

2003

**PHYSICS**

1. Particle of mass  $M$  and charge  $Q$  moving with velocity  $v$  describes a circular path of radius  $R$  when subjected to a uniform transverse magnetic field of induction  $B$ . The work done by the field when the particle completes one full circle is  
(a)  $(Mv^2/R) 2\pi R$  (b) zero  
(c)  $BQ 2\pi R$  (d)  $BQv 2\pi R$
2. A particle of charge  $-16 \times 10^{-18}$  C moving with velocity  $10 \text{ ms}^{-1}$  along the  $x$ -axis enters a region where a magnetic field of induction  $B$  is along the  $y$ -axis and an electric field of magnitude  $10^4$  V/m is along the negative  $z$ -axis. If the charged particle continues moving along the  $x$ -axis, the magnitude of  $B$  is  
(a)  $10^3 \text{ Wb/m}^2$  (b)  $10^5 \text{ Wb/m}^2$   
(c)  $10^{16} \text{ Wb/m}^2$  (d)  $10^{-3} \text{ Wb/m}^2$
3. A thin rectangular magnet suspended freely has a period of oscillation equal to  $T$ . Now, it is broken into two equal halves (each having half of the original length) and one piece is made to oscillate freely in the same field. If its period of oscillation is  $T'$ , the ratio  $T'/T$  is  
(a)  $\frac{1}{2\sqrt{2}}$  (b)  $\frac{1}{2}$   
(c) 2 (d)  $\frac{1}{4}$
4. A magnetic needle lying parallel to a magnetic field requires  $W$  unit of work to turn it through  $60^\circ$ . The torque needed to maintain the needle in this position will be  
(a)  $\sqrt{3}W$  (b)  $W$   
(c)  $(\sqrt{3}/2)W$  (d)  $2W$
5. The magnetic lines of two force inside a bar magnet  
(a) are from north-pole to south-pole of the magnet  
(b) do not exist  
(c) depend upon the area of cross-section of the bar magnet  
(d) are from south-pole to north-pole of the magnet
6. Curie temperature is the temperature above which  
(a) a ferromagnetic material becomes paramagnetic  
(b) a paramagnetic material becomes diamagnetic  
(c) a ferromagnetic material becomes diamagnetic  
(d) a paramagnetic material becomes ferromagnetic
7. A spring balance is attached to the ceiling of a lift. A man hangs his bag on the spring and the spring reads 49 N, when the lift is stationary. If the lift moves downward with an acceleration of  $5 \text{ m/s}^2$ , the reading of the spring balance will be  
(a) 24 N (b) 74 N  
(c) 15 N (d) 49 N



8. The length of a wire of a potentiometer is 100 cm and emf of its stand and cell is  $E$  volt. It is employed to measure the emf of a battery whose internal resistance is  $0.5 \Omega$ . If the balance point is obtained at  $l = 30$  cm from the positive end, the emf of the battery is
- (a)  $\frac{300e}{100.5}$   
 (b)  $\frac{30E}{100-0.5}$   
 (c)  $\frac{30(E-0.5i)}{100}$ , where  $I$  is the current in the potentiometer wire  
 (d)  $\frac{30E}{100}$
9. A strip of copper and another of germanium are cooled from room temperature to 80 K. The resistance of
- (a) each of these decreases  
 (b) copper strip increases and that of germanium decreases  
 (c) copper strip decreases and that of germanium increases  
 (d) each of the above increases
10. Consider telecommunication through optical fibres. Which of the following statements is not true?
- (a) Optical fibres can be of graded refractive index  
 (b) Optical fibres are subjected to electromagnetic interference from outside  
 (c) Optical fibres have extremely low transmission loss  
 (d) Optical fibres may have homogeneous core with suitable cladding
11. The thermo-emf of thermocouple is  $25\mu\text{V}/^\circ\text{C}$  at room temperature. A galvanometer of  $40 \Omega$  resistance, capable of detecting current as low as  $10^{-5}$  A, is connected with the thermocouple. The smallest temperature difference that can be detected by this system is
- (a)  $16^\circ\text{C}$   
 (b)  $12^\circ\text{C}$   
 (c)  $8^\circ\text{C}$   
 (d)  $20^\circ\text{C}$
12. The negative Zn-pole of Daniell cell, sending a constant current through a circuit, decreases in mass by 0.13 g in 30 min. If the electrochemical equivalent of Zn and Cu are 32.5 and 31.5 respectively, the increase in the mass of the positive Cu-pole in this time is
- (a) 0.180 g  
 (b) 0.141 g  
 (c) 0.126 g  
 (d) 0.242 g
13. Dimensions of  $1/\mu_0\epsilon_0$ , where symbols have their usual meaning, are
- (a)  $[\text{L}^{-1}\text{T}]$   
 (b)  $[\text{L}^2\text{T}^2]$   
 (c)  $[\text{L}^2\text{T}^{-2}]$   
 (d)  $[\text{LT}^{-1}]$
14. A circular disc X of radius  $R$  is made from an iron plate of thickness  $t$  and another disc Y of radius  $4R$  is made from an iron plate of thickness  $t/4$ . Then, the relation between the moment of inertia  $I_x$  and  $I_y$  is
- (a)  $I_y = 32I_x$   
 (b)  $I_y = 16I_x$   
 (c)  $I_y = I_x$   
 (d)  $I_y = 64I_x$

15. The time period of a satellite of earth is 5 h. If the separation between the earth and the satellite is increased to 4 times the previous value, the new time period will become
- (a) 10 h (b) 80 h  
(c) 40 h (d) 20 h
16. A particle performing uniform circular motion has angular momentum  $L$ . If its angular frequency is doubled and its kinetic energy halved, then the new angular momentum is
- (a)  $\frac{L}{4}$  (b)  $2L$   
(c)  $4L$  (d)  $\frac{L}{2}$
17. Which of the following radiations has the least wavelength?
- (a)  $\gamma$ -rays (b)  $\beta$ -rays  
(c)  $\alpha$ -rays (d) X-rays
18. When  $U^{238}$  nucleus originally at rest, decays by emitting an alpha particle having a speed  $u$ , the recoil speed of the residual nucleus is
- (a)  $\frac{4u}{238}$  (b)  $-\frac{4u}{234}$   
(c)  $\frac{4u}{234}$  (d)  $-\frac{4u}{238}$
19. Two spherical bodies of mass  $M$  and  $5M$  and radii  $R$  and  $2R$  respectively are released in free space with initial separation between their centres equal to  $12R$ . If they attract each other due to gravitational force only, then the distance covered by the smaller body just before collision is
- (a)  $2.5R$  (b)  $4.5R$   
(c)  $7.5R$  (d)  $1.5R$
20. The difference in the variation of resistance with temperature in a metal and a semiconductor arises essentially due to the difference in the
- (a) crystal structure  
(b) variation of the number of charge carriers with temperature  
(c) type of bonding  
(d) variation of scattering mechanism with temperature
21. A car moving with a speed of 50 km/h, can be stopped by brakes after at least 6 m. If the same car is moving at a speed of 100 km/h, the minimum stopping distance is
- (a) 12 m (b) 18 m  
(c) 24 m (d) 6 m
22. A boy playing on the roof of a 10 m high building throws a ball with a speed of 10 m/s at an angle of  $30^\circ$  with the horizontal. How far from the throwing point will the ball be at the height of 10 m from the ground?
- [ $g = 10 \text{ m/s}^2$ ,  $\sin 30^\circ = 1/2$ ,  $\cos 30^\circ = \sqrt{3}/2$ ]
- (a) 5.20 m (b) 4.33 m  
(c) 2.60 m (d) 8.66 m



23. An ammeter reads upto 1 A. Its internal resistance is  $0.81 \Omega$ . To increase the range to 10 A, the value of the required shunt is  
(a)  $0.03 \Omega$  (b)  $0.3 \Omega$   
(c)  $0.9 \Omega$  (d)  $0.09 \Omega$
24. The physical quantities not having same dimensions are  
(a) torque and work (b) momentum and Planck's constant  
(c) stress and Young's modulus (d) speed and  $(\mu_0 \epsilon_0)^{-1/2}$
25. Three forces start acting simultaneously on a particle moving with velocity  $v$ . These forces are represented in magnitude and direction by the three sides of a  $\Delta ABC$  (as shown). The particle will now move with velocity  
(a) less than  $v$   
(b) greater than  $v$   
(c)  $|v|$  in the direction of largest force BC  
(d)  $v$  remain unchanged
26. If the electric flux entering and leaving an enclosed surface respectively is  $\phi_1$  and  $\phi_2$ , the electric charge inside the surface will be  
(a)  $(\phi_2 - \phi_1) \epsilon_0$  (b)  $(\phi_1 \phi_2) / \epsilon_0$   
(c)  $(\phi_2 - \phi_1) / \epsilon_0$  (d)  $(\phi_1 + \phi_2) \epsilon_0$
27. A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. The weight of the block is  
(a) 20 N (b) 50 N  
(c) 100 N (d) 2 N
28. A marble block of mass 2 kg lying on ice when given a velocity of 6 m/s is stopped by friction in 10 s. Then, the coefficient of friction is  
(a) 0.02 (b) 0.03  
(c) 0.06 (d) 0.01
29. Consider the following two statements  
A. Linear momentum of a system of particles is zero.  
B. Kinetic energy of a system of particles is zero.  
Then,  
(a) A does not imply B and B does not imply A  
(b) A implies B but B does not imply A  
(c) A does not imply B but B implies A  
(d) A implies B and B implies A
30. Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon  
(a) the rates at which currents are changing in the two coils  
(b) relative position and orientation of the two coils  
(c) time for which current is flown  
(d) the currents in the two coils

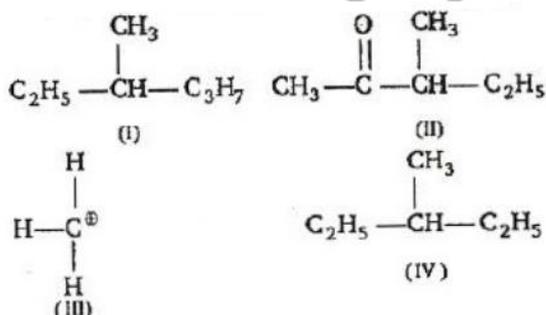


## CHEMISTRY

31. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inner-orbit jumps of the electron for Bohr orbits in an atom of hydrogen?
- (a)  $3 \rightarrow 2$  (b)  $5 \rightarrow 2$   
(c)  $4 \rightarrow 1$  (d)  $2 \rightarrow 5$
32. The de-Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 m/s is approximately
- (a)  $10^{-33}$  m (b)  $10^{-31}$  m  
(c)  $10^{-16}$  m (d)  $10^{-25}$  m
33. The orbital angular momentum for an electron revolving in an orbit is given by  $\sqrt{l(l+1)} \frac{h}{2\pi}$ . This momentum for an s-electron will be given by
- (a)  $+\frac{1}{2} \cdot \frac{h}{2\pi}$  (b) zero  
(c)  $\frac{h}{2\pi}$  (d)  $\sqrt{2} \cdot \frac{h}{2\pi}$
34. How many unit cells are present in a cube shaped ideal crystal of NaCl of mass 1.00 g?
- (a)  $2.57 \times 10^{21}$  (b)  $5.14 \times 10^{21}$   
(c)  $1.28 \times 10^{21}$  (d)  $1.71 \times 10^{21}$
35. Glass is a
- (a) micro-crystalline solid (b) super-cooled liquid  
(c) gel (d) polymeric mixture
36. Which one of the following statements is correct?
- (a) Manganese salts give a violet borax bead test in the reducing flame  
(b) From a mixed precipitate of AgCl and AgI, ammonia solution dissolves only AgCl  
(c) Ferric ions give a deep green precipitate on adding potassium ferrocyanide solution  
(d) On boiling a solution having  $K^+$ ,  $Ca^{2+}$  and  $HCO_3^-$  ions we get a precipitate of  $K_2Ca(CO_3)_2$
37. According to the periodic law of elements, the variation in properties of elements is related to their
- (a) atomic masses (b) nuclear masses  
(c) atomic masses (d) nuclear neutron-proton number ratio
38. Graphite is a soft solid lubricant extremely difficult to melt. The reason for this anomalous behaviour is that graphite
- (a) is a non-crystalline substance  
(b) is an allotropic form of diamond  
(c) has molecules of variable molecular masses like polymers  
(d) has carbon atoms arranged in large plates of rings of strongly bound carbon atoms with weak interplate bonds



39. The IUPAC name of  $\text{CH}_3\text{COCH}(\text{CH}_3)_2$  is  
 (a) isopropylmethyl ketone (b) 2-methyl-3-butanone  
 (c) 4-methyl-sopropyl ketone (d) 3-methyl-2-butanone
40. When  $\text{CH}_2 = \text{CH} - \text{COOH}$  is reduced with  $\text{LiAlH}_4$ , the compound obtained will be  
 (a)  $\text{CH}_3 - \text{CH}_2 - \text{COOH}$  (b)  $\text{CH}_2 = \text{CH} - \text{CH}_2\text{OH}$   
 (c)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2\text{OH}$  (d)  $\text{CH}_3 - \text{CH}_2 - \text{CHO}$
41. According to the kinetic theory of gases, in an ideal gas, between two successive collisions a gas molecule travels  
 (a) in a circular path (b) in a wavy path  
 (c) in a straight line path (d) with an accelerated velocity
42. Which of the following group of transition metals is called coinage metals?  
 (a) Cu, Ag, Au (b) Ru, Rh, Pd  
 (c) Fe, Co, Ni (d) Os, Ir, Pt
43. The general formula  $\text{C}_n\text{H}_{2n}\text{O}_2$  could be for open chain  
 (a) diketones (b) carboxylic acids  
 (c) diols (d) dialdehydes
44. An ether is more volatile than an alcohol having the same molecular formula. This is due to  
 (a) dipolar character of ethers  
 (b) alcohols having resonance structures  
 (c) inter-molecular hydrogen bonding in ethers  
 (d) inter-molecular hydrogen bonding in alcohols
45. Among the following four structures I to IV



It is true that

- (a) all four are chiral compounds  
 (b) only I and II are chiral compounds  
 (c) only III is a chiral compound  
 (d) only II and IV are chiral compounds

46. Which one of the following processes will produce hard water?  
(a) Saturation of water with  $\text{CaCO}_3$       (b) Saturation of water with  $\text{MgCO}_3$   
(c) Saturation of water with  $\text{CaSO}_4$       (d) Addition of  $\text{Na}_2\text{SO}_4$  to water
47. Which one of the following compounds has the smallest bond angle in its molecule?  
(a)  $\text{SO}_2$       (b)  $\text{OH}_2$   
(c)  $\text{SH}_2$       (d)  $\text{NH}_3$
48. Which one of the following pairs of molecules will have permanent dipole moments for both members?  
(a)  $\text{SiF}_4$  and  $\text{NO}_2$       (b)  $\text{NO}_2$  and  $\text{CO}_2$   
(c)  $\text{NO}_2$  and  $\text{O}_3$       (d)  $\text{SiF}_4$  and  $\text{CO}_2$
49. Which one of the following group represents a collection of isoelectronic species? (At. No. Cs-55, Br-35)  
(a)  $\text{Na}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$       (b)  $\text{N}^{3-}$ ,  $\text{F}^-$ ,  $\text{Na}^+$   
(c)  $\text{Be}$ ,  $\text{Al}^{3+}$ ,  $\text{Cl}^-$       (d)  $\text{Ca}^{2+}$ ,  $\text{Cs}^+$ ,  $\text{Br}^-$
50. In the anion  $\text{HCOO}^-$  the two carbon-oxygen bonds are found to be of equal length. What is the reason for it?  
(a) Electronic orbits of carbon atom are hybridised  
(b) The  $\text{C}=\text{O}$  bond is weaker than the  $\text{C}-\text{O}$  bond  
(c) The anion  $\text{HCOO}^-$  has two resonating structures  
(d) The anion is obtained by the removal of a proton from the acid molecule
51. The pair of species having identical shapes for molecules of both species is  
(a)  $\text{CF}_4$ ,  $\text{SF}_4$       (b)  $\text{XeF}_2$ ,  $\text{CO}_2$   
(c)  $\text{BF}_3$ ,  $\text{PCl}_3$       (d)  $\text{PF}_5$ ,  $\text{IF}_5$
52. The atomic numbers of vanadium (V), chromium (Cr), manganese (Mn) and iron (Fe) are respectively 23, 24, 25 and 26. Which one of these may be expected to have the highest second ionisation enthalpy?  
(a) V      (b) Cr  
(c) Mn      (d) Fe
53. Consider the reaction equilibrium,  $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ ;  $\Delta H^\circ = -198 \text{ kJ}$   
On the basis of Le-Chatelier's principle, the condition favourable for the forward reaction is  
(a) lowering of temperature as well as pressure  
(b) increasing temperature as well as pressure  
(c) lowering the temperature and increasing the pressure  
(d) any value of temperature and pressure
54. What volume of hydrogen gas, at 273K and 1 atm pressure will be consumed in obtaining 21.6 g of elemental boron (atomic mass = 10.8) from the reduction of boron trichloride by hydrogen?  
(a) 89.6 L      (b) 67.2 L  
(c) 44.8 L      (d) 22.4 L



55. For the reaction equilibrium,  $N_2O_4(g) \rightleftharpoons 2NO(g)$   
The concentrations of  $N_2O_4$  and  $NO_2$  at equilibrium are  $4.8 \times 10^{-2}$  and  $1.2 \times 10^{-2} \text{ mol L}^{-1}$  respectively. The value of  $K_c$  for the reaction is  
(a)  $3.3 \times 10^2 \text{ mol L}^{-1}$  (b)  $3 \times 10^1 \text{ mol L}^{-1}$   
(c)  $3 \times 10^{-3} \text{ mol L}^{-1}$  (d)  $3 \times 10^3 \text{ mol L}^{-1}$
56. The solubility in water of a sparingly soluble salt  $AB_2$  is  $1.0 \times 10^{-5} \text{ mol L}^{-1}$ . Its solubility product number will be  
(a)  $4 \times 10^{-15}$  (b)  $4 \times 10^{-10}$   
(c)  $1 \times 10^{-15}$  (d)  $1 \times 10^{-10}$
57. When during electrolysis of a solution of  $AgNO_3$ , 9650 coulombs of charge pass through the electroplating bath, the mass of silver deposited on the cathode will be  
(a) 1.08 g (b) 10.8 g  
(c) 21.6 g (d) 108 g
58. For the redox reaction,  
 $Zn(s) + Cu^{2+}(0.1 \text{ M}) \rightarrow Zn^{2+}(1\text{M}) + Cu(s)$   
Taking place in a cell,  $E_{\text{cell}}^0$  is 1.10 volt.  $E_{\text{cell}}$  for the cell will be  $(2.303 \frac{RT}{F} = 0.0591)$   
(a) 2.14 V (b) 1.80 V  
(c) 1.07 V (d) 0.82 V
59. In a 0.2 molal aqueous solution of a weak acid HX, the degree of ionisation is 0.3. Taking  $K_f$  for water as 1.85, the freezing point of the solution will be nearest to  
(a)  $-0.480^\circ\text{C}$  (b)  $-0.360^\circ\text{C}$   
(c)  $-0.260^\circ\text{C}$  (d)  $+0.480^\circ\text{C}$
60. The rate law for a reaction between the substances A and B is given by  $\text{rate} = k[A]^n[B]^m$ . On doubling the concentration of A and having the concentration of B, the ratio of the new rate to the earlier rate of the reaction will be as  
(a)  $1/2^{m+n}$  (b)  $(m + n)$   
(c)  $(n - m)$  (d)  $2^{(n - m)}$



**MATHEMATICS**

61. A function  $f$  from the set of natural numbers to integers defined by  
 (a) one-one but not onto (b) onto but not one-one  
 (c) one-one and onto both (d) neither one-one nor onto
62. Let  $z_1$  and  $z_2$  be two roots of the equation  $z^2 + az + b = 0$ ,  $z$  being complex. Further, assume that the origin,  $z_1$  and  $z_2$  form an equilateral triangle. Then,  
 (a)  $a^2 = b$  (b)  $a^2 = 2b$   
 (c)  $a^2 = 3b$  (d)  $a^2 = 4b$
63. If  $z$  and  $\omega$  are two non-zero complex numbers such that  $|z\omega| = 1$  and  $\arg(z) - \arg(\omega) = \frac{\pi}{2}$ , then  $z'\omega$  is equal to  
 (a) 1 (b) -1  
 (c)  $i$  (d)  $-i$
64. If  $(1+i/1-i)^x = 1$ , then  
 (a)  $x = 4n$ , where  $n$  is any positive integer  
 (b)  $x = 2n$ , where  $n$  is any positive integer  
 (c)  $x = 4n + 1$ , where  $n$  is any positive integer  
 (d)  $x = 2n + 1$ , where  $n$  is any positive integer
65. If  $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^3 \end{vmatrix} = 0$  and vectors  $(1, a, a^2)$ ,  $(1, b, b^2)$  and  $(1, c, c^2)$  are non-coplanar, then the product  $abc$  equals  
 (a) 2 (b) -1  
 (c) 1 (d) 0
66. If the system of linear equations  
 $x + 2ay + az = 0$ ,  
 $x + 3by + bz = 0$   
 and  $x + 4cy + cz = 0$   
 has a non-zero solution, then  $a, b, c$   
 (a) are in AP (b) are in GP  
 (c) are in HP (d) satisfy  $a + 2b + 3c = 0$
67. If the sum of the roots of the quadratic equation  $ax^2 + bx + c = 0$  is equal to the sum of the squares of their reciprocals, then  $\frac{a}{c}, \frac{b}{a}$  and  $\frac{c}{b}$  are in  
 (a) arithmetic progression (b) geometric progression  
 (c) harmonic progression (d) arithmetic-geometric progression
68. The number of the real solutions of the equation  $x^2 - 3|x| + 2 = 0$  is  
 (a) 2 (b) 4  
 (c) 1 (d) 3



69. The value of  $a$  for which one root of the quadratic equation  
 $(a^2 - 5a + 3)x^2 + (3a - 1)x + 2 = 0$   
 is twice as large as the other, is

- (a)  $2/3$  (b)  $-2/3$   
 (c)  $1/3$  (d)  $-1/3$

70. If  $A = \begin{pmatrix} a & b \\ b & a \end{pmatrix}$  and  $A^2 = \begin{pmatrix} \alpha & \beta \\ \beta & \alpha \end{pmatrix}$ , then

- (a)  $\alpha = a^2 + b^2$ ,  $\beta = ab$  (b)  $\alpha = a^2 + b^2$ ,  $\beta = 2ab$   
 (c)  $\alpha = a^2 + b^2$ ,  $\beta = a^2 - b^2$  (d)  $\alpha = 2ab$ ,  $\beta = a^2 + b^2$

71. A student is to answer 10 out of 13 questions in an examination such that he must choose atleast 4 from the first five questions. The number of choices available to him is

- (a) 140 (b) 196  
 (c) 280 (d) 346

72. The number of ways in which 6 men and 5 women can dine at a round table, if no two women are to sit together, is given by

- (a)  $6! \times 5!$  (b) 30  
 (c)  $5! \times 4!$  (d)  $7! \times 5!$

73. If  $1, \omega, \omega^2$  are the cube roots of unity, then

$$\Delta = \begin{vmatrix} 1 & \omega^n & \omega^{2n} \\ \omega^n & \omega^{2n} & 1 \\ \omega^{2n} & 1 & \omega^n \end{vmatrix}$$

is equal to

- (a) 0 (b) 1  
 (c)  $\omega$  (d)  $\omega^2$

74. If  ${}^nC_r$  denotes the number of combinations of  $n$  things taken  $r$  at a time, then the expression  ${}^nC_{r+1} + {}^nC_{r-1} + 2 \times {}^nC_r$  equals

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

75. The number of integral terms in the expansion of  $(x^2 + \frac{1}{x})^{35}$  is

- (a) 32 (b) 33  
 (c) 34 (d) 35

76. If  $X$  is positive, the first negative term in the expansion of  $(1 + X)^{27/5}$  is

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

77. The sum of the series  $\frac{1}{1.2} - \frac{1}{2.3} + \frac{1}{3.4} - \dots$  upto  $\infty$  is equal to  
 (a)  $2 \log_e 2$  (b)  $\log_e 2 - 1$   
 (c)  $\log_e 2$  (d)  $\log_e (4/e)$
78. Let  $f(x)$  be a polynomial function of second degree. If  $f(1) = f(-1)$  and  $a, b, c$  are in AP, then  $f'(a), f'(b)$  and  $f'(c)$  are in  
 (a) AP (b) GP  
 (c) HP (d) arithmetico-geometric progression
79. If  $x_1, x_2, x_3$  and  $y_1, y_2, y_3$  are both in GP with the same common ratio, then the points  $(x_1, y_1), (x_2, y_2)$  and  $(x_3, y_3)$   
 (a) lie on a straight line (b) lie on an ellipse  
 (c) lie on a circle (d) are vertices of a triangle
80. The sum of the radii of inscribed and circumscribed circles for an  $n$  sided regular polygon of side  $a$ , is  
 (a)  $a \cot (\pi/n)$  (b)  $\frac{a}{2} \cot (\pi/2n)$   
 (c)  $a \cot (\pi/2n)$  (d)  $\frac{a}{4} \cot (\pi/2n)$
81. If in a  $\Delta ABC$ ,  $a \cos^2 (C/2) + c \cos^2 (A/2) = \frac{3b}{2}$ ,  
 (a) are in AP (b) are in GP  
 (c) are in HP (d) satisfy  $a + b = c$
82. In a  $\Delta ABC$ , medians  $AD$  and  $BE$  are drawn. If  $AD = 4$ ,  $\angle DAB = \frac{\pi}{6}$  and  $\angle ABE = \frac{\pi}{3}$ , then the area of the  $\Delta ABC$  is  
 (a)  $\frac{8}{3}$  (b)  $\frac{16}{3}$   
 (c)  $\frac{32}{3}$  (d)  $\frac{64}{3}$
83. The trigonometric equation  $\sin^{-1} x = 2 \sin^{-1} a$ , has a solution for  
 (a)  $-\frac{1}{\sqrt{2}} < a < \frac{1}{\sqrt{2}}$  (b) all real values of  $a$   
 (c)  $|a| < \frac{1}{2}$  (d)  $|a| \geq \frac{1}{\sqrt{2}}$
84. The upper  $3/4^{\text{th}}$  portion of a vertical pole subtends an angle  $\tan^{-1} 3/5$  at a point in the horizontal plane through its foot and at a distance 40 m from the foot. A possible height of the vertical pole is  
 (a) 20 m (b) 40 m  
 (c) 60 m (d) 80 m
85. The real number  $x$  when added to its inverse gives the minimum sum at  $x$  equal to  
 (a) 2 (b) 1  
 (c) -1 (d) -2



86. If  $f : \mathbb{R} \rightarrow \mathbb{R}$  satisfies  $f(x + y) = f(x) + f(y)$ , for all  $x, y \in \mathbb{R}$  and  $f(1) = 7$ , then  $f(n)$  is

- (a)  $\frac{7n}{2}$  (b)  $\frac{7(n+1)}{2}$   
(c)  $7n(n+1)$  (d)  $\frac{7n(n+1)}{2}$

87. If  $f(x) = x^n$ , then the value of  $f(1) - \frac{f'(1)}{1!} + \frac{f''(1)}{2!} - \frac{f'''(1)}{3!} + \dots + (-1)^n \frac{f^{(n)}(1)}{n!}$  is

- (a)  $2^n$  (b)  $2^{n-1}$   
(c) 0 (d) 1

88. Domain of definition of the function  $f(x) = \frac{3}{4-x^2} + \log_{10}(x^3 - x)$ , is

- (a) (1, 2) (b) (-1, 0) (1, 2)  
(c) (1, 2) (2,  $\infty$ ) (d) (-1, 0) (1, 2) (2,  $\infty$ )

89.  $[1 - \tan(2/2)][1 - \sin x][1 + \tan(x/2)][\pi - 2x]^3$

- (a)  $\frac{1}{8}$  (b) 0  
(c)  $\frac{1}{32}$  (d)  $\infty$

90. If  $\log \frac{\log(3+x) - \log(3-x)}{x} = k$ , then value of  $k$  is

- (a) 0 (b)  $-1/3$   
(c)  $2/3$  (d)  $-2/3$

