(c) 2, 2-dichloroacetic acid > 3-chloropropanoic acid > 2-chloropropanoic acid > propanoic acid
(d) 2, 2-dichloroacetic acid > propanoic acid > 2-chloropropanoic acid > 3-chloropropanoic acid
114. A reaction between a carbonyl compound and a Grignard reagent is termed as
(a) nucleophilic addition
(b) electrophilic addition
(c) S_N1 reaction
(d) S_N2 reaction
115. Ethanal is treated with a primary alcohol in presence of HCl gas. The reaction is known as
(a) aldol condensation
(b) acetal formation
(c) cross aldol condensation
(d) Cannizzaro reaction
116. $\text{CH}_3 - \text{CN} \xrightarrow[\text{C}_2\text{H}_5\text{OH}]{\text{Na}} \text{A} \xrightarrow{\text{HNO}_2} \text{B} \xrightarrow[573 \text{ K}]{\text{Cu}} \text{C}$ Here C is
(a) $\text{CH}_3 - \text{CH}_2\text{NHOH}$
(b) $\text{CH}_3 - \text{CHO}$
(c) $\text{CH}_3\text{CO} - \text{NH}_2$
(d) $\text{CH}_3 - \text{COOH}$
117. In nucleic acids the nucleotides are linked by
(a) ester linkage (b) amide linkage
(c) peptide linkage (d) glycosidic linkage
118. Amino acids exist as zwitter ions at
(a) acidic pH (b) basic pH
(c) neutral pH (d) isoelectric pH
119. Which one of the following is an addition polymer?
(a) Terylene (b) Nylon-6, 6
(c) Neoprene (d) Teflon
120. Among the following compounds, the only one which is not an artificial sweetening agent is
(a) aspartame (b) sucrose
(c) sucralose (d) saccharin

MATHEMATICS

121. Which of the following is an empty set?
(a) $\{x \mid x \text{ is a real number and } x^2 - 1 = 0\}$

- (b) $\{x \mid x \text{ is a real number and } x^2 + 3 = 0\}$
 (c) $\{x \mid x \text{ is a real number and } x^2 - 9 = 0\}$
 (d) $\{x \mid x \text{ is a real number and } x^2 = x + 2\}$

122. The number of proper subsets of a set having $n + 1$ elements is

- (a) 2^{n+1} (b) $2^{n+1} - 1$
 (c) $2^{n+1} - 2$ (d) 2^{n-2}

123. The domain of the function $y = \sqrt{x-2} + \sqrt{1-x}$ is

- (a) $x \leq 2$ (b) $x \geq 2$
 (c) Null set (d) The set of all numbers

124. If $A = \{1, 2, 3, 4\}$, then which one of the following is reflexive?

- (a) $\{(1,1), (2,3), (3,3)\}$
 (b) $\{(1,1), (2,2), (3,3), (4,4)\}$
 (c) $\{(1,2), (2,1), (3,2), (2,3)\}$
 (d) $\{(1,2), (1,3), (1,4)\}$

125. If $f(x) = \frac{2x-3}{3x+4}$, then $f^{-1}\left(\frac{-4}{3}\right) =$

- (a) Zero (b) $\frac{3}{4}$
 (c) $-\frac{2}{3}$ (d) None of these

126. If $f: [0, \infty) \rightarrow [2, \infty)$ is given by $f(x) = x + \frac{1}{x}$, then $f^{-1}(x)$ equals

- (a) $\frac{x+\sqrt{x^2-4}}{2}$ (b) $\frac{x}{1+x^2}$
 (c) $\frac{2x-\sqrt{x^2-4}}{2}$ (d) $1 + \sqrt{x^2 - 4}$

127. The value of $\frac{\tan 330^\circ \sec 420^\circ \sin 300^\circ}{\tan 135^\circ \sin 210^\circ \sec 315^\circ}$ is equal to

- (a) $\frac{1}{\sqrt{2}}$ (b) $\sqrt{2}$
 (c) $\frac{1}{\sqrt{3}}$ (d) $\sqrt{3}$

128. If $\sin(120 - A) = \sin(120 - B)$ and $0 < A, B < \pi$ then all values of A and B are given by

- (a) $A + B = \frac{\pi}{3}$ (b) $A = B$ or $A + B = \frac{\pi}{3}$
 (c) $A = B$ (d) $A + B = 0$

129. If $\cot^{-1} \frac{1}{5} + \cot^{-1} \frac{1}{3} - \cot^{-1} \frac{4}{7} = \cot^{-1} x$, then x is equal to

- (a) 0 (b) 3
 (c) $\frac{1}{\sqrt{3}}$ (d) ∞

130. If $1 + i = (x + iy)(u + iv)$, then $\tan^{-1}\left(\frac{y}{x}\right) + \cot^{-1}\left(\frac{u}{v}\right)$ has the value

- (a) $n\pi + \frac{\pi}{6}, n \in \mathbb{I}$ (b) $2n\pi + \frac{\pi}{3}, n \in \mathbb{I}$
 (c) $n\pi + \frac{\pi}{4}, n \in \mathbb{I}$ (d) $n\pi - \frac{\pi}{3}, n \in \mathbb{I}$

131. For a natural number n, which one is the correct statement?

- (a) $1^3 + 2^3 + \dots + n^3 = (1 + 2 + \dots + n)^2$
 (b) $1^3 + 2^3 + \dots + n^3 > (1 + 2 + \dots + n)^2$
 (c) $1^3 + 2^3 + \dots + n^3 < (1 + 2 + \dots + n)^2$
 (d) $1^3 + 2^3 + \dots + n^3 \neq (1 + 2 + \dots + n)^2$

132. If a complex number lies in the III quadrant. Find the quadrant in which its conjugate lies.

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

133. If β satisfies the inequation $x^2 - x - 6 > 0$, then a value exists for
 (a) $\cos^{-1}(\cos\beta)$ (b) $\sec(\sec^{-1}\beta)$
 (c) $\tan(\tan^{-1}\beta)$ (d) $\sin(\sin^{-1}\beta)$
134. If ${}^{56}P_{r+6} : {}^{54}P_{r+3} = 30800 : 1$, then
 (a) $r = 41$ (b) $r = 51$
 (c) $r = 31$ (d) None of these
135. If the coefficient of x^5 and x^6 in $\left(2 + \frac{x}{3}\right)^n$ are equal, then n is
 (a) 51 (b) 31
 (c) 41 (d) None of these
136. The term independent of x in $\left[\sqrt{\frac{x}{3}} + \sqrt{\frac{3}{2x^2}}\right]^{10}$ is
 (a) $\frac{5}{4}$ (b) $\frac{7}{4}$
 (c) $\frac{9}{4}$ (d) None of these
137. The sum of the series $\frac{1^2}{1 \cdot 2} + \frac{1^2+2^2}{2 \cdot 3} + \frac{1^2+2^2+3^2}{3 \cdot 4} + \dots$ upto 20 terms is
 (a) $\frac{205}{3}$ (b) $\frac{200}{3}$
 (c) $\frac{220}{3}$ (d) $\frac{210}{3}$
138. The angle between lines $\sqrt{3}x + y = 1$ and $x + \sqrt{3}y = 1$ is
 (a) $\frac{\pi}{6}$ (b) $\frac{3\pi}{4}$
 (c) $\frac{5\pi}{2}$ (d) $\frac{\pi}{3}$
139. If a is a parameter then an equation of a family of lines having the sum of the intercepts on axes equal to 7 is
 (a) $4x + 3y = 12a$ (b) $3x + 4y = 7a$
 (c) $7x + ay = a(7 - a)$ (d) $ay = (7 - a)(a - x)$
140. The equation of the ellipse whose centre is at the origin and the X-axis is major axis, which passes through the points $(-3, 1)$ and $(2, -2)$ is
 (a) $5x^2 + 3y^2 = 32$ (b) $3x^2 + 5y^2 = 32$
 (c) $5x^2 - 3y^2 = 32$ (d) $3x^2 + 5y^2 + 32 = 0$
141. The equation of the lines joining the vertex of the parabola $y^2 = 6x$ to the point on it which have abscissa 24 are
 (a) $y \pm 2x = 0$ (b) $2y \pm x = 0$
 (c) $x \pm y = 0$ (d) $2x \pm 3y = 0$
142. From a point $P(a, b, c)$ perpendicular PA, PB are drawn to yz and zx planes. Find the equation of the plane OAB , where O is the origin.
 (a) $bcx + cay + abz = 0$
 (b) $bcx + cay - abz = 0$
 (c) $bcx - cay + abz = 0$
 (d) $-bcx + cay + abz = 0$
143. Find the distance of a point $(1, 2, 3)$ from the plane $3y + 4z + 4 = 0$.
 (a) 4.4 (b) 4
 (c) 4.04 (d) 4.44
144. AB and CD are two line segments, where $A(2, 3, 0), B(6, 9, 0), C(-6, -9, 0)$. P and Q are mid-point of AB and CD , respectively and L is the mid-point of PQ . Find the distance of L from the plane $3x + 4z + 25 = 0$

- (a)25 (b)15
(c)5 (d)40

145. Determine the plane through the intersection of the planes $x + 2y + 3z - 4 = 0$ and $2x + y - z + 5 = 0$ and perpendicular to the plane $5x + 3y + 6z + 8 = 0$

- (a) $-51x - 15y - 50z - 173 = 0$
(b) $51x + 15y - 50z + 173 = 0$
(c) $51x - 15y + 50z - 173 = 0$
(d) $51x + 50y + 15z + 173 = 0$

146. $\lim_{x \rightarrow 0} \frac{xa^x - x}{1 - \cos x}$ is equal to

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

147. If $y = \tan x$, then $\frac{d^2 y}{dx^2} =$

- (a) $1 + y^2$ (b) $2y(1 + y^2)$
(c) $y(1 + y^2)$ (d) $2y(1 - y^2)$

148. If $y = \tan^{-1} \left(\frac{a-x}{1+ax} \right)$, then $\frac{dy}{dx} =$

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

149. If $f(x) = \begin{cases} [x] + [-x], & x \neq 2 \\ K, & x = 2 \end{cases}$, then $f(x)$ is continuous at $x = 2$, provided K is equal to

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

150. The curve $x^2 - xy + y^2 = 27$ has tangents parallel to X-axis at

- (a) $(-3, -6)$ and $(3, -6)$
(b) $(3, 6)$ and $(-3, -6)$
(c) $(-3, 6)$ and $(-3, -6)$
(d) $(3, -6)$ and $(-3, 6)$

151. The point on the circle $x^2 + y^2 = 2$ at the abscissa and ordinate increase at the same rate is

- (a) $(-1, -1)$ (b) $(1, -1)$
(c) $(1, 1)$ (d) $(-1, 4)$

152. A spherical balloon is being inflated at the rate of 35 cm/min. When its radius is 7 cm, its surface area increases at the rate of

- (a) 10 cm²/min (b) 15 cm²/min
(c) 20 cm²/min (d) 25 cm²/min

153. $\int e^x (\cos x - \sin x) dx$ is equal to

- (a) $e^x \cos x + C$ (b) $e^x \sin x + C$
(c) $-e^x \cos x + C$ (d) $-e^x \sin x + C$

154. The solution of $(2x - 10y^3) \frac{dy}{dx} + y = 0$ is

- (a) $xy^2 = 2y^5 + C$ (b) $yx^2 = 2y^5 + C$
(c) $x^2 y^2 = 2y^5 + C$ (d) None of these

155. The solution of $(x + y)^2 \left(x \frac{dy}{dx} + y \right) = xy \left(1 + \frac{dy}{dx} \right)$ is

- (a) $\log(xy) = -\frac{1}{x+y} + C$
(b) $\log\left(\frac{x}{y}\right) = -\frac{1}{x+y} + C$

(c) $\log(xy) = \frac{1}{x-y} + C$

(d) None of the above

156. Find $\sin\theta$, if θ is the angle between the vectors $3\hat{i} + \hat{j} + 2\hat{k}$ and $\hat{i} + \hat{j} + 2\hat{k}$.

(a) $\sqrt{\frac{5}{21}}$

(b) $\frac{5}{\sqrt{21}}$

(c) $\frac{4}{\sqrt{21}}$

(d) $\sqrt{\frac{3}{21}}$

157. If a and b are two vectors of magnitude 2, each inclined at an $\angle 60^\circ$, then angle between a and $a + b$ is

(a) 30°

(b) 45°

(c) 60°

(d) 90°

158. If $\begin{bmatrix} -2 & 5 \\ 3 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 3 \\ -1 \end{bmatrix}$, then (x, y) is

(a) $(1, 2)$

(b) $(-1, 2)$

(c) $(1, -2)$

(d) $(2, 1)$

159. If the product of the matrix $B = \begin{bmatrix} 2 & 6 & 4 \\ 1 & 0 & 1 \\ -1 & 1 & -1 \end{bmatrix}$ with a matrix A has the inverse $C = \begin{bmatrix} -1 & 0 & 1 \\ 1 & 1 & 3 \\ 2 & 0 & 2 \end{bmatrix}$, then

A^{-1} equals

(a) $\begin{bmatrix} -3 & -5 & 5 \\ 0 & 9 & 14 \\ 2 & 2 & 9 \end{bmatrix}$

(b) $\begin{bmatrix} -3 & 5 & 5 \\ 0 & 0 & 9 \\ 2 & 14 & 16 \end{bmatrix}$

(c) $\begin{bmatrix} -3 & -5 & -5 \\ 0 & 0 & 2 \\ 2 & 14 & 6 \end{bmatrix}$

(d) $\begin{bmatrix} -3 & -5 & -5 \\ 0 & 9 & 2 \\ 2 & 14 & 6 \end{bmatrix}$

160. A and B are two matrices such that $AB = B$, $BA = A$, then $A^2 + B^2 =$

(a) $2AB$

(b) $2BA$

(c) $A + B$

(d) AB

161. If α, β, γ are the roots of $x^3 + a^2x + b = 0$, the value of $\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$ is

(a) $-a^3$

(b) $a^3 - 3b$

(c) a^3

(d) 0

162. The value of $\begin{vmatrix} 4 & 4 & 4 \\ (a + a^{-1})^2 & (b + b^{-1})^2 & (c + c^{-1})^2 \\ (a - a^{-1})^2 & (b - b^{-1})^2 & (c - c^{-1})^2 \end{vmatrix}$ is

(a) 0

(b) $4abc$

(c) $4(abc)^{-1}$

(d) $4[abc + (abc)^{-1}]$

163. Given that, $P(A) = 0.1$, $P(B | A) = 0.6$ and $P(B | A^c) = 0.3$ what is $P(A | B) = ?$

(a) $\frac{2}{11}$

(b) $\frac{4}{11}$

(c) $\frac{7}{11}$

(d) $\frac{9}{11}$

164. A card is picked at random from a pack of cards. Given that the picked card is a queen, what is the probability that it is a spade?

(a) $\frac{1}{3}$

(b) $\frac{4}{13}$

(c) $\frac{1}{4}$

(d) $\frac{1}{2}$

165. If the occurrence of an event A implies that occurrence of an event B , the $P(A^c \cap B^c)$ is equal to

(a) $P(B^c)$

(b) $P(A^c)P(B^c)$

(c) $P(A^c)$

(d) $1 - P(A \cap B)$

166. A certain item is manufactured by 3 factory F_1 , F_2 and F_3 with 30% of item made in F_1 , 20% in F_2 and 50% in F_3 . It is found that 2% of the items produced by F_1 , 3% of the items produced by F_2 and 4% of the items produced by F_3 are defective. Suppose that an items selected at random from the stock is found defective. What is the probability that the item came from F_1 ?
- (a) $\frac{1}{16}$ (b) $\frac{1}{8}$
 (c) $\frac{1}{3}$ (d) $\frac{3}{16}$
167. Ram obtained 60 and 85 in first two unit tests. The minimum marks he should get in the third test to have an average of atleast 55 marks is
- (a) $x \geq 20$ (b) $x \leq 20$
 (c) $x > 20$ (d) $x < 20$
168. Coefficient of variation of two distributions are 60 and 70, and their standard deviation are 21 and 16 respectively. What are their arithmetic means?
- (a) 35, 20 (b) 35, 22.85
 (c) 30, 22.85 (d) 30, 20
169. Consider an experiment E in which a box contains 10 identical tickets numbered 1 to 10 and 2 tickets are drawn at random from the box. What is the probability that both the tickets have even number on them?
- (a) $\frac{4}{9}$ (b) $\frac{1}{3}$
 (c) $\frac{2}{9}$ (d) $\frac{1}{9}$
170. Which of the following is not a logical statement?
- (a) Two non-empty sets have always a non-empty intersection.
 (b) The real number 'n' is less than 2 .
 (c) Two individuals are always related.
 (d) None of the above
171. A mathematical model written to construct a maximum area rectangle out of a thread of length 10 cm is given by maximise lb . Such that $2(l + b) = 10, l, b > 0$, where l and b are the length and breadth of the rectangle.
- This is not a linear programming problem because
- (a) l and b is always positive.
 (b) first constraints is an equation.
 (c) the objective function is no maximise.
 (d) objective function is not linear.
172. Lakshmi wants to buy few bangles and ear drops. Each bangle costs ₹5 and each ear drop costs ₹10. She should buy atleast 6 bangles and atmost 2 ear drops. If she buys x bangles and y ear drops with minimum expenditure, then the formulation for this linear programming is
- (a) Maximise $5x + 10y$ subject to $x \geq 6, y \leq 2, x, y \geq 0$.
 (b) Minimise $5x + 10y$ subject to $x \geq 6, y \leq 2, x, y \geq 0$.
 (c) Maximise $x + y$ subject to $5x + 10y \leq 50, x, y \geq 0$.
 (d) Maximise $6x + 2y$ subject to $5x + 10y \leq 50, x, y \geq 0$.
173. The function $f(x) = \log(x + \sqrt{x^2 + 1})$ is
- (a) an even function.
 (b) an odd function.
 (c) a periodic function.
 (d) neither an even nor an odd function.
174. The number of real roots of the equation $x^4 + \sqrt{x^4 + 20} = 22$ is
- (a) 4 (b) 2
 (c) 0 (d) 1

175. If the sum of first n natural numbers is $\frac{1}{78}$ times the sum their cubes, then the value of n is

- (a)11 (b)12
(c)13 (d)14

176. If a polygon of n sides 275 diagonals, then n is equal to

- (a)25 (b)35
(c)20 (d)15

177. $7^9 + 9^7$ is divisible by

- (a)128 (b)24
(c)64 (d)72

178. $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 - bc & b^2 - ca & c^2 - ab \end{vmatrix}$ is equal to

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

179. The number of values of x in $[0, 2\pi]$ satisfying the equation $3\cos 2x - 10\cos x + 7 = 0$ is

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

180. $\lim_{x \rightarrow -\infty} \frac{2x-1}{\sqrt{x^2+2x+1}}$ is equal to

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

