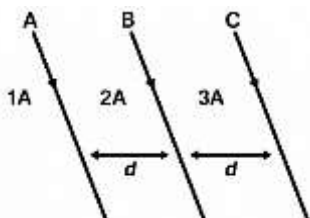


PHYSICS

1. 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) 15 ms^{-1} (b) 12 ms^{-1}
(c) 6 ms^{-1} (d) 3 ms^{-1}

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

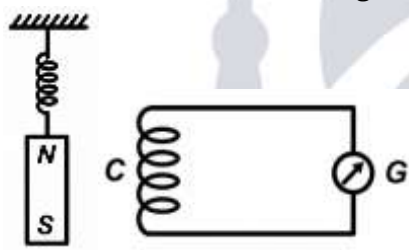


(a) perpendicular to the plane of paper and outward
(b) perpendicular to the plane of paper and inward
(c) towards A
(d) towards C

3. Curie-Weiss law is obeyed by iron

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

4. A magnet N – S is suspended from a spring and when 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 no deflection
(b) G shows deflection to the left and right but the amplitude steadily decreases
(c) G shows deflection to the left and right with constant amplitude
(d) G shows deflection on one side

5. The dimensional formula for inductance is

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

6. 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 Ω) is

(a) 2010 (b) 4050
(c) 5040 (d) 4960

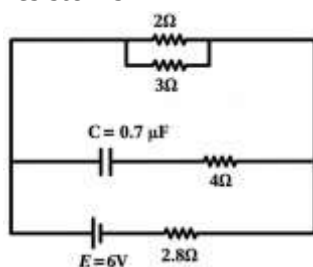
7. The spectrum obtained from the chromosphere of the sun at the time of total solar eclipse is

(a) line emission spectrum
(b) band emission spectrum
(c) continuous emission spectrum
(d) line absorption spectrum

8. Heavy water is

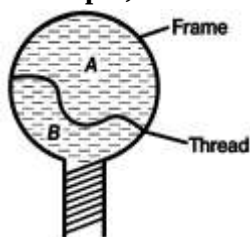
(a) compound of deuterium and oxygen

- (b) water at 4°C
 (c) water, in which soap does not lather
 (d) compound of heavy oxygen and heavy hydrogen
9. The nuclear reactor at Kaiga is a
 (a) research reactor (b) fusion reactor
 (c) breeder reactor (d) power reactor
10. When a body moves in a circular path, no work is done by the force since
 (a) force and displacement are perpendicular to each other
 (b) the force is always away from the centre
 (c) there is no displacement
 (d) there is no net force
11. 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) 6 (b) 10
 (c) 4 (d) 8
12. Two bodies of masses 1 kg and 2 kg have equal momentum, then the ratio of their kinetic energies is
 (a) 2 : 1 (b) 3 : 1
 (c) 1 : 3 (d) 1 : 1
13. Absorption coefficient of an open window is
 (a) 1 (b) 0.25
 (c) zero (d) 0.5
14. The loudness and pitch of a sound note depend on
 (a) intensity and velocity
 (b) frequency and velocity
 (c) intensity and frequency
 (d) frequency and number of harmonics
15. 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) 2 : 1 (b) 4 : 1
 (c) 1 : 1 (d) 1 : 2
16. An electron is accelerated through a potential difference of 45.5 V. The velocity acquired by it is (in ms^{-1})
 (a) 10^6 (b) zero
 (c) 4×10^6 (d) 4×10^4
17. 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 Ω) is
 (a) 20 (b) 10
 (c) 60 (d) 40
18. In the circuit shown, the internal resistance of the cell is negligible. The steady state current in the 2Ω resistor is



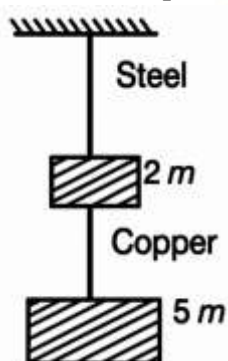
- (a) 0.6 A (b) 1.2 A
 (c) 0.9 A (d) 1.5 A

19. 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 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 V) is
 (a) 300π (b) 3000π
 (c) 3π (d) 30π
20. In an $L - C - R$ 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) 130 V (b) 10 V
 (c) 50 V (d) 70 V
21. 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 $B_H = 0.314 \times 10^{-4} \text{ T}$, the current in the coil is
 (a) 0.5 A (b) 0.25 A
 (c) 2 A (d) 1 A
22. A thread is tied slightly loose to a wire frame as shown 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



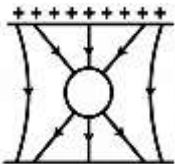
- (a) becomes concave towards A
 (b) becomes convex towards A
 (c) Either (a) or (b) depending on the size of A with respect to B
 (d) remains in the initial position
23. Oxygen is 16 times heavier than hydrogen. Equal volumes of hydrogen and oxygen are mixed. The ratio of speed of sound in the mixture to that in hydrogen is
 (a) $\sqrt{8}$ (b) $\sqrt{2/17}$
 (c) $\sqrt{1/8}$ (d) $\sqrt{32/17}$
24. 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) π (b) zero
 (c) $\pi/3$ (d) $2\pi/3$
25. 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) 680 m (b) 1700 m
 (c) 340 m (d) 1620 m
26. A beam of light of wavelength 600 nm from a 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) 2.4 cm (b) 2.4 mm
 (c) 1.2 mm (d) 1.2 cm
27. The pair of quantities having same dimensions is
 (a) impulse and surface tension
 (b) angular momentum and work

- (c) work and torque
(d) Young's modulus and energy
28. The displacement x (in m) of a particle of mass m (in kg) moving in one dimension under the action of a force, is related to time t (in s) by $t = \sqrt{x} + 3$. The displacement of the particle when its velocity is zero, will be
(a) 4 m (b) 0
(c) 6 m (d) 2 m
29. Vectors A , B and C are such that $A \cdot B = 0$ and $A \cdot C = 0$, then the vector parallel to A is
(a) $A \times B$ (b) $B + C$
(c) $B \times C$ (d) B and C
30. The primary of a transformer when connected to a DC battery of 10 V draws a current of 1 mA. The number of turns of the primary and secondary windings are 50 and 100, respectively. The voltage in the secondary and the current drawn by the circuit in the secondary are respectively
(a) 20 V and 2.0 mA (b) 10 V and 0.5 mA
(c) 0 and 0 (d) 20 V and 0.5 mA
31. One coolie takes 1 min to raise a suitcase through a height of 2 m but the second coolie takes 30 s to raise the same suitcase to the same height. The powers of two coolies are in the ratio.
(a) 1:3 (b) 2:1
(c) 3:1 (d) 1:2
32. An electric dipole of dipole moment p is aligned parallel to a uniform electric field E . The energy required to rotate the dipole by 90° is
(a) $p^2 E$ (b) pE
(c) infinity (d) pE^2
33. A car is moving in a circular horizontal track of radius 10 m with a constant speed of 10 m/s. A bob is suspended from the roof of the car by a light wire of length 1.0 m. The angle made by the wire with the vertical is
(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$
(c) $\frac{\pi}{4}$ (d) 0°
34. The radius of a planet is twice the radius of earth. Both have almost equal average mass-densities. v_p and v_e are escape velocities of the planet and the earth, respectively, then
(a) $v_p = 1.5v_e$ (b) $v_p = 2v_e$
(c) $v_e = 3v_p$ (d) $v_e = 15v_p$
35. If the ratio of diameters, lengths and Young's modulus of steel and copper wires shown in the figure are p , q and s respectively, then the corresponding ratio of increase in their lengths would be

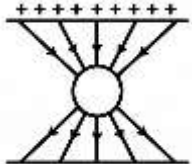


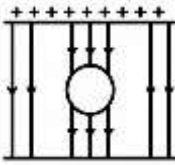
- (a) $\frac{5q}{7sp^2}$ (b) $\frac{7q}{5sp^2}$
(c) $\frac{2q}{5sp}$ (d) $\frac{7q}{5sp}$
36. Which of the following relations does not give the equation of an adiabatic process, where terms have their usual meaning?

- (a) $p^{1-\gamma} T^\gamma = \text{constant}$
 (b) $pV^\gamma = \text{constant}$
 (c) $TV^{\gamma-1} = \text{constant}$
 (d) $p^\gamma T^{1-\gamma} = \text{constant}$
37. A particle of mass m is kept at rest at a height $3R$ from the surface of earth, where R is radius of earth and M is mass of earth. The minimum speed with which it should be projected, so that it does not return back, is (g is acceleration due to gravity on the surface of earth)
- (a) $\left(\frac{GM}{2R}\right)^{1/2}$ (b) $\left(\frac{gR}{4}\right)^{1/2}$
 (c) $\left(\frac{2g}{R}\right)^{1/2}$ (d) $\left(\frac{GM}{R}\right)^{1/2}$
38. H-polaroid is prepared by
- (a) orienting herapathite crystal in the same direction in nitrocellulose
 (b) using thin tourmaline crystals
 (c) stretching polyvinyl alcohol and then heated with dehydrating agent
 (d) stretching polyvinyl alcohol and then impregnating with iodine
39. SI unit of permittivity is
- (a) $C^2 m^2 N^2$ (b) $C^2 m^{-2} N^{-1}$
 (c) $C^2 m^2 N^{-1}$ (d) $C^{-1} m^2 N^{-2}$
40. A spherical drop of capacitance $1\mu F$ is broken into eight drops of equal radius, then the capacitance of each small drop is
- (a) $\frac{1}{2}\mu F$ (b) $\frac{1}{4}\mu F$
 (c) $\frac{1}{8}\mu F$ (d) $8\mu F$
41. 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) $P/2$ (b) $P/4$
 (c) P (d) $2P$
42. 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) 1 W IR lamp (b) 50 W UV lamp
 (c) 50 W IR lamp (d) 10 W IR lamp
43. In Young's double slit experiment, if monochromatic light used is replaced by white light, then
- (a) no fringes are observed
 (b) only central fringe is white, all other fringes are coloured
 (c) all bright fringes become white
 (d) all bright fringes have colours between violet and red
44. Which state of triply ionised Beryllium (Be^{+++}) has the same orbital radius as that of the ground state of hydrogen?
- (a) $n = 3$ (b) $n = 4$
 (c) $n = 1$ (d) $n = 2$
45. If M is the atomic mass and A is the mass number, packing fraction is given by
- (a) $\frac{M}{M-A}$ (b) $\frac{M-A}{A}$
 (c) $\frac{A}{M-A}$ (d) $\frac{A-M}{A}$
46. 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) 80 min (b) 120 min
 (c) 20 min (d) 30 min

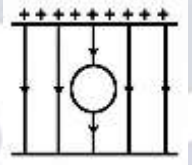
47. Two conductors of the same material have their diameters in the ratio 1: 2 and their lengths in the ratio 2: 1. If the temperature difference between their ends is the same, then the ratio of amounts of heat conducted per second through them will be
 (a) 4: 1 (b) 1: 4
 (c) 8: 1 (d) 1: 8
48. Blowing air with open mouth is an example of
 (a) isobaric process
 (b) isochoric process
 (c) isothermal process
 (d) adiabatic process
49. Sound waves in air are always longitudinal because
 (a) of the inherent characteristics of sound waves in air
 (b) air does not have a modulus of rigidity
 (c) air is a mixture of several gases
 (d) density of air is very small
50. An uncharged sphere of metal is placed inside a charged parallel plate capacitor. The lines of force will look like
- 

(a)

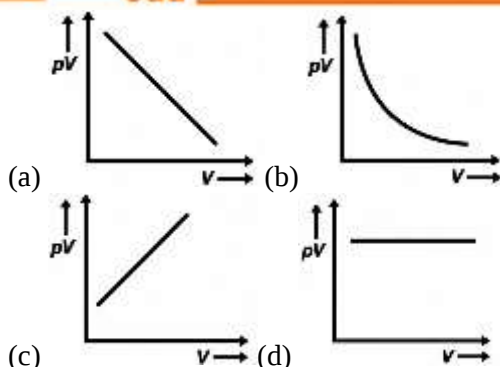


(b)
- 

(c)



(d)
51. 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 East (b) towards West
 (c) towards North (d) towards South
52. A bar magnet is equivalent to
 (a) toroid carrying current
 (b) straight conductor carrying current
 (c) solenoid carrying current
 (d) circular coil carrying current
53. 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) 40.8 eV (b) 27.2 eV
 (c) 54.4 eV (d) 13.6 eV
54. 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) 0.031 (b) 1.60
 (c) 0.0615 (d) 0.024
55. An ideal gas heat engine operates in a Carnot's cycle between 227°C and 127°C. It absorbs 6×10^4 J at high temperature. The amount of heat converted into work is
 (a) 1.6×10^4 J (b) 1.2×10^4 J
 (c) 4.8×10^4 J (d) 3.5×10^4 J
56. Which one of the following graphs represents the behaviour of an ideal gas ?



57. Rainbow is formed due to

- (a) total internal reflection
- (b) scattering
- (c) refraction
- (d) dispersion and total internal reflection

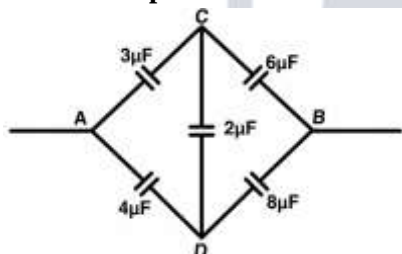
58. A beam of parallel rays is brought to focus by a plano-convex lens. A thin concave lens of the same focal length is joined to the first lens. The effect of this is

- (a) the focus shifts to infinity
- (b) the focal point shifts towards the lens by a small distance
- (c) the focal point shifts away from the lens by a small distance
- (d) the focus remains undisturbed

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

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

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



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

CHEMISTRY

61. A colourless crystalline salt X is soluble in dilute HCl. On adding NaOH solution, it gives a white precipitate which is insoluble in excess of NaOH. X is

- (a) $\text{Al}_2(\text{SO}_4)_3$
- (b) ZnSO_4
- (c) MgSO_4
- (d) SnCl_2

62. Which metal is used to make alloy steel for armour plates, safes and helmets ?

- (a) Al
- (b) Mn
- (c) Cr
- (d) Pb

63. Iodoform test is not answered by

- (a) $\text{C}_2\text{H}_5\text{OH}$
- (b) CH_3OH
- (c) CH_3COCH_3
- (d) $\text{CH}_3-\underset{\text{OH}}{\text{CH}}-\text{CH}_3$

64. A gaseous carbon compound is soluble in dilute HCl. The solution on treating with NaNO_2 gives off nitrogen leaving behind a solution, which smells of wood spirit. The carbon compound is

- (a) HCHO
- (b) CO
- (c) $\text{C}_2\text{H}_5\text{NH}_2$
- (d) CH_3NH_2

65. Which of the following statements is incorrect regarding benzyl chloride?

- (a) It gives white precipitate with alcoholic AgNO_3 .
- (b) It is an aromatic compound with substitution in the side chain.
- (c) It undergoes nucleophilic substitution reaction.
- (d) It is less reactive than vinyl chloride.

66. Enthalpy of formation of HF and HCl are -161 kJ and -92 kJ respectively. Which of the following statements is incorrect?

- (a) HCl is more stable than HF.
- (b) HF and HCl are exothermic compounds.
- (c) The affinity of fluorine to hydrogen is greater than the affinity of chlorine to hydrogen.
- (d) HF is more stable than HCl.

67. Heat liberated with 100 mL of 1 N NaOH is neutralised by 300 mL of 1 N HCl

- (a) 11.56 kJ
- (b) 5.73 kJ
- (c) 22.92 kJ
- (d) 17.19 kJ

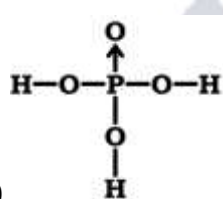
68. For a reaction $\text{A} + \text{B} \rightarrow \text{C} + \text{D}$, if concentration of A is doubled without altering that of B, rate doubles. If concentration of B is increased nine-times without altering that of A, rate triples. Order of the reaction is

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

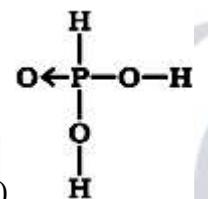
69. In Goldschmidt aluminothermic process, thermite contains

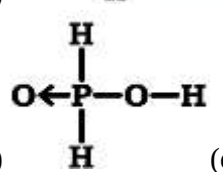
- (a) 3 parts of Al_2O_3 and 4 parts of Al
- (b) 3 parts of Fe_2O_3 and 2 parts of Al
- (c) 3 parts of Fe_2O_3 and 1 part of Al
- (d) 1 part of Fe_2O_3 and 1 part of Al

70. The structure of orthophosphoric acid is

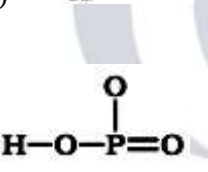
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(a)



(b)
- 

(c)



(d)

71. A galvanic cell is constructed using the redox reaction, $\frac{1}{2}\text{H}_2(\text{g}) + \text{AgCl}(\text{s}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq}) + \text{Ag}(\text{s})$ it is represented as

- (a) $\text{Pt}|\text{H}_2(\text{g})|\text{HCl}(\text{sol})||\text{AgNO}_3(\text{sol})|\text{Ag}$
- (b) $\text{Ag}|\text{AgCl}(\text{s})|\text{KCl}(\text{sol})||\text{HCl}(\text{sol}), \text{H}_2(\text{g})|\text{Pt}$
- (c) $\text{Pt}|\text{H}_2(\text{g})|\text{KCl}(\text{sol})||\text{AgCl}(\text{s})|\text{Ag}$
- (d) $\text{Pt}|\text{H}_2(\text{g}), \text{HCl}(\text{sol})||\text{AgCl}(\text{s})|\text{Ag}$

72. Same amount of electric current is passed through solutions of AgNO_3 and HCl. If 1.08 g of silver is obtained in the first case, the amount of hydrogen liberated at STP in the second case is

- (a) 224 cm^3
- (b) 1.008 g
- (c) 112 cm^3
- (d) 22400 cm^3

73. The flame colours of metal ions are due to

- (a) Frenkel defect
- (b) Schottky defect

- (c) metal deficiency defect
(d) metal excess defect
74. The order of reactivities of methyl halides in the formation of Grignard reagent is
(a) $\text{CH}_3\text{I} > \text{CH}_3\text{Br} > \text{CH}_3\text{Cl}$
(b) $\text{CH}_3\text{Cl} > \text{CH}_3\text{Br} > \text{CH}_3\text{I}$
(c) $\text{CH}_3\text{Br} > \text{CH}_3\text{Cl} > \text{CH}_3\text{I}$
(d) $\text{CH}_3\text{Br} > \text{CH}_3\text{I} > \text{CH}_3\text{Cl}$
75. The reaction of an organic compound with ammonia followed by nitration of the product gives a powerful explosive, called RDX. The organic compound is
(a) phenol (b) toluene
(c) glycerine (d) formaldehyde
76. A signature, written in carbon pencil weighs 1 mg. What is the number of carbon atoms present in the signature?
(a) 5.02×10^{23} (b) 5.02×10^{20}
(c) 6.02×10^{20} (d) 0.502×10^{20}
77. NH_3 and HCl gas are introduced simultaneously from the two ends of a long tube. A white ring of NH_4Cl appears first
(a) nearer to the HCl end
(b) at the centre of the tube
(c) throughout the tube
(d) nearer to the NH_3 end
78. A gas formed by the action of alcoholic KOH on ethyl iodide, decolourises alkaline KMnO_4 . The gas is
(a) C_2H_6 (b) CH_4
(c) C_2H_2 (d) C_2H_4
79. Which of the following is not a characteristic of chemisorption?
(a) ΔH is of the order of 400 kJ
(b) Adsorption is irreversible
(c) Adsorption may be multimolecular layer
(d) Adsorption is specific
80. The concentration of electrolyte required to coagulate a given amount of As_2S_3 sol is minimum in the case of
(a) magnesium nitrate
(b) potassium nitrate
(c) potassium sulphate
(d) aluminium nitrate
81. Identify the organic compound which, on heating with strong solution of NaOH , partly converted into an acid salt and partly into alcohol
(a) benzyl alcohol (b) acetaldehyde
(c) acetone (d) benzaldehyde
82. The process by which synthesis of protein takes place based on the genetic information present in m-RNA is called
(a) translation (b) transcription
(c) replication (d) messenger hypothesis
83. The enthalpies of formation of Al_2O_3 and Cr_2O_3 are -1596 kJ and -1134 kJ respectively. ΔH for the reaction, $2\text{Al} + \text{Cr}_2\text{O}_3 \rightarrow 2\text{Cr} + \text{Al}_2\text{O}_3$ is
(a) -2730 KJ (b) -462 kJ
(c) -1365 kJ (d) +2730 kJ
84. The gaseous reaction $\text{A} + \text{B} \rightleftharpoons 2\text{C} + \text{D} + \text{Q}$ is most favoured at.

- (a) low temperature and high pressure
 (b) high temperature and high pressure
 (c) high temperature and low pressure
 (d) low temperature and low pressure
85. Temperature coefficient of a reaction is 2 . When temperature is increased from 30°C to 100°C, rate of the reaction increases by
 (a) 128 times (b) 100 times
 (c) 500 times (d) 250 times
86. The volume of water to be added to $\frac{N}{2}$ HCl to prepare 500 cm³ of $\frac{N}{10}$ solution is
 (a) 450 cm³ (b) 100 cm³
 (c) 45 cm³ (d) 400 cm³
87. The equivalent weight of a certain trivalent element is 20 . Molecular weight of its oxide is
 (a) 152 (b) 56
 (c) 168 (d) 68
88. Identify the reaction that doesn't take place during the smelting process of copper extraction
 (a) $2\text{FeS} + 3\text{O}_2 \rightarrow 2\text{FeO} + 2\text{SO}_2 \uparrow$
 (b) $\text{Cu}_2\text{O} + \text{FeS} \rightarrow \text{Cu}_2\text{S} + \text{FeO}$
 (c) $2\text{Cu}_2\text{S} + 3\text{O}_2 \rightarrow 2\text{Cu}_2\text{O} + 2\text{SO}_2 \uparrow$
 (d) $\text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3$
89. Pick out the complex compound in which the central metal atom obeys EAN rule strictly.
 (a) $\text{K}_4[\text{Fe}(\text{CN})_6]$ (b) $\text{K}_3[\text{Fe}(\text{CN})_6]$
 (c) $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ (d) $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$
90. In a reversible reaction, the catalyst
 (a) increases the activation energy of the backward reaction
 (b) increases the activation energy of the forward reaction
 (c) decreases the activation energy of both, forward and backward reaction
 (d) decreases the activation energy of forward reaction
91. Solubility product of a salt AB is 1×10^{-8} in a solution in which concentration of A is 10^{-3}M . The salt will precipitate when the concentration of B becomes more than
 (a) 10^{-4}M (b) 10^{-7}M
 (c) 10^{-6}M (d) 10^{-5}M
92. The standard reduction potentials of Zn and Ag in water at 298 K are, $\text{Zn}^{2+} + 2\text{e}^- \rightleftharpoons \text{Zn}$, $E^\circ = -0.76\text{ V}$ and $\text{Ag}^+ + \text{e}^- \rightleftharpoons \text{Ag}$; $E^\circ = +0.80\text{ V}$
 Which of the following reactions take place?
 (a) $\text{Zn}^{2+}(\text{aq}) + 2\text{Ag}(\text{s}) \rightarrow 2\text{Ag}^+(\text{aq}) + \text{Zn}(\text{s})$
 (b) $\text{Zn}(\text{s}) + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Ag}(\text{s})$
 (c) $\text{Zn}^{2+}(\text{aq}) + \text{Ag}^+(\text{aq}) \rightarrow \text{Zn}(\text{s}) + \text{Ag}(\text{s})$
 (d) $\text{Zn}(\text{s}) + \text{Ag}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Ag}^+(\text{aq})$
93. The ratio of cationic radius to anionic radius in an ionic crystal is greater than 0.732 . Its coordination number is
 (a) 6 (b) 8
 (c) 1 (d) 4
94. Dacron is obtained by the condensation polymerisation of
 (a) dimethyl terephthalate and ethylene glycol
 (b) terephthalic acid and formaldehyde
 (c) phenol and phthalic acid
 (d) phenol and formaldehyde

95. 4-chloro-3,5-dimethyl phenol is called
 (a)chloramphenicol (b)paracetamol
 (c)barbital (d)dettol
96. The percentage s-character of the hybrid orbitals in methane, ethene and ethyne are respectively
 (a)25,33,50 (b)25,50,75
 (c)50,75,100 (d)10, 20, 40
97. In the manufacture of sulphuric acid by contact process, Tyndall box is used to
 (a)filter dust particles
 (b)remove impurities
 (c)convert SO_2 to SO_3
 (d)test the presence of dust particles
98. The pH value of gastric juice in human stomach is about 1.8 and in the small intestine it is about 7.8 .The pK_a value of aspirin is 3.5 . Aspirin will be
 (a)completely ionised in the small intestine and in the stomach
 (b)unionised in the small intestine and in the stomach
 (c)ionised in the small intestine and almost unionised in the stomach
 (d)ionised in the stomach and almost unionised in the small intestine
99. The number of α and β -particles emitted during the transformation of ${}_{90}\text{Th}^{232}$ to ${}_{82}\text{Pb}^{208}$ are respectively
 (a)4, 2 (b)2, 2
 (c)8, 6 (d)6, 4
100. When chlorine is passed through warm benzene in presence of the sunlight, the product obtained is
 (a)benzotrichloride (b)chlorobenzene
 (c)gammexane (d)DDT
101. Ethyl benzoate reacts with PCl_5 to give
 (a) $\text{C}_2\text{H}_5\text{Cl} + \text{C}_6\text{H}_5\text{COCl} + \text{POCl}_3 + \text{HCl}$
 (b) $\text{C}_2\text{H}_5\text{Cl} + \text{C}_6\text{H}_5\text{COCl} + \text{POCl}_3$
 (c) $\text{CH}_3\text{COCl} + \text{C}_6\text{H}_5\text{COCl} + \text{POCl}_3$
 (d) $\text{C}_2\text{H}_5\text{Cl} + \text{C}_6\text{H}_5\text{COOH} + \text{POCl}_3$
102. Pick out the statement which is not relevant in the discussion of colloids
 (a)sodium aluminium silicate is used in the softening of hard water.
 (b)potash alum is used in shaving rounds and as a styptic in medicine.
 (c)artificial rain is caused by throwing electrified sand on the clouds from an aeroplane.
 (d)deltas are formed at a place where the river pours its water into the sea.
103. A wooden box excavated from Indus valley had an activity of 1.18×10^{13} disintegration per minute per g of carbon. What is the approximate age of this civilisation?
 (a)4000 years (b)5700 years
 (c)8100 years (d)6000 years
104. For a reaction, if $K_p > K_c$, the forward reaction is favoured by
 (a)low pressure (b)high pressure
 (c)high temperature (d)low temperature
105. In a lime kiln, to get higher yield of CO_2 , the measure that can be taken is
 (a)to remove CaO
 (b)to add more CaCO_3
 (c)to maintain high temperature
 (d)to pump out CO_2
106. What is the volume of ' 20 volume H_2O_2 ' required to get 5000 cm^3 of oxygen at STP?
 (a) 250 cm^3 (b) 50 cm^3
 (c) 100 cm^3 (d) 125 cm^3

107. The IUPAC name of $(\text{CH}_3)_3\text{C} - \text{CH} = \text{CH}_2$ is
 (a) 1, 1, 1-trimethyl-2-propene
 (b) 3, 3, 3-trimethyl-2-propene
 (c) 2, 2-dimethyl-3-butene
 (d) 3, 3-dimethyl-1-butene
108. Railway wagon axles are made by heating iron rods embedded in charcoal powder. This process is known as
 (a) tempering (b) case-hardening
 (c) sherardizing (d) annealing
109. Thomas slag is
 (a) CaSiO_3 (b) $\text{Ca}_3(\text{PO}_4)_2$
 (c) MnSiO_3 (d) CaCO_3
110. Urea is preferred to ammonium sulphate as a nitrogenous fertiliser because
 (a) it is more soluble in water
 (b) it is cheaper than ammonium sulphate
 (c) it is quite stable
 (d) it does not cause acidity in the soil
111. Two gas cylinders having same capacity have been filled with 44g H_2 and 44g of CO_2 respectively. If the pressure in CO_2 cylinder is 1 atmosphere at a particular temperature. The pressure in the hydrogen cylinder at the same temperature is
 (a) 2 atm (b) 1 atm
 (c) 22 atm (d) 44 atm
112. Angular momentum of an electron in the n th orbit of hydrogen atom is given by
 (a) $\frac{nh}{2\pi}$ (b) nh
 (c) $\frac{2\pi}{nh}$ (d) $\frac{\pi}{2nh}$
113. The element with atomic number 36 belongs to.....block in the periodic table.
 (a) p (b) s
 (c) f (d) d
114. The function of AlCl_3 in Friedel-Craft's reaction is
 (a) to absorb HCl
 (b) to absorb water
 (c) to produce nucleophile
 (d) to produce electrophile
115. An important reaction of acetone is auto-condensation in presence of concentrated sulphuric acid to give the aromatic compound____
 (a) mesitylene (b) mesityl oxide
 (c) trioxane (d) phorone
116. Kinetic energy of one mole of an ideal gas at 300 K in kJ is
 (a) 3.74 (b) 348
 (c) 34.8 (d) 3.48
117. The tripeptide hormone present in most living cells is
 (a) glutathione (b) glutamine
 (c) oxytocin (d) ptyalin
118. Phenol $\xrightarrow{\text{NaNO}_2/\text{H}_2\text{SO}_4}$ B $\xrightarrow{\text{H}_2\text{O}}$ C $\xrightarrow{\text{NaOH}}$ D name of the reaction is
 (a) Liebermann's reaction
 (b) Phthalein fusion test
 (c) Reimer-Tiemann reaction
 (d) Schotten-Baumann reaction

119. Energy is stored in our body in the form of

- (a)ATP (b)ADP
(c)fats (d)carbohydrates

120. An organic compound answers Molisch's test as well as Benedict's test, but it does not answer Scliwanoff's test. Most probably, it is

- (a)sucrose (b)protein
(c)fructose (d)maltose

MATHEMATICS

121. $\sim p \wedge q$ is logically equivalent to

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

122. Which of the following is the inverse of the proposition : "If a number is a prime, then it is odd"?

- (a)If a number is not a prime, then it is odd
(b)If a number is not a prime, then it is not odd
(c)If a number is not odd, then it is not a prime
(d)If a number is odd, then it is a prime

123. What must be the matrix X if $2X + \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$?

- (a) $\begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -3 \\ 2 & -1 \end{bmatrix}$
(c) $\begin{bmatrix} 2 & 6 \\ 4 & -2 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & -6 \\ 4 & -2 \end{bmatrix}$

124. The value of $\begin{vmatrix} 1 & 1 & 1 \\ bc & ca & ab \\ b+c & c+a & a+b \end{vmatrix}$ is

- (a)1
(b)0
(c) $(a-b)(b-c)(c-a)$
(d) $(a+b)(b+c)(c+a)$

125. The value of $\begin{vmatrix} 441 & 442 & 443 \\ 445 & 446 & 447 \\ 449 & 450 & 451 \end{vmatrix}$ is

- (a) $441 \times 446 \times 4510$ (b)0
(c)-1 (d)1

126. $(\mathbf{a} \cdot \hat{\mathbf{i}})\hat{\mathbf{i}} + (\mathbf{a} \cdot \hat{\mathbf{j}})\hat{\mathbf{j}} + (\mathbf{a} \cdot \hat{\mathbf{k}})\hat{\mathbf{k}}$ is equal to

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

127. Inverse of the matrix $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ is

- (a) $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ (b) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{bmatrix}$
(c) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ (d) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix}$

128. If $|\mathbf{a}| = 3, |\mathbf{b}| = 4$, then a value of λ for which $\mathbf{a} + \lambda\mathbf{b}$ is perpendicular to $\mathbf{a} - \lambda\mathbf{b}$ is

- (a) $\frac{9}{16}$ (b) $\frac{3}{4}$
(c) $\frac{3}{2}$ (d) $\frac{4}{3}$

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

- (a) $\frac{1}{\sqrt{14}}$ (b) $\frac{2}{\sqrt{14}}$
(c) $\sqrt{14}$ (d) $\frac{-2}{\sqrt{14}}$

130. the group (1, 2, 3, 4, 5, 6) under multiplication $7, 2^{-1} \times 4$ is equal to
 (a)1 (b)4
 (c)2 (d)3
131. The maximum of the function $3\cos x - 4\sin x$ is
 (a)2 (b)3
 (c)4 (d)5
132. If the distance ' S ' metres traversed by a particle in t seconds is given by $S = t^3 - 3t^2$, then the velocity of the particle when the acceleration is zero, in m/sec is
 (a)3 (b)-2
 (c)-3 (d)2
133. For the curve $y^n = a^{n-1}x$ if the subnormal at any point is a constant, then n is equal to
 (a)1 (b)2
 (c)-2 (d)-1
134. If $x = A\cos 4t + B\sin 4t$, then $\frac{d^2x}{dt^2}$ is equal to
 (a)-16x (b)16x
 (c)x (d)-x
135. If tangent to the curve $x = at^2, y = 2at$ is perpendicular to X-axis, then its point of contact is
 (a)(a, a) (b)(0, a)
 (c)(0,0) (d)(a, 0)
136. The general solution of the differential equation $\frac{dy}{dx} + \frac{1+\cos 2y}{1-\cos 2y} = 0$ is given by
 (a) $\tan y + \cot x = c$ (b) $\tan y - \cot x = c$
 (c) $\tan x - \cot y = c$ (d) $\tan x + \cot x = c$
137. The degree of the differential equation $\left(1 + \left(\frac{dy}{dx}\right)^2\right)^{3/4} = \left(\frac{d^2y}{dx^2}\right)^{1/3}$ is
 (a)2 (b)4
 (c)9 (d)1
138. The area enclosed between the curves $y = x^3$ and $y = \sqrt{x}$ is, (in square units)
 (a) $\frac{5}{3}$ (b) $\frac{5}{4}$
 (c) $\frac{5}{12}$ (d) $\frac{12}{5}$
139. $\int_0^{\pi/8} \cos^3 4\theta d\theta$ is equal to
 (a) $\frac{5}{3}$ (b) $\frac{5}{4}$
 (c) $\frac{1}{3}$ (d) $\frac{1}{6}$
140. $\int_0^{\pi/2} \frac{\cos x - \sin x}{1 + \cos x \sin x} dx$ is equal to
 (a)0 (b) $\frac{\pi}{2}$
 (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$
141. If $ax^2 - y^2 + 4x - y = 0$ represents a pair of lines, then a is equal to
 (a)-16 (b)16
 (c)4 (d)-4
142. What is the equation of the locus of a point which moves such that 4 times its distance from the X-axis is the square of its distance from the origin?
 (a) $x^2 + y^2 - 4y = 0$
 (b) $x^2 + y^2 - 4|y| = 0$
 (c) $x^2 + y^2 - 4x = 0$
 (d) $x^2 + y^2 - 4|x| = 0$

143. Equation of the straight line making equal intercepts on the axes and passing through the point (2, 4) is
 (a) $4x - y - 4 = 0$
 (b) $2x + y - 8 = 0$
 (c) $x + y - 6 = 0$
 (d) $x + 2y - 10 = 0$
144. If the area of the triangle with vertices (x, 0), (1, 1) and (0, 2) is 4 sq units, then the value of x is
 (a) -2 (b) -4
 (c) -6 (d) 8
145. $\lim_{\theta \rightarrow \pi/2} \frac{\frac{\pi}{2} - \theta}{\cot \theta} =$
 (a) 0 (b) -1
 (c) 1 (d) ∞
146. The co-axial system of circles given by $x^2 + y^2 + 2gx + c = 0$ for $c < 0$ represents
 (a) intersecting circles
 (b) non-intersecting circles
 (c) touching circles
 (d) touching or non-intersecting circles
147. The radius of the circle passing through the point (6, 2) and two of whose diameters are $x + y = 6$ and $x + 2y = 4$ is
 (a) 4 (b) 6
 (c) 20 (d) $\sqrt{20}$
148. If (0, 6) and (0, 3) are respectively the vertex and focus of a parabola, then its equation is
 (a) $x^2 + 12y = 72$ (b) $x^2 - 12y = 72$
 (c) $y^2 - 12x = 72$ (d) $y^2 + 12x = 72$
149. For the ellipse $25x^2 + 9y^2 - 150x - 90y + 225 = 0$ the eccentricity e is equal to
 (a) $\frac{2}{5}$ (b) $\frac{3}{5}$
 (c) $\frac{4}{5}$ (d) $\frac{1}{5}$
150. If the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide then the value of b^2 is
 (a) 1 (b) 7
 (c) 5 (d) 9
151. The differential coefficient is $f(\sin x)$ with respect to x where $f(x) = \log x$ is
 (a) $\tan x$ (b) $\cot x$
 (c) $f(\cos x)$ (d) $\frac{1}{x}$
152. If $f(x) = \begin{cases} \frac{1 - \cos x}{x} & x \neq 0 \\ k & x = 0 \end{cases}$ is continuous at $x = 0$, then the value of k is
 (a) 0 (b) $\frac{1}{2}$
 (c) $\frac{1}{4}$ (d) $-\frac{1}{2}$
153. If $\omega = \frac{-1 + \sqrt{3}i}{2}$ then $(3 + \omega + 3\omega^2)^4$ is
 (a) 16 (b) -16
 (c) 16ω (d) $16\omega^2$
154. If $y = \tan^{-1}(\sec x - \tan x)$, then $\frac{dy}{dx}$ is equal to
 (a) 2 (b) -2
 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

155. If $x + \frac{1}{x} = 2\cos\alpha$, then $x^n + \frac{1}{x^n}$ is equal to

- (a) $2^n \cos\alpha$ (b) $2^n \cos n\alpha$
(c) $2 \sin n\alpha$ (d) $2 \cos n\alpha$

156. $\int_{-1}^1 |1 - x| dx$ is equal to

- (a) -2 (b) 0
(c) 2 (d) 4

157. $\int \frac{dx}{x(x^7+1)}$ is equal to

- (a) $\log\left(\frac{x^7}{x^7+1}\right) + c$ (b) $\frac{1}{7} \log\left(\frac{x^7}{x^7+1}\right) + c$
(c) $\log\left(\frac{x^7+1}{x^7}\right) + c$ (d) $\frac{1}{7} \log\left(\frac{x^7+1}{x^7}\right) + c$

158. $\int \sqrt{x} e^{\sqrt{x}} dx$ is equal to

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

159. $\int \frac{dx}{x^2+2x+2}$ is equal to

- (a) $\sin^{-1}(x+1) + c$
(b) $\sinh^{-1}(x+1) + c$
(c) $\tanh^{-1}(x+1) + c$
(d) $\tan^{-1}(x+1) + c$

160. If a tangent to the curve $y = 6x - x^2$ is parallel to the line $4x - 2y - 1 = 0$, then the point of tangency on the curve is

- (a) (2,8) (b) (8,2)
(c) (6,1) (d) (4,2)

161. 0.5737373... is equal to

- (a) $\frac{284}{497}$ (b) $\frac{284}{495}$
(c) $\frac{568}{999}$ (d) $\frac{567}{990}$

162. The number of solutions for the equation $x^2 - 5|x| + 6 = 0$ is

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

163. How many numbers of 6 -digits can be formed from the digits of the number 112233 ?

- (a) 30 (b) 60
(c) 90 (d) 120

164. The last digit in 7^{300} is

- (a) 7 (b) 9
(c) 1 (d) 3

165. If $\frac{\log x}{a-b} = \frac{\log y}{b-c} = \frac{\log z}{c-a}$, then xyz is equal to

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

166. The smallest positive integer n for which $(1+i)^{2n} = (1-i)^{2n}$ is

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

167. If $\cos^{-1}p + \cos^{-1}q + \cos^{-1}r = \pi$, then $p^2 + q^2 + r^2 + 2pqr$ is equal to
 (a)3 (b)1
 (c)2 (d)-1
168. If $\sin^{-1}\frac{x}{5} + \operatorname{cosec}^{-1}\frac{5}{4} = \frac{\pi}{2}$, then x is equal to
 (a)1 (b)4
 (c)3 (d)5
169. If $0 \leq x \leq \pi$ and $81^{\sin^2 x} + 81^{\cos^2 x} = 30$, then x is equal to
 (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{2}$
 (c) $\frac{\pi}{4}$ (d) $\frac{3\pi}{4}$
170. The equation of the director circle of the hyperbola $\frac{x^2}{16} - \frac{y^2}{4} = 1$ is given by
 (a) $x^2 + y^2 = 16$ (b) $x^2 + y^2 = 4$
 (c) $x^2 + y^2 = 20$ (d) $x^2 + y^2 = 12$
171. If Q_1 is the set of all relations other than 1 with the binary operation $*$ defined by $a * b = a + b - ab$ for all a, b in Q_1 , then the identity in Q_1 with respect to $*$ is
 (a)1 (b)0
 (c)-1 (d)2
172. The circle $x^2 + y^2 - 8x + 4y + 4 = 0$ touches
 (a)X-axis (b)Y-axis
 (c)both axes (d)neither X-axis nor Y-axis.
173. Which of the following is true ?
 (a)The set of all fourth roots of unity is a multiplicative group
 (b)The set of all cube roots of unity is an additive group
 (c) $(ab)^{-1} = a^{-1}b^{-1}$ for all a, b in any group G
 (d)If $(ab)^2 = a^2b^2$ for all a, b in any group G , then the group G is non-abelian
174. The set of all integral multiples of 5 is a subgroup of
 (a)The set of all rational numbers under multiplication
 (b)The set of all integers under multiplication
 (c)The set of all non-zero rational numbers under multiplication
 (d)The set of all integers under addition
175. The value of k so that $x^2 + y^2 + kx + 4y + 2 = 0$ and $2(x^2 + y^2) - 4x - 3y + k = 0$ cut orthogonally is
 (a) $\frac{10}{3}$ (b) $-\frac{8}{3}$
 (c) $-\frac{10}{3}$ (d) $\frac{8}{3}$
176. $\lim_{x \rightarrow \infty} \left(1 - \frac{4}{x-1}\right)^{3x-1}$ is equal to
 (a) e^{12} (b) e^{-12}
 (c) e^4 (d) e^3
177. If $A + B + C = 180^\circ$, then $\Sigma \tan \frac{A}{2} \tan \frac{B}{2}$ is equal to
 (a)0 (b)1
 (c)2 (d)3
178. In a $\triangle ABC$ if $b = 2, B = 30^\circ$ then the area of the circumcircle of $\triangle ABC$ in square units is
 (a) π (b) 2π
 (c) 4π (d) 6π
179. If $\sin x + \sin^2 x = 1$, then $\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x$ is equal to
 (a)1 (b)2
 (c)3 (d)0

180. If $\mathbb{R}$ denotes the set of all real number, then the function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined $f(x) = |x|$ is
- (a) one-one only
 - (b) onto only
 - (c) both one-one and onto
 - (d) neither one-one nor onto

