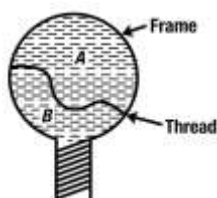


PHYSICS

- A thin plano-convex lens acts like a concave mirror of focal length 0.2 m when silvered from its plane surface. The refractive index of the material of the lens is 1.5 . The radius of curvature of the convex surface of the lens will be
 (a) 0.4 m (b) 0.2 m
 (c) 0.1 m (d) 0.75 m
- The physical quantity having the same dimensions as Planck's constant h is
 (a) Boltzmann constant
 (b) force
 (c) linear momentum
 (d) angular momentum
- A balloon is rising vertically up with a velocity of 29 ms^{-1} . A stone is dropped from it and it reaches the ground in 10 s . The height of the balloon when the stone was dropped from it is ($g = 98 \text{ ms}^{-2}$)
 (a) 100 m (b) 200 m
 (c) 400 m (d) 150 m
- A thread is tied slightly loose to a wire frame as in figure and the frame is dipped into a soap solution and taken out. The frame is completely covered with the film. When the portion A is punctured with a pin, the thread



- becomes concave towards A
 - becomes convex towards A
 - remains in the initial position
 - Either (a) or (b) depending on the size of A w.r.t. B
- Oxygen is 16 times heavier than hydrogen. Equal volumes of hydrogen and oxygen are mixed. The ratio of speed of sound in the mixture to that in hydrogen is
 (a) $\sqrt{1/8}$ (b) $\sqrt{\frac{32}{17}}$
 (c) $\sqrt{8}$ (d) $\sqrt{\frac{2}{17}}$
 - When light is incident on a diffraction grating, the zero order principal maximum will be
 (a) one of the component colours
 (b) absent
 (c) spectrum of the colours
 (d) white
 - H-polaroid is prepared by
 (a) stretching polyvinyl alcohol and then heated with dehydrating agent
 (b) stretching polyvinyl alcohol and then impregnating with iodine
 (c) orienting herapathite crystal in the same direction in nitrocellulose
 (d) by using thin tourmaline crystals
 - SI unit of permittivity is
 (a) $\text{C}^2 \text{m}^2 \text{N}^{-1}$ (b) $\text{C}^{-1} \text{m}^2 \text{N}^{-2}$
 (c) $\text{C}^2 \text{m}^2 \text{N}^2$ (d) $\text{C}^2 \text{m}^{-2} \text{N}^{-1}$
 - A spherical drop of capacitance $1 \mu \text{ F}$ is broken into eight drops of equal radius. Then, the capacitance of each small drop is

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

10. Two equal forces (p each) act at a point inclined to each other at an angle of 120° . The magnitude of their resultant is

- (a) p (b) 2p
 (c) p/2 (d) p / 4

11. If two waves of the same frequency and amplitude respectively on superposition produce a resultant disturbance of the same amplitude the waves differ in phase by

- (a) $\pi/3$ (b) $2\pi/3$
 (c) π (d) zero

12. A man, standing between two cliffs, claps his hands and starts hearing a series of echoes at intervals of one second. If the speed of sound in air is 340 ms^{-1} , then the distance between the cliffs, is

- (a) 340 m (b) 1620 m
 (c) 680 m (d) 1700 m

13. A beam of light of wavelength 600 nm from a distant source falls on a single slit 1 mm wide and the resulting diffraction pattern is observed on a screen 2 m away. The distance between the first dark fringes on either side of the central bright fringe is

- (a) 1.2 mm (b) 1.2 cm
 (c) 2.4 cm (d) 2.4 mm

14. Specific rotation of sugar solution is 0.01 SI units. 200 kgm^{-3} of impure sugar solution is taken in a polarimeter tube of length 0.25 m and an optical rotation of 0.4 rad is observed. The percentage of purity of sugar in the sample is

- (a) 80% (b) 89%
 (c) 11% (d) 20%

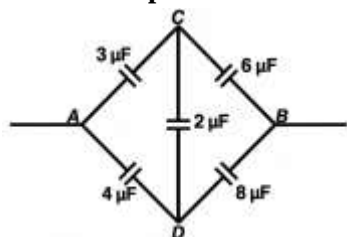
15. An electron is accelerated through a potential difference of 45.5 V . The velocity acquired by it (in ms^{-1}) is

- (a) 4×10^6 (b) 4×10^4
 (c) 10^6 (d) zero

16. When a body is earth connected, electrons from the earth flow into the body. This means, the body is

- (a) uncharged (b) charged positively
 (c) charged negatively (d) an insulator

17. Effective capacitance between A and B in the figure shown is (all capacitances are in μF)



- (a) $21 \mu\text{F}$ (b) $23 \mu\text{F}$
 (c) $\frac{3}{14} \mu\text{F}$ (d) $\frac{14}{3} \mu\text{F}$

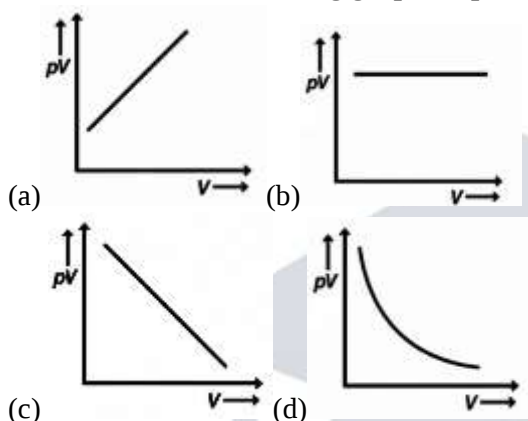
18. Which state of triply ionised Beryllium (Be^{+++}) has the same orbital radius as that of the ground state of hydrogen?

- (a) $n = 1$ (b) $n = 2$
 (c) $n = 3$ (d) $n = 4$

19. If M is the atomic mass and A is the mass number, packing fraction is given by

- (a) $\frac{A}{M-A}$ (b) $\frac{A-M}{A}$
 (c) $\frac{M}{M-A}$ (d) $\frac{M-A}{A}$

20. A count rate meter shows a count of 240 per min from a given radioactive source. One hour later the meter shows a count rate of 30 per min. The half-life of the source is
 (a) 20 min (b) 30 min
 (c) 80 min (d) 120 min
21. The refractive index of a particular material is 1.67 for blue light, 1.65 for yellow light and 1.63 for red light. The dispersive power of the material is
 (a) 0.0615 (b) 0.024
 (c) 0.031 (d) 1.60
22. An ideal gas heat engine operates in a Carnot's cycle between 227°C and 127°C . It absorbs $6 \times 10^4 \text{ J}$ at high temperature. The amount of heat converted into work is
 (a) $4.8 \times 10^4 \text{ J}$ (b) $35 \times 10^4 \text{ J}$
 (c) $1.6 \times 10^4 \text{ J}$ (d) $1.2 \times 10^4 \text{ J}$
23. Which one of the following graphs represents the behaviour of an ideal gas?



24. Rainbow is formed due to
 (a) refraction
 (b) dispersion and total internal reflection
 (c) total internal reflection
 (d) scattering
25. A beam of parallel rays is brought to a focus by a plano-convex lens. A thin concave lens of the same focal length is joined to the first lens. The effect of this is
 (a) the focal point shifts away from the lens by a small distance
 (b) the focus remains undisturbed
 (c) the focus shifts to infinity
 (d) the focal point shifts towards the lens by a small distance
26. Two conductors of the same material have their diameters in the ratio 1:2 and their lengths in the ratio 2:1. If the temperature difference between their ends is the same, then the ratio of amounts of heat conducted per second through them will be
 (a) 8:1 (b) 1:8
 (c) 4:1 (d) 1:4
27. Blowing air with open mouth is an example of
 (a) isothermal process
 (b) adiabatic process
 (c) isobaric process
 (d) isochoric process
28. Sound waves in air are always longitudinal because
 (a) air is a mixture of several gases
 (b) density of air is very small

- (c) of the inherent characteristics of sound waves in air
(d) air does not have a modulus of rigidity

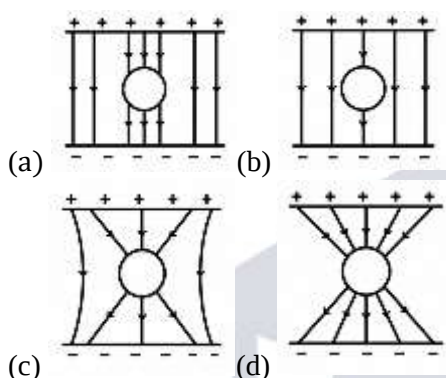
29. In Young's double slit experiment, if monochromatic light used is replaced by white light, then

- (a) all bright fringes become white
(b) all bright fringes have colours between violet and red
(c) no fringes are observed
(d) only central fringe is white, all other fringes are coloured

30. In a Young's double slit experiment, the separation between the two slits is 0.9 mm and the fringes are observed 1 m away. If it produces the second dark fringe at a distance of 1 mm from the central fringe, the wavelength of the monochromatic source of light used is

- (a) 500 nm (b) 600 nm
(c) 450 nm (d) 400 nm

31. An uncharged sphere of metal is placed inside a charged parallel plate capacitor. The lines of force will look like



32. A wire has a resistance of 6Ω . It is cut into two parts and both half values are connected in parallel. The new resistance is

- (a) 12Ω (b) 15Ω
(c) 3Ω (d) 6Ω

33. A current flows in a conductor from East to West. The direction of the magnetic field at a point above the conductor is

- (a) towards North (b) towards South
(c) towards East (d) towards West

34. A bar magnet is equivalent to

- (a) solenoid carrying current
(b) circular coil carrying current
(c) torroid carrying current
(d) straight conductor carrying current

35. Excitation energy of a hydrogen like ion in its first excitation state is 40.8 eV. Energy needed to remove the electron from the ion in ground state is

- (a) 54.4 eV (b) 13.6 eV
(c) 40.8 eV (d) 27.2 eV

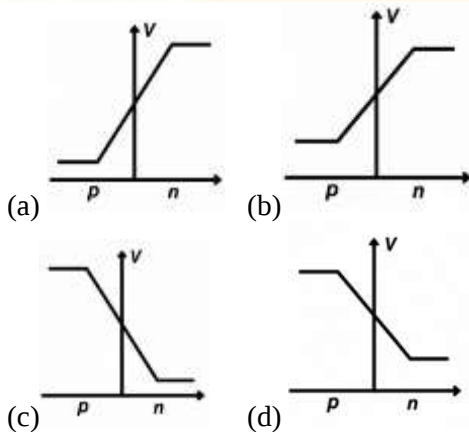
36. Threshold wavelength for photoelectric emission from a metal surface is $5200\text{\AA}$. Photoelectrons will be emitted when this surface is illuminated with monochromatic radiation from

- (a) 50 W IR-lamp (b) 10 W IR-lamp
(c) 1 W IR-lamp (d) 50 W UV-lamp

37. The emitter-base junction of a transistor is biased, while the collector-base junction is ____ biased.

- (a) reverse, forward (b) reverse, reverse
(c) forward, forward (d) forward, reverse

38. In a forward biased p – n junction diode, the potential barrier in the depletion region is of the form



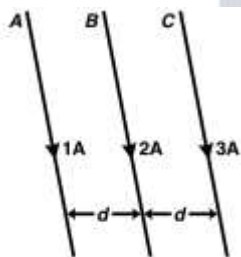
39. A cylinder of radius r and length l is placed in a uniform electric field E parallel to the axis of the cylinder. The total flux for the surface of the cylinder is given by

- (a) $\pi r^2 E$ (b) $(\pi r^2 + \pi l^2) E$
(c) Zero (d) $2\pi r^2 E$

40. Two electric bulbs A and B are rated as 60 W and 100 W. They are connected in parallel to the same source. Then,

- (a) Both draw the same current
(b) A draws more current than B
(c) B draws more current than A
(d) currents drawn are in the ratio of their resistances

41. Three long straight wires A, B and C are carrying currents as shown in figure. Then, the resultant force on B is directed



- (a) towards A
(b) towards C
(c) perpendicular to the plane of paper and outward
(d) perpendicular to the plane of paper and inward

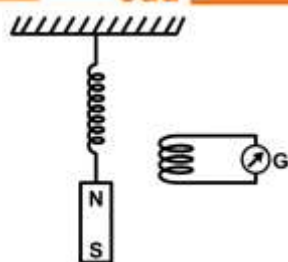
42. Curie-Weiss law is obeyed by iron at a temperature

- (a) below Curie temperature
(b) above Curie temperature
(c) at Curie temperature only
(d) at all temperatures

43. The dimensional formula for inductance is

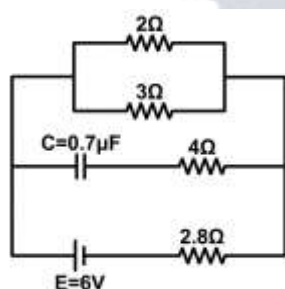
- (a) $[ML^2 T^{-1} A^{-2}]$ (b) $[ML^2 T^{-2} A^{-1}]$
(c) $[ML^2 T^{-2} A^{-2}]$ (d) $[ML^2 T A^{-2}]$

44. A magnet NS is suspended from a spring and while it oscillates, the magnet moves in and out of the coil C. The coil is connected to a galvanometer G. Then, as the magnet oscillates,



- (a) G shows deflection to the left and right with constant amplitude
- (b) G shows deflection on one side
- (c) G shows no deflection
- (d) G shows deflection to the left and right but the amplitude steadily decreases

45. The maximum current that can be measured by a galvanometer of resistance 40Ω is 10 mA . It is converted into a voltmeter that can read upto 50 V . The resistance to be connected in series with the galvanometer (in ohm) is
- (a) 5040
 - (b) 4960
 - (c) 2010
 - (d) 4050
46. An unknown resistance R_1 is connected in series with a resistance of 10Ω . This combination is connected to one gap of a meter bridge, while a resistance R_2 is connected in the other gap. The balance point is at 50 cm . Now, when the 10Ω resistance is removed the balance point shifts to 40 cm . The value of R_1 (in ohm) is
- (a) 60
 - (b) 40
 - (c) 20
 - (d) 10
47. In the circuit shown, the internal resistance of the cell is negligible. The steady state current in the 2Ω resistor is



- (a) 0.9 A
- (b) 1.5 A
- (c) 0.6 A
- (d) 1.2 A

48. A rectangular coil of 300 turns has an average area of $25\text{ cm} \times 10\text{ cm}$. The coil rotates with a speed of 50 cps in a uniform magnetic field of strength $4 \times 10^{-2}\text{ T}$ about an axis perpendicular to the field. The peak value of the induced emf (in volt) is
- (a) 3π
 - (b) 30π
 - (c) 300π
 - (d) 3000π
49. In a $L - C - R$ circuit the potential difference between the terminals of the inductance is 60 V , between the terminals of the capacitor is 30 V and that between the terminals of resistance is 40 V . The supply voltage will be equal to
- (a) 50 V
 - (b) 70 V
 - (c) 130 V
 - (d) 10 V
50. A vertical circular coil of radius 0.1 m and having 10 turns carries a steady current. When the plane of the coil is normal to the magnetic meridian, a neutral point is observed at the centre of the coil. If $B_H = 0.314 \times 10^{-4}\text{ T}$, then the current in the coil is
- (a) 2 A
 - (b) 1 A
 - (c) 0.5 A
 - (d) 0.25 A
51. The spectrum obtained from the chromosphere of the sun at the time of total solar eclipse is
- (a) continuous emission spectrum
 - (b) line absorption spectrum

- (c) line emission spectrum
(d) band absorption spectrum
52. **Heavy water is**
(a) water, in which soap does not lather
(b) compound of heavy oxygen and heavy hydrogen
(c) compound of deuterium and oxygen
(d) water at 4°C
53. **The nuclear reactor at Kaiga is a**
(a) breeder reactor (b) power reactor
(c) research reactor (d) fusion reactor
54. **When a body moves in a circular path, no work is done by the force since**
(a) there is no displacement
(b) there is no net force
(c) force and displacement are perpendicular to each other
(d) the force is always away from the centre
55. **A bullet moving with a speed of 100 ms^{-1} can just penetrate two planks of equal thickness. Then, the number of such planks penetrated by the same bullet when the speed is doubled will be**
(a) 4 (b) 8
(c) 6 (d) 10
56. **Two bodies of masses 1 kg and 2 kg have equal momentum. Then, the ratio of their kinetic energies is**
(a) 1: 3 (b) 1: 1
(c) 2: 1 (d) 3: 1
57. **The loudness and pitch of a sound note depends on**
(a) intensity and frequency
(b) frequency and number of harmonics
(c) intensity and velocity
(d) frequency and velocity
58. **Absorption co-efficient of an open window is**
(a) Zero (b) 0.5
(c) 1 (d) 0.25
59. **In Melde's experiment in the transverse mode, the frequency of the tuning fork and the frequency of the waves in the string are in the ratio**
(a) 1: 1 (b) 1: 2
(c) 2 : 1 (d) 4 : 1
60. **The difference between the apparent frequency of a source of sound as perceived by the observer during its approach and recession is 2% of the frequency of the source. If the speed of sound in air is 300 ms^{-1} , then the velocity of the source is**
(a) 6 ms^{-1} (b) 3 ms^{-1}
(c) 15 ms^{-1} (d) 12 ms^{-1}

CHEMISTRY

61. **Ozone in stratosphere is depleted by**
(a) CF_2Cl_2 (b) C_7F_{16}
(c) $\text{C}_6\text{H}_6\text{Cl}_2$ (d) C_6F_6
62. **Which one of the following is an unsaturated fatty acid?**
(a) Palmitic acid (b) Lauric acid
(c) Linolenic acid (d) Myristic acid
63. **When chlorine is passed through boiling toluene, we get**
(a) o-chloro toluene
(b) p-chlorotoluene

- (c)mixture of o and p-chlorotoluene
(d)benzyl chloride
64. The standard temperature used in thermo chemical calculations is
(a)273 K (b)298 K
(c)297 K (d)303 K
65. Which of the following is an intensive property?
(a)Enthalpy (b)Entropy
(c)Density (d)Mass
66. Schiff's reagent contains
(a)rochelle salt (b)resorcinol
(c)rosaniline (d) α -naphthol
67. The formula of chromyl chloride is
(a)CrCl (b)CrCl₃
(c)CrOCl₂ (d)CrO₂Cl₂
68. Horn silver is
(a)oxide ore (b)sulphide ore
(c)halide ore (d)carbonate ore
69. Tetrahedral structure is formed by
(a)sp²-hybridisation (b)sp³-hybridisation
(c)dsp³-hybridisation (d)d²sp³-hybridisation
70. NO⁺ ligand is
(a)nitronium (b)nitrosyl
(c)nitrosonium (d)nitro
71. Cationic complex is
(a)hexa amino platinum chloride
(b)potassium ferro cyanide
(c)sodium argento cyanide
(d)nickel carbonyl
72. 2p_x atomic orbital undergoes linear combination with
(a)2p_y orbital (b)2p_x orbital
(c)Both 2p_y and 2p_z orbitals (d)2p_z orbital
73. In a first order reaction, molar concentration of a reactant decreases from 0.1 to 0.01 in 100 s . The rate constant of the reaction is
(a)2.3030 (b)0.02303
(c)0.2303 (d)0.002303
74. In which one of the following equilibria, pressure has no effect
(a)PCl₅ $\rightleftharpoons$ PCl₃ + Cl₂ (b)2NH₃ $\rightleftharpoons$ N₂ + 3H₂
(c)2SO₂ + O₂ $\rightleftharpoons$ 2SO₃ (d)N₂ + O₂ $\rightleftharpoons$ 2NO
75. Conductivity of a solution is not affected by
(a)addition of water
(b)process of heating
(c)addition of acetic acid
(d)addition of ethanol
76. The lowering in vapour pressure is maximum for
(a)0.1 M urea (b)0.1 M NaCl
(c)0.1MMgCl₂ (d)0.1MK₄[Fe(CN)₆]
77. Bromo ethane and isopropyl chloride with metallic sodium in ether forms
(a)pentane (b)2-methyl butane
(c)3-methyl butane (d)2,3-dimethyl butane

78. To dry ammonia gas the drying agent used is
 (a) conc. H_2SO_4 (b) P_2O_5
 (c) soda lime (d) anhydrous CaCl_2
79. The metal hydroxide which is soluble in excess of ammonium hydroxide is
 (a) $\text{Fe}(\text{OH})_2$ (b) $\text{Fe}(\text{OH})_3$
 (c) $\text{Cu}(\text{OH})_2$ (d) $\text{Al}(\text{OH})_3$
80. Potassium dichromate can be converted to potassium chromate by adding
 (a) KOH (b) conc. H_2SO_4
 (c) NH_4OH (d) acetic acid
81. 0.5 g of an acid is neutralised by 40 cc of 0.125 N NaOH . The equivalent mass of the acid is
 (a) 50 (b) 100
 (c) 40 (d) 80
82. 5 L of NaOH solution of pH 12 contains
 (a) 200 g (b) 0.2 g
 (c) 20 g (d) 2 g
83. 50 cc of oxalic acid is oxidised by 25 cc of 0.20 N KMnO_4 . The mass of oxalic acid present in 500 cc of the solution is
 (a) 3.15 g (b) 31.5 g
 (c) 6.3 g (d) 63 g
84. Pure water is neutral because
 (a) $\text{pH} = 7$
 (b) litmus has no effect
 (c) it is free from dissolved salts
 (d) $\text{pH} = 0$
85. In the titration of Mohr salt against KMnO_4 , the indicator used is
 (a) diphenyl amine (b) KMnO_4
 (c) phenolphthalein (d) methyl orange
86. The relationship between half-life of a reaction and the order of reaction is
 (a) $t_{\frac{1}{2}} \propto \frac{1}{a^{(n+1)}}$ (b) $t_{\frac{1}{2}} \propto \frac{1}{a^{(n+2)}}$
 (c) $t_{\frac{1}{2}} \propto \frac{1}{a^n}$ (d) $t_{\frac{1}{2}} \propto \frac{1}{a^{(n-1)}}$
87. 6 g of urea is dissolved in 90 g of water. Relative lowering of vapour pressure is
 (a) 0.02 (b) 0.2
 (c) 0.002 (d) 0.04
88. 6.84 g of sucrose is dissolved in 200 g of water. The molality of the solution is
 (a) 0.2 M (b) 0.3 M
 (c) 0.1 M (d) 0.02 M
89. When common salt is added to a saturated solution of soap, it is precipitated. This is based on the principle of
 (a) common ion effect
 (b) principle of solubility product
 (c) adsorption from solution
 (d) peptisation
90. Highest osmotic pressure is shown by a solution of
 (a) 0.1 M aluminium sulphate
 (b) 0.1 M potassium nitrate
 (c) 0.1 M magnesium chloride
 (d) 0.1 M barium chloride

91. 50% of first order reaction is completed in 30 min . The velocity constant of the reaction is
 (a)0.231 (b)2.31
 (c)0.00231 (d)0.0231
92. The ebullioscopic constant is the elevation in boiling point produced by
 (a)1 molar solution (b)1 molal solution
 (c)1 N solution (d)10% solution
93. The mass of glucose to be dissolved in 50g of water to get 0.3 molal solution is
 (a)27 g (b)0.27 g
 (c)2.7 g (d)5.4 g
94. 25 mL of 0.08 N Mohr salt solution is oxidised by 20 mL of $K_2Cr_2O_7$ in acid medium. The mass of Mohr's salt present in 500 cc is
 (a)3.96 g (b)15.68 g
 (c)39.6 g (d)39.2 g
95. A reaction is spontaneous at all temperature, when
 (a) ΔH is -ve and ΔS is + ve
 (b) ΔH is + ve and ΔS is - ve
 (c)Both ΔH and ΔS are - ve
 (d)Both ΔH and ΔS are + ve
96. The coordination number of sodium chloride is
 (a)4 (b)8
 (c)6 (d)12
97. Conjugate acid of NH_2^- is
 (a) NH_3 (b) NH_4^+
 (c) N (d) NH_2^+
98. Highest molar conductivity is given by
 (a)0.005 M NaCl (b)0.1 M NaCl
 (c)0.05 M NaCl (d)0.01 M NaCl
99. In the detection of III group basic radicals NH_4OH is added after NH_4Cl to
 (a)increase in the ionisation of NH_4OH
 (b)increase in the ionisation of salt solution
 (c)decrease in the ionisation of salt solution
 (d)decrease in the ionisation of NH_4OH
100. Just before attaining the chemical equilibrium
 (a)rate of forward reaction decreases and rate of backward reaction increases
 (b)rate of forward reaction increases and rate of backward reaction decreases
 (c)no change in the rates of forward and backward reactions.
 (d)rate of forward reaction equals the rate backward reaction.
101. Which one of the following shows highest magnetic moment?
 (a) Fe^{2+} (b) Co^{2+}
 (c) Cr^{3+} (d) Ni^{2+}
102. In 3rd series as we move from scandium to zinc the paramagnetism
 (a)increases
 (b)decreases
 (c)first increases to a maximum and then decreases
 (d)first decreases to a minimum and then increases
103. The number of unpaired electrons in Fe^{3+} is
 (a)2 (b)3
 (c)4 (d)5

104. The IUPAC name of $K_4[Fe(CN)_6]$ is

- (a) potassium ferri cyanide
- (b) potassium ferro cyanide
- (c) potassium hexa cyano ferrate (II)
- (d) potassium hexa cyano ferrate (III)

105. The adsorption of an inert gases on activated charcoal increase with

- (a) decrease of pressure
- (b) increase of temperature
- (c) decrease of atomic mass
- (d) decrease of temperature

106. Electrolysis of brine gives a mixture of

- (a) H_2 , Na, Cl_2
- (b) Cl_2 , H_2 , NaOH
- (c) H_2 , O_2 , NaOH
- (d) O_2 , Cl_2 , NaOH

107. Sucrose is a non-reducing sugar due to

- (a) 1-2 linkage
- (b) 1-4 linkage
- (c) 1-5 linkage
- (d) 1-6 linkage

108. Sulphur containing amino acid is

- (a) alanine
- (b) proline
- (c) tyrosine
- (d) cysteine

109. Lysine is

- (a) neutral amino acid
- (b) acidic amino acid
- (c) basic amino acid
- (d) heterocyclic amino acid

110. In the Molisch reagent, the substance used is

- (a) β -naphthol in alcohol
- (b) α -naphthol in alcohol
- (c) Resorcinol in alcohol
- (d) Resorcinol in water

111. In benzene, each carbon atom undergoes

- (a) sp hybridization
- (b) sp^2 hybridisation
- (c) sp^3 hybridisation
- (d) dsp^2 hybridisation

112. When vapours of isopropyl alcohol is passed over heated copper, we get acetone. It is an example for

- (a) dehydration
- (b) dehalogenation
- (c) dehydrohalogenation
- (d) dehydrogenation

113. The IUPAC name of $CH_3 - \overset{\overset{CH_3}{|}}{N} - CH_3$ is

- (a) trimethyl amine
- (b) 2-methyl ethanamine
- (c) N, N-dimethyl methanamine
- (d) trimethyl ammonia

114. When benzaldehyde is condensed with acetic anhydride in presence of fused sodium acetate, we get

- (a) crotonic acid
- (b) cinnamic acid
- (c) aspartic acid
- (d) salicylic acid

115. When a mixture of calcium benzoate and calcium formate is dry distilled, we get

- (a) formaldehyde
- (b) acetaldehyde
- (c) benzaldehyde
- (d) salicylaldehyde

116. Which one of the following is strongly basic?

- (a) Dimethyl amine (b) Methyl amine
(c) Ammonia (d) Aniline

117. Which one of the following is bi-functional compound?

- (a) Formic acid (b) Acetic acid
(c) Benzoic acid (d) Cinnamic acid

118. When phenol is treated with chloromethane in presence of AlCl_3 we get

- (a) o-cresol
(b) m-cresol
(c) p-cresol
(d) mixture of o and p-cresol

119. In the synthesis of ammonia $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$

- (a) $K_p = K_c RT$ (b) $K_p = K_c$
(c) $K_p = K_c (RT)^{-2}$ (d) $K_p = K_c (RT)^{-1}$

120. When the same amount of electricity is passed through solutions of silver nitrate and copper sulphate, 0.4 g copper is deposited. The amount of silver deposited is

- (a) 1.35 g (b) 2.7 g
(c) 5.1 g (d) 5.4 g

MATHEMATICS

121. A variable line $\frac{x}{a} + \frac{y}{b} = 1$ is such that $a + b = 4$. The locus of the mid-point of the portion of the line intercepted between the axes is

- (a) $x + y = 4$ (b) $x + y = 8$
(c) $x + y = 1$ (d) $x + y = 2$

122. The point $(5, -7)$ lies outside the circle

- (a) $x^2 + y^2 - 8x = 0$
(b) $x^2 + y^2 - 5x + 7y = 0$
(c) $x^2 + y^2 - 5x + 7y - 1 = 0$
(d) $x^2 + y^2 - 8x + 7y - 2 = 0$

123. If the circle $x^2 + y^2 = 9$ and $x^2 + y^2 + 2\alpha x + 2y + 1 = 0$ touch each other internally, then $\alpha =$

- (a) $\pm \frac{4}{3}$ (b) 1
(c) $\frac{4}{3}$ (d) $-\frac{4}{3}$

124. The locus of the mid-points of the line joining the focus and point on the parabola $y^2 = 4ax$ is a parabola with the equation of directrix as

- (a) $x + a = 0$ (b) $2x + a = 0$
(c) $x = 0$ (d) $x = \frac{a}{2}$

125. The tangents drawn at the extremities of a focal chord of the parabola $y^2 = 16x$

- (a) intersect on $x = 0$
(b) intersect on the line $x + 4 = 0$
(c) intersect at an angle of 60°
(d) intersect at an angle of 45°

126. On the set $\mathbb{Z}$, of all integers $*$ is defined by $a * b = a + b - 5$. If $2 * (x * 3) = 5$, then $x =$

- (a) 0 (b) 3
(c) 5 (d) 10

127. Which of the following is false?

- (a) Addition is commutative in $\mathbb{N}$.
(b) Multiplication is associative in $\mathbb{N}$.

(c) If $a * b = a^b$ for all $a, b \in \mathbb{N}$, then $*$ is commutative in $\mathbb{N}$.

(d) Addition is associative in $\mathbb{N}$.

128. If $a\hat{i} = a(\hat{i} + \hat{j}) = a(\hat{i} + \hat{j} + \hat{k}) = 1$, then $a =$

(a) $\hat{i} + \hat{j}$

(b) $\hat{i} - \hat{k}$

(c) $\hat{i}$

(d) $\hat{i} + \hat{j} - \hat{k}$

129. If a and b are unit vectors and $|a + b| = 1$, then $|a - b|$ is equal to

(a) $\sqrt{2}$

(b) 1

(c) $\sqrt{5}$

(d) $\sqrt{3}$

130. The projection of $a = 3\hat{i} - \hat{j} + 5\hat{k}$ on $b = 2\hat{i} + 3\hat{j} + \hat{k}$ is

(a) $\frac{8}{\sqrt{35}}$

(b) $\frac{8}{\sqrt{39}}$

(c) $\frac{8}{\sqrt{14}}$

(d) $\sqrt{14}$

131. If $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = x^3$, then $f^{-1}(8) =$

(a) $\{2\}$

(b) $\{2, 2\omega, 2\omega^2\}$

(c) $\{2, -2\}$

(d) $\{2, 2\}$

132. R is a relation on $\mathbb{N}$ given by $R = \{(x, y) \mid 4x + 3y = 20\}$. Which of the following belongs of R ?

(a) $(-4, 12)$

(b) $(5, 0)$

(c) $(3, 4)$

(d) $(2, 4)$

133. If $\log_{10} 7 = 0.8451$, then the position of the first significant figure of 7^{-20} is

(a) 16

(b) 17

(c) 20

(d) 15

134. $\frac{1}{2 \cdot 5} + \frac{1}{5 \cdot 8} + \frac{1}{8 \cdot 11} + \dots$ upto n terms is equal to

(a) $\frac{n}{4n+6}$

(b) $\frac{1}{4n+4}$

(c) $\frac{n}{6n+4}$

(d) $\frac{n}{3n+7}$

135. The ten's digit in $1! + 4! + 7! + 10! + 12! + 13! + 15! + 16! + 17!$ is divisible by

(a) 4

(b) 3!

(c) 5

(d) 7

136. The equation $\frac{x^2}{2-\lambda} - \frac{y^2}{\lambda-5} - 1 = 0$ represents an ellipse if

(a) $\lambda > 5$

(b) $\lambda < 2$

(c) $2 < \lambda < 5$

(d) $2 > \lambda > 5$

137. The equation to the normal to the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ at $(-4, 0)$ is

(a) $2x - 3y = 1$

(b) $x = 0$

(c) $x = 1$

(d) $y = 0$

138. The converse of the contrapositive of the conditional $p \rightarrow \sim q$ is

(a) $p \rightarrow q$

(b) $\sim p \rightarrow \sim q$

(c) $\sim q \rightarrow p$

(d) $\sim p \rightarrow q$

139. The perimeter of a certain sector of a circle is equal to the length of the arc of the semicircle. Then, the angle at the centre of the sector in radians is

(a) $\pi - 2$

(b) $\pi + 2$

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

(d) $\frac{2\pi}{3}$

140. The value of $\tan 67\frac{1}{2}^\circ + \cot 67\frac{1}{2}^\circ$ is

(a) $\sqrt{2}$

(b) $3\sqrt{2}$

(c) $2\sqrt{2}$

(d) $2 - \sqrt{2}$

141. If e_1 and e_2 are the eccentricities of a hyperbola $3x^2 - 3y^2 = 25$ and its conjugate, then
 (a) $e_1^2 + e_2^2 = 2$ (b) $e_1^2 + e_2^2 = 4$
 (c) $e_1 + e_2 = 4$ (d) $e_1 + e_2 = \sqrt{2}$
142. If p and q are prime numbers satisfying the condition $p^2 - 2q^2 = 1$, then the value of $p^2 + 2q^2$ is
 (a) 5 (b) 15
 (c) 16 (d) 17
143. If $A(\text{adj}A) = 5I$, where I is the identity matrix of order 3, then $|\text{adj}A|$ is equal to
 (a) 125 (b) 25
 (c) 5 (d) 10
144. The number of solutions for the equation $\sin 2x + \cos 4x = 2$ is
 (a) 0 (b) 1
 (c) 2 (d) Infinite
145. $\int e^x \cdot x^5 dx$ is
 (a) $e^x[x^5 + 5x^4 + 20x^3 + 60x^2 + 120x + 120] + C$
 (b) $e^x[x^5 - 5x^4 - 20x^3 - 60x^2 - 120x - 120] + C$
 (c) $e^x[x^5 - 5x^4 + 20x^3 - 60x^2 + 120x - 120] + C$
 (d) $e^x[x^5 + 5x^4 + 20x^3 - 60x^2 - 120x + 120] + C$
146. If $f(x)$ is an even function and $f'(x)$ exists, then $f'(e) + f'(-e)$ is
 (a) > 0 (b) 0
 (c) ≥ 0 (d) < 0
147. If α is a complex number satisfying the equation $\alpha^2 + \alpha + 1 = 0$, then α^{31} is equal to
 (a) α (b) α^2
 (c) 1 (d) i
148. The derivative of $\sin(x^3)$ w.r.t. $\cos(x^3)$ is
 (a) $-\tan(x^3)$ (b) $\tan(x^3)$
 (c) $-\cot(x^3)$ (d) $\cot(x^3)$
149. A unit vector perpendicular to both the vectors $\hat{i} + \hat{j}$ and $\hat{j} + \hat{k}$ is
 (a) $\frac{-\hat{i}-\hat{j}+\hat{k}}{\sqrt{3}}$ (b) $\frac{\hat{i}+\hat{j}-\hat{k}}{3}$
 (c) $\frac{\hat{i}+\hat{j}+\hat{k}}{\sqrt{3}}$ (d) $\frac{\hat{i}-\hat{j}+\hat{k}}{\sqrt{3}}$
150. If $A = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ and $B = \begin{vmatrix} c_1 & c_2 & c_3 \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$ then
 (a) $A = -B$ (b) $A = B$
 (c) $B = 0$ (d) $B = A^2$
151. The locus of a point which moves such that the sum of its distances from two fixed points is a constant is
 (a) a circle (b) a parabola
 (c) an ellipse (d) a hyperbola
152. The centroid of the $\triangle ABC$, where $A \equiv (2, 3)$, $B \equiv (8, 10)$ and $C \equiv (5, 5)$ is
 (a) (5, 6) (b) (6, 5)
 (c) (6, 6) (d) (15, 18)
153. If $3x^2 + xy - y^2 - 3x + 6y + k = 0$ represents a pair of lines, then $k =$
 (a) 0 (b) 9
 (c) 1 (d) -9
154. The equation of the smallest circle passing through the points (2, 2) and (3, 3) is
 (a) $x^2 + y^2 + 5x + 5y + 12 = 0$
 (b) $x^2 + y^2 - 5x - 5y + 12 = 0$

- (c) $x^2 + y^2 + 5x - 5y + 12 = 0$
 (d) $x^2 + y^2 - 5x + 5y - 12 = 0$

155. The characteristic roots of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 0 \\ 4 & 5 & 6 \end{bmatrix}$ are

- (a) 1, 3, 6 (b) 1, 2, 4
 (c) 4, 5, 6 (d) 2, 4, 6

156. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then $A^{-1} =$

- (a) $\frac{-1}{2} \begin{bmatrix} 4 & -2 \\ -3 & 1 \end{bmatrix}$ (b) $\frac{1}{2} \begin{bmatrix} 4 & -2 \\ -3 & 1 \end{bmatrix}$
 (c) $\begin{bmatrix} -2 & 4 \\ 1 & 3 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & 4 \\ 1 & 3 \end{bmatrix}$

157. The set $\{-1, 0, 1\}$ is not a multiplicative group because of the failure of

- (a) Closure law (b) Associative law
 (c) Identity law (d) Inverse law

158. The angle of elevation of the top of a TV tower from three points A, B and C in a straight line through the foot of the tower are $\alpha, 2\alpha$ and 3α respectively. If $AB = a$, then height of the tower is

- (a) $a \tan \alpha$ (b) $a \sin \alpha$
 (c) $a \sin 2\alpha$ (d) $a \sin 3\alpha$

159. The angles A, B and C of a $\triangle ABC$ are in A.P. If $b : c = \sqrt{3} : \sqrt{2}$, then the angle A is

- (a) 30° (b) 15°
 (c) 75° (d) 45°

160. $\sin \left(2 \sin^{-1} \sqrt{\frac{63}{65}} \right)$ is equal to

- (a) $\frac{2\sqrt{126}}{65}$ (b) $\frac{4\sqrt{65}}{65}$
 (c) $\frac{8\sqrt{63}}{65}$ (d) $\frac{\sqrt{63}}{65}$

161. The general solution of $|\sin x| = \cos x$ is (when $n \in \mathbb{Z}$) given by

- (a) $n\pi + \frac{\pi}{4}$ (b) $2n\pi \pm \frac{\pi}{4}$
 (c) $n\pi \pm \frac{\pi}{4}$ (d) $n\pi - \frac{\pi}{4}$

162. The real root of the equation $x^3 - 6x + 9 = 0$ is

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

163. The digit in the unit's place of 5^{834} is

- (a) 0 (b) 1
 (c) 3 (d) 5

164. The remainder when $3^{100} \times 2^{50}$ is divided by 5 is

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

165. $\int \frac{\sin x \cos x}{\sqrt{1 - \sin^4 x}} dx =$

- (a) $\frac{1}{2} \sin^{-1}(\sin^2 x) + C$ (b) $\frac{1}{2} \cos^{-1}(\sin^2 x) + C$
 (c) $\tan^{-1}(\sin^2 x) + C$ (d) $\tan^{-1}(2 \sin x) + C$

166. The value of $\int_{-2}^2 (ax^3 + bx + c) dx$ depends on the

- (a) value of b (b) value of c
 (c) value of a (d) value of a and b

167. The area of the region bounded by $y = 2x - x^2$ and the X-axis is
 (a) $\frac{8}{3}$ sq units (b) $\frac{4}{3}$ sq units
 (c) $\frac{7}{3}$ sq units (d) $\frac{2}{3}$ sq units
168. The differential equation $y \frac{dy}{dx} + x = c$ represents
 (a) a family of hyperbolas.
 (b) a family of circles whose centres are on the Y-axis.
 (c) a family of parabolas.
 (d) a family of circles whose centres are on the X-axis.
169. If $f(x^5) = 5x^3$, then $f'(x) =$
 (a) $\frac{3}{5\sqrt{x^2}}$ (b) $\frac{3}{5\sqrt{x}}$
 (c) $\frac{3}{x}$ (d) $\sqrt[5]{x}$
170. $(x) = 2a - x$ in $-a < x < a = 3x - 2a$ in $a \geq x$. Then which of the following is true?
 (a) $f(x)$ is discontinuous at $x = a$
 (b) $f(x)$ is not differentiable at x
 (c) $f(x)$ is differentiable at all $x \geq a$
 (d) $f(x)$ is continuous at all $x < a$
171. The maximum area of a rectangle that can be inscribed in a circle of radius 2 units is (in square units)
 (a) 4 (b) 8π
 (c) 8 (d) 5
172. If Z is a complex number such that $Z = -\bar{Z}$, then
 (a) Z is purely real.
 (b) Z is purely imaginary.
 (c) Z is any complex number.
 (d) Real part of Z is the same as its imaginary part.
173. The value of $\sum_{k=1}^6 \left[\sin \frac{2K\pi}{7} - i \cos \frac{2K\pi}{7} \right]$ is
 (a) i (b) 0
 (c) $-i$ (d) -1
174. $\lim_{x \rightarrow \infty} x \sin \left(\frac{2}{x} \right)$ is equal to
 (a) ∞ (b) 0
 (c) 2 (d) $\frac{1}{2}$
175. A stone is thrown vertically upwards and the height x ft. reached by the stone in t sec is given by $x = 80t - 16t^2$. The stone reaches the maximum height in
 (a) 2 sec (b) 2.5 sec
 (c) 3 sec (d) 1.5 sec
176. The maximum value of $\frac{\log x}{x}$ in $(2, \infty)$ is
 (a) 1 (b) $\frac{2}{e}$
 (c) e (d) $\frac{1}{e}$
177. If $f(x) = be^{ax} + ae^{bx}$, then $f''(0) =$
 (a) 0 (b) $2ab$
 (c) $ab(a + b)$ (d) ab

178. If $\sqrt{\frac{1+\cos A}{1-\cos A}} = \frac{x}{y}$, then the value of $\tan A =$

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

179. $\int \frac{\sec x}{\sec x + \tan x} dx =$

- (a) $\tan x - \sec x + C$
(b) $\log(1 + \sin x) + C$
(c) $\sec x + \tan x + C$
(d) $\log \sin x + \log \cos x + C$

180. If $\int f(x) dx = g(x)$, then $\int f(x)g(x) dx =$

- (a) $\frac{1}{2} f^2(x)$ (b) $\frac{1}{2} g^2(x)$
(c) $\frac{1}{2} [g'(x)]^2$ (d) $f'(x)g(x)$

