

# BITSAT-PILANI ENGINEERING ENTRANCE

**SOLVED PAPER / 2005**

## Mathematics

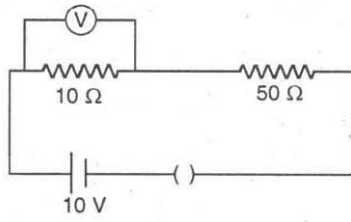
1. The equation of a parabola which passes through the intersection of a straight line  $x + y = 0$  and the circle  $x^2 + y^2 + 4y = 0$  is :  
 (a)  $y^2 = 4x$                       (b)  $y^2 = x$   
 (c)  $y^2 = 2x$                       (d) none of these
2. The point  $(4, -3)$  with respect to the ellipse  $4x^2 + 5y^2 = 1$  is :  
 (a) lies on the curve  
 (b) is inside the curve  
 (c) is outside the curve  
 (d) is focus of the curve
3. If  $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$  and  $\vec{b} = 3\hat{i} - \hat{j} + 2\hat{k}$  then the angle between the vectors  $\vec{a} + \vec{b}$  and  $\vec{a} - \vec{b}$  is:  
 (a)  $60^\circ$                               (b)  $90^\circ$   
 (c)  $45^\circ$                               (d)  $55^\circ$
4. Let  $S$  be a set containing  $n$  elements and we select two subsets  $A$  and  $B$  of  $S$  at random, then the probability that  $A \cup B = S$  and  $A \cap B = \phi$ , is :  
 (a)  $2^n$                                 (b)  $n^2$   
 (c)  $1/n$                                 (d)  $1/2^n$
5. 
$$\begin{vmatrix} 1 + \sin^2 \theta & \sin^2 \theta & \sin^2 \theta \\ \cos^2 \theta & 1 + \cos^2 \theta & \cos^2 \theta \\ 4 \sin 4\theta & 4 \sin 4\theta & 1 + 4 \sin 4\theta \end{vmatrix} = 0,$$
 then  $\sin 4\theta$  equals to :  
 (a)  $1/2$                                 (b)  $1$   
 (c)  $-1/2$                                 (d)  $-1$
6. The value of the constant  $\alpha$  and  $\beta$  such that  $\lim_{x \rightarrow \infty} \left( \frac{x^2 + 1}{x + 1} - \alpha x - \beta \right) = 0$  are respectively :  
 (a)  $(1, 1)$                               (b)  $(-1, 1)$   
 (c)  $(1, -1)$                               (d)  $(0, 1)$
7. Let the homogeneous system of linear equations  $px + y + z = 0$ ,  $x + qy + z = 0$ , and  $x + y + rz = 0$ , where  $p, q, r \neq 1$ , have a non-zero solution, then the value of  $\frac{1}{1-p} + \frac{1}{1-q} + \frac{1}{1-r}$  is :  
 (a)  $-1$                                   (b)  $0$   
 (c)  $2$                                     (d)  $1$
8. A point  $(\alpha, \beta)$  lies on a circle  $x^2 + y^2 = 1$ , then locus of the point  $(3\alpha + 2, \beta)$  is a/an :  
 (a) straight line                      (b) ellipse  
 (c) parabola                            (d) none of these
9. If  $\theta$  is an acute angle and  $\sin \frac{\theta}{2} = \sqrt{\frac{x-1}{2x}}$ , then  $\tan \theta$  is equal to :  
 (a)  $x^2 - 1$                               (b)  $\sqrt{x^2 - 1}$   
 (c)  $\sqrt{x^2 + 1}$                             (d)  $x^2 + 1$
10. The value of 
$$\left[ \int_0^{\sin^2 \theta} \sin^{-1} \sqrt{\phi} d\phi + \int_0^{\cos^2 \theta} \cos^{-1} \sqrt{\phi} d\phi \right]$$
 is equal to :  
 (a)  $\pi$                                     (b)  $\pi/2$   
 (c)  $\pi/3$                                   (d)  $\pi/4$
11.  $\int_0^{2n\pi} \left\{ |\sin x| - \frac{1}{2} \sin x \right\} dx$  equals :  
 (a)  $n$   
 (b)  $2n$   
 (c)  $-2n$   
 (d) none of the above
12. Range of the function  $f(x) = \frac{x^2}{x^2 + 1}$  is :  
 (a)  $(-1, 0)$                               (b)  $(-1, 1)$   
 (c)  $[0, 1]$                                 (d)  $(1, 1)$

13. If  $\sin^{-1}(1-x) - 2\sin^{-1}x = \pi/2$ , then  $x$  is equals :
- (a)  $\{0, -1/2\}$  (b)  $\{1/2, 0\}$   
 (c)  $\{0\}$  (d)  $\{-1, 0\}$
14.  $\sin A, \sin B, \cos A$  are in GP. Roots of  $x^2 + 2x \cot B + 1 = 0$  are always :
- (a) real (b) imaginary  
 (c) greater than 1 (d) equal
15. If  $\int_{\log 2}^x \frac{du}{(e^u - 1)^{1/2}} = \frac{\pi}{6}$ , then  $e^x$  is equal to :
- (a) 1 (b) 2  
 (c) 4 (d) -1
16. Total number of books is  $2n + 1$ . One is allowed to select a minimum of the one book and a maximum of  $n$  books. If total number of selections is 63, then value of  $n$  is :
- (a) 3 (b) 6  
 (c) 2 (d) none of these
17.  $x^2 = xy$  is a relation which is :
- (a) symmetric (b) reflexive  
 (c) transitive (d) none of these
18. Let the determinant of a  $3 \times 3$  matrix  $A$  be 6, then  $B$  is a matrix defined by  $B = 5A^2$ . Then determinant of  $B$  is :
- (a) 180 (b) 100  
 (c) 80 (d) none of these
19. Let  $f(x) = \begin{cases} 1 & \forall x < 0 \\ 1 + \sin x & \forall 0 \leq x \leq \pi/2 \end{cases}$   
 then what is the value of  $f'(x)$  at  $x = 0$  ?
- (a) 1 (b) -1  
 (c)  $\infty$  (d) does not exist
20. The length intercepted by the curve  $y^2 = 4x$  on the line satisfying  $dy/dx = 1$  and passing through point  $(0, 1)$ , is given by:
- (a) 1 (b) 2  
 (c) 0 (d) none of these
21. Area bounded by curve  $y = x^2$  and  $y = 2 - x^2$  is:
- (a)  $8/3$  sq units (b)  $3/8$  sq units  
 (c)  $3/2$  sq units (d) none of these
22.  $\lim_{\theta \rightarrow 0} \frac{4\theta(\tan \theta - 2\theta \tan \theta)}{(1 - \cos 2\theta)}$  is :
- (a)  $1/\sqrt{2}$  (b)  $1/2$   
 (c) 1 (d) 2
23. The largest value of  $2x^3 - 3x^2 - 12x + 5$  for  $-2 \leq x \leq 4$  occurs at  $x$  is equal to :
- (a) -4 (b) 0  
 (c) 1 (d) 4
24. The number of solutions for the equations  $|z-1| = |z-2| = |z-i|$  is :
- (a) one solution (b) 3 solutions  
 (c) 2 solutions (d) no solution
25. Let  $A$  and  $B$  are two events and  $P(A) = 0.3$ ,  $P(B) = 0.4$ ,  $P(A \cap B) = 0.5$  then  $P(A \cup B)$  is:
- (a) 0.5 (b) 0.8  
 (c) 1 (d) 0.1
26.  $(10101101)_2 = (\dots)_{10}$  :
- (a) 137 (b) 173  
 (c) 170 (d) none of these
27. Given function  $f(x) = \left( \frac{e^{2x} - 1}{e^{2x} + 1} \right)$  is :
- (a) increasing (b) decreasing  
 (c) even (d) none of these
28. The solution of  $x^2 + y^2 - 2xy \frac{dy}{dx} = 0$  is :
- (a)  $x^2 - y^2 = cx$  (b)  $x^2 + y^2 = cx$   
 (c)  $2(x^2 - y^2) = cx$  (d) none of these
29.  $f(x) = ax^2 + bx + c$  and  $g(x) = px^2 + qx$  with  $g(1) = f(1)$ ,  $g(2) - f(2) = 1$ ,  $g(3) - f(3) = 4$ , then  $g(4) - f(4)$  is :
- (a) 0 (b) 5  
 (c) 6 (d) none of these
30. If the vectors  $\alpha \hat{i} + \hat{j} + \hat{k}$ ,  $\hat{i} + \beta \hat{j} + \hat{k}$ ,  $\hat{i} + \hat{j} + \lambda \hat{k}$  ( $\alpha, \beta, \gamma \neq 1$ ) are coplanar, then the value of  $\frac{1}{1-\alpha} + \frac{1}{1-\beta} + \frac{1}{1-\gamma}$  is :
- (a) -1 (b) 0  
 (c) 1 (d)  $1/2$
31. The circumcentre of a triangle formed by the line  $xy + 2x + 2y + 4 = 0$  and  $x + y + 2 = 0$  is :
- (a)  $(-1, -1)$  (b)  $(0, -1)$   
 (c)  $(1, 1)$  (d)  $(-1, 0)$
32. The number of common tangents to circle  $x^2 + y^2 + 2x + 8y - 23 = 0$  and  $x^2 + y^2 - 4x - 10y + 9 = 0$ , is :
- (a) 1 (b) 3  
 (c) 2 (d) none of these
33. If  $\frac{x}{\alpha} + \frac{y}{\beta} = 1$  touches the circle  $x^2 + y^2 = a^2$ , then point  $(1/\alpha, 1/\beta)$  lies on a/an:
- (a) straight line (b) circle  
 (c) parabola (d) ellipse

34. The point of intersection of the line  $\frac{x-1}{3} = \frac{y+2}{4} = \frac{z-3}{-2}$  and plane  $2x - y + 3z - 1 = 0$  is :  
 (a) (10, -10, 3) (b) (10, 10, -3)  
 (c) (-10, 10, 3) (d) none of these
35. The tangents from a point  $(2\sqrt{2}, 1)$  to the hyperbola  $16x^2 - 25y^2 = 400$  include an angle equal to :  
 (a)  $\pi/2$  (b)  $\pi/4$   
 (c)  $\pi$  (d)  $\pi/3$
36. Let  $\alpha, \beta, \gamma$  and  $\delta$  are four positive real number such that their product is unity, then the least value of  $(1 + \alpha)(1 + \beta)(1 + \gamma)(1 + \delta)$  is:  
 (a) 6 (b) 16  
 (c) 0 (d) 32
37. Value of  $\sum_{k=1}^6 \left(\frac{2k\pi}{7}\right) - i \cos\left(\frac{2k\pi}{7}\right)$  is equal to:  
 (a) -1 (b) 1  
 (c) 0 (d) none of these
38. The degree of the differential equation  $y(x) = 1 + \frac{dy}{dx} + \frac{1}{1 \cdot 2} \left(\frac{dy}{dx}\right)^2 + \frac{1}{1 \cdot 2 \cdot 3} \left(\frac{dy}{dx}\right)^3 + \dots$  is:  
 (a) 2 (b) 3  
 (c) 1 (d) none of these
39. Let  $P(x_1, y_1)$  and  $Q(x_2, y_2)$  are two points such that their abscissa  $x_1$  and  $x_2$  are the roots of the equation  $x^2 + 2x - 3 = 0$  while the ordinate  $y_1$  and  $y_2$  are the roots of the equation  $y^2 + 4y - 12 = 0$ . The centre of the circle with  $PQ$  as diameter is :  
 (a) (-1, -2) (b) (1, 2)  
 (c) (1, -2) (d) (-1, 2)
40. The equation of plane passing through a point  $A(2, -1, 3)$  and parallel to the vectors  $\vec{a} = (3, 0, -1)$  and  $\vec{b} = (-3, 2, 2)$  is :  
 (a)  $2x - 3y + 6z - 25 = 0$   
 (b)  $2x - 3y + 6z + 25 = 0$   
 (c)  $3x - 2y + 6z - 25 = 0$   
 (d)  $3x - 2y + 6z + 25 = 0$
41. The equation of a straight line drawn through the focus of the parabola  $y^2 = -4x$  at an angle of  $120^\circ$  to the  $x$ -axis is :  
 (a)  $y + \sqrt{3}(x - 1) = 0$   
 (b)  $y - \sqrt{3}(x - 1) = 0$   
 (c)  $y + \sqrt{3}(x + 1) = 0$   
 (d)  $y - \sqrt{3}(x + 1) = 0$
42. Let  $x = \alpha + \beta, y = \alpha\omega + \beta\omega^2, z = \alpha\omega^2 + \beta\omega, \omega$  is an imaginary cube root of unity. Product of  $xyz$  is :  
 (a)  $\alpha^2 + \beta^2$  (b)  $\alpha^2 - \beta^2$   
 (c)  $\alpha^3 + \beta^3$  (d)  $\alpha^3 - \beta^3$
43. If  $r = [2\phi + \cos^2(2\phi + \pi/4)]^{1/2}$ , then what is the value of the derivative of  $dr/d\phi$  at  $\phi = \pi/4$ ?  
 (a)  $2\left(\frac{1}{\pi+1}\right)^{1/2}$  (b)  $2\left(\frac{2}{\pi+1}\right)^2$   
 (c)  $\left(\frac{2}{\pi+1}\right)^{1/2}$  (d)  $2\left(\frac{2}{\pi+1}\right)^{1/2}$
44. If a vector  $\vec{\alpha}$  lie in the plane of  $\vec{\beta}$  and  $\vec{\gamma}$ , then which is correct?  
 (a)  $[\vec{\alpha} \vec{\beta} \vec{\gamma}] = 0$  (b)  $[\vec{\alpha} \vec{\beta} \vec{\gamma}] = 1$   
 (c)  $[\vec{\alpha} \vec{\beta} \vec{\gamma}] = 3$  (d)  $[\vec{\beta} \vec{\gamma} \vec{\alpha}] = 1$
45. If  $\vec{\alpha} = 2\hat{i} + 3\hat{j} - \hat{k}, \vec{\beta} = -\hat{i} + 2\hat{j} - 4\hat{k}, \vec{\gamma} = \hat{i} + \hat{j} + \hat{k}$ , then what is the value of  $(\vec{\alpha} \times \vec{\beta}) \cdot (\vec{\alpha} \times \vec{\gamma})$ ?  
 (a) 47  
 (b) 74  
 (c) -74  
 (d) none of the above

### Physics

46. If  $M$  is the mass of the earth and  $R$  its radius, the ratio of the gravitational acceleration and the gravitational constants is:  
 (a)  $\frac{R^2}{M}$  (b)  $\frac{M}{R^2}$   
 (c)  $MR^2$  (d)  $\frac{M}{R}$
47. A student unable to answer a question on Newton's laws of motion attempts to pull himself up by tugging on his hair. He will not succeed :  
 (a) as the force exerted is small  
 (b) the frictional force while gripping, is small

- (c) Newton's law of inertia is not applicable to living beings  
 (d) as the force applied is internal to the system
48. Which one of the following is not a unit of Young's modulus?  
 (a)  $\text{Nm}^{-1}$   
 (b)  $\text{Nm}^{-2}$   
 (c)  $\text{dyne cm}^{-2}$   
 (d) mega pascal
49. A piece of blue glass heated to a high temperature and a piece of red glass at room temperature, are taken inside a dimly lit room, then:  
 (a) the blue piece will look blue and red will look as usual  
 (b) red looks brighter red and blue looks ordinary blue  
 (c) blue shines like brighter red compared to the red piece  
 (d) both the pieces will look equally red
50. A 5.0 A current is setup in an external circuit by a 6.0 V storage battery for 6.0 min. The chemical energy of the battery is reduced by:  
 (a)  $1.08 \times 10^4 \text{ J}$   
 (b)  $1.08 \times 10^{-4} \text{ J}$   
 (c)  $1.8 \times 10^4 \text{ J}$   
 (d)  $1.8 \times 10^{-4} \text{ J}$
51. The current in a simple series circuit is 5.0 A. When an additional resistance of  $2.0 \Omega$  is inserted, the current drops to 4.0 A. The original resistance of the circuit in ohms was :  
 (a) 1.25                      (b) 8  
 (c) 10                         (d) 20
52. Two resistances are connected in two gaps of a metre bridge. The balance point is 20 cm from the zero end. A resistance of  $15 \Omega$  is connected in series with the smaller of the two. The null point shifts to 40 cm. The value of the smaller resistance in ohms is :  
 (a) 3                            (b) 6  
 (c) 9                            (d) 12
53. By using only two resistance coils-singly, in series or in parallel one should be able to obtain resistances of 3, 4, 12 and  $16 \Omega$ . The separate resistances of the coil are :  
 (a) 3 and 4                    (b) 4 and 12  
 (c) 12 and 16                (d) 16 and 3
54. In the given circuit, the voltmeter records 5 V. The resistance of the voltmeter in ohms is :
- 
- (a) 200                        (b) 100  
 (c) 10                         (d) 50
55. The wavelength of the radiation emitted by a body depends upon :  
 (a) the nature of the surface  
 (b) the area of the surface  
 (c) the temperature of the surface  
 (d) all of the above factors
56. Which mirror is to be used to obtain a parallel beam of light from a small lamp?  
 (a) Plane mirror  
 (b) Convex mirror  
 (c) Concave mirror  
 (d) Any one of the above
57. Which of the following is a wrong statement?  
 (a)  $D = 1/f$  where  $f$  is the focal length and  $D$  is called the refractive power of a lens.  
 (b) Power is expressed in a diopter when  $f$  is in metres  
 (c) Power is expressed in diopter and does not depend on the system of unit used to measure  $f$   
 (d)  $D$  is positive for convergent lens and negative for divergent lens
58. An electric field of  $1500 \text{ V/m}$  and a magnetic field of  $0.40 \text{ Wb/m}^2$  act on a moving electron. The minimum uniform speed along a straight line the electron could have is:  
 (a)  $1.6 \times 10^{15} \text{ m/s}$       (b)  $6 \times 10^{-16} \text{ m/s}$   
 (c)  $3.75 \times 10^3 \text{ m/s}$       (d)  $3.75 \times 10^2 \text{ m/s}$
59. In an ammeter 10% of main current is passing through the galvanometer. If the resistance of the galvanometer is  $G$ , then the shunt resistance, in ohms is:  
 (a)  $9G$                         (b)  $\frac{G}{9}$   
 (c)  $90G$                       (d)  $\frac{G}{90}$

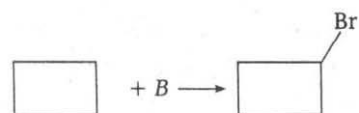
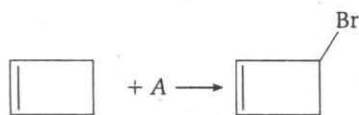
60. Among the following properties describing diamagnetism identify the property that is wrongly stated:
- Diamagnetic material do not have permanent magnetic moment
  - Diamagnetism is explained in terms of electromagnetic induction
  - Diamagnetic materials have a small positive susceptibility
  - The magnetic moment of individual electrons neutralize each other
61. The induction coil works on the principle of :
- self-induction
  - mutual induction
  - Ampere's rule
  - Fleming's right hand rule
62. The square root of the product of inductance and capacitance has the dimension of :
- length
  - mass
  - time
  - no dimension
63. The relationship between the force  $F$  and position  $x$  of a body is as shown in figure. The work done in displacing the body from  $x = 1$  m to  $x = 5$  m will be :
- 
- 30 J
  - 15 J
  - 25 J
  - 20 J
64. From the top of a tower of two stones, whose masses are in the ratio 1 : 2 are thrown on straight up with an initial speed  $u$  and the second straight down with the same speed  $u$ . Then neglecting air resistance:
- the heavier stone hits the ground with a higher speed
  - the lighter stone hits the ground with a higher speed
  - both the stones will have the same speed when they hit the ground
  - the speed cannot be determined with the given data
65. Infrared radiation was discovered in 1800 by :
- William Wollaston
  - William Herschel
  - Wilhelm Roentgen
  - Thomas Young
66. A particle on the trough of a wave at any instant will come to the mean position after a time : ( $T$  = time period)
- $T/2$
  - $T/4$
  - $T$
  - $2T$
67. The disc of a siren containing 60 holes rotates at a constant speed of 360 rpm. The emitted sound is in unison with a tuning fork of frequency :
- 10 Hz
  - 360 Hz
  - 216 Hz
  - 60 Hz
68. The ratio of velocity of sound in hydrogen and oxygen at STP is :
- 16 : 1
  - 8 : 1
  - 4 : 1
  - 2 : 1
69. In an experiment with sonometer a tuning fork of frequency 256 Hz resonates with a length of 25 cm and another tuning fork resonates with a length of 16 cm. Tension of the string remaining constant the frequency of the second tuning fork is :
- 163.84 Hz
  - 400 Hz
  - 320 Hz
  - 204.8 Hz
70. The wave theory of light, in its original form, was first postulated by:
- Isaac Newton
  - Christian Huygens
  - Thomas Young
  - Augustin Jean Fresnel.
71. If a liquid does not wet glass, its angle of contact is :
- zero
  - acute
  - obtuse
  - right angle
72. Electron of mass  $m$  and charge  $q$  is travelling with a speed  $v$  along a circular path of radius  $r$  at right angles to a uniform magnetic field of intensity  $B$ . If the speed of the electron is doubled and the magnetic field is halved the resulting path would have a radius:
- $2r$
  - $4r$
  - $r/4$
  - $r/2$

73. Two coherent light beams of intensity  $I$  and  $4I$  are superposed. The maximum and minimum possible intensities in the resulting beam are :  
 (a)  $9I$  and  $I$  (b)  $9I$  and  $3I$   
 (c)  $5I$  and  $I$  (d)  $5I$  and  $3I$
74. The electron in a hydrogen atom makes a transition from  $n = n_1$  to  $n = n_2$  state. The time period of the electron in the initial state ( $n_1$ ) is eight times that in the final state ( $n_2$ ). The possible values of  $n_1$  and  $n_2$  are :  
 (a)  $n_1 = 8, n_2 = 1$   
 (b)  $n_1 = 4, n_2 = 2$   
 (c)  $n_1 = 2, n_2 = 4$   
 (d)  $n_1 = 1, n_2 = 8$
75. If the forward voltage in a diode is increased, the width of the depletion region :  
 (a) increases  
 (b) decreases  
 (c) fluctuates  
 (d) no change
76. Two nucleons are at a separation of one Fermi. Protons have a charge of  $+1.6 \times 10^{-19}$  C. The net nuclear force between them is  $F_1$ , if both are neutrons,  $F_2$  if both are protons and  $F_3$  if one is proton and the other is neutron. Then :  
 (a)  $F_1 = F_2 > F_3$   
 (b)  $F_1 = F_2 = F_3$   
 (c)  $F_1 < F_2 < F_3$   
 (d)  $F_1 > F_2 > F_3$
77. The potential to which a conductor is raised, depends on :  
 (a) the amount of charge  
 (b) geometry and size of the conductor  
 (c) both (a) and (b)  
 (d) only on (a)
78. The work done in carrying a charge  $q$  once round a circle of radius  $r$  with a charge  $Q$  at the centre is :  
 (a)  $\frac{qQ}{4\pi\epsilon_0 r}$   
 (b)  $\frac{qQ}{4\pi\epsilon_0^2 r^2}$   
 (c)  $\frac{qQ}{4\pi\epsilon_0 r^2}$   
 (d) none of the above
79. An air filled parallel plate condenser has a capacity of 2pF. The separation of the plates is doubled and the interspace between the plates is filled with wax. If the capacity is increased to 6 pF, the dielectric constant of wax is :  
 (a) 2 (b) 3  
 (c) 4 (d) 6
80. The energy that should be added to an electron to reduce its de-Broglie wavelength from 1 nm to 0.5 nm is :  
 (a) four times the initial energy  
 (b) equal to the initial energy  
 (c) twice the initial energy  
 (d) thrice the initial energy
81. Mean life of a radioactive sample is 100 s. Then its half-life (in minutes) is:  
 (a) 0.693 (b) 1  
 (c)  $10^{-4}$  (d) 1.155
82. Consider two nuclei of the same radioactive nuclide. One of the nuclei was created in a supernova explosion 5 billion years ago. The probability of decay during the next time is :  
 (a) different for each nuclei  
 (b) nuclei created in explosion decays first  
 (c) nuclei created in the reactor decays first  
 (d) independent of the time of creation
83. Bohr's atom model assumes :  
 (a) the nucleus is of infinite mass and is at rest  
 (b) electrons in a quantized orbit will not radiate energy  
 (c) mass of electron remains constant  
 (d) all the above conditions
84. Identify the wrong statement in the following. Coulomb's law correctly described the electric force that :  
 (a) binds the electrons of an atom to its nucleus  
 (b) binds the protons and neutrons in the nucleus of an atom  
 (c) binds atoms together to form molecules  
 (d) binds atoms and molecules to form solids
85. When unpolarised light beam is incident from air onto glass ( $n = 1.5$ ) at the polarising angle:  
 (a) reflected beam is polarised 100 percent  
 (b) reflected and refracted beams are partially polarised  
 (c) the reason for (a) is that almost all the light is reflected  
 (d) all of the above

86. Which of the following silver salts is insoluble in water ?

- (a)  $\text{AgClO}_4$  (b)  $\text{Ag}_2\text{SO}_4$   
(c)  $\text{AgF}$  (d)  $\text{AgNO}_3$

87. Suitable reagents A and B for the following reactions are:

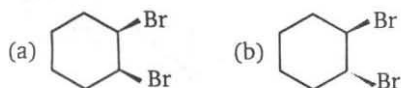


- (a)  $\text{Br}_2, \text{Br}_2$  (b)  $\text{Br}_2, \text{NBS}$   
(c)  $\text{NBS, NBS}$  (d)  $\text{NBS, Br}_2$

88. KF combines with HF to form  $\text{KHF}_2$ . The compound contains the species:

- (a)  $\text{K}^+, \text{F}^-$  and  $\text{H}^+$  (b)  $\text{K}^+, \text{F}^-$  and  $\text{HF}$   
(c)  $\text{K}^+$  and  $[\text{HF}_2]^-$  (d)  $[\text{KHF}]^+$  and  $\text{F}_2$

89.  $\text{Cyclohexene} + \text{Br}_2 \rightarrow A$ , A will have configuration :



- (c) both (a) and (b) (d) none of these

90. Among the following sets of quantum numbers. Which one is incorrect for 4d electron ?

- (a) 4, 3, 2,  $+\frac{1}{2}$  (b) 4, 2, 1, 0  
(c) 4, 2, -2,  $+\frac{1}{2}$  (d) 4, 2, 1,  $-\frac{1}{2}$

91. Raffinose is :

- (a) trisaccharide  
(b) monosaccharide  
(c) disaccharide  
(d) none of the above

92. The molecular electronic configuration of  $\text{Be}_2$  is :

- (a)  $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2p^2$   
(b)  $KK\sigma 2s^2$   
(c)  $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2$   
(d) none of the above

93. Which of the following is deliquescent ?

- (a)  $\text{ZnCl}_2$  (b)  $\text{Hg}_2\text{Cl}_2$   
(c)  $\text{HgCl}_2$  (d)  $\text{CdCl}_2$

94. The velocity of electron in first orbit of H-atom as compared to the velocity of light is :

- (a)  $\frac{1}{10}$ th (b)  $\frac{1}{100}$ th  
(c)  $\frac{1}{1000}$ th (d) same

95.  $\text{trans-2-butene} \xrightarrow[\text{H}_2\text{O}_2]{\text{OsO}_4} A$ , A is :

- (a) meso diol  
(b) racemic diol  
(c) both (a) and (b)  
(d) none of the above

96. In which of the following reactions is  $K_p < K_c$ ?

- (a)  $\text{I}_2(\text{g}) \rightleftharpoons 2\text{I}(\text{g})$   
(b)  $2\text{BrCl}(\text{g}) \rightleftharpoons \text{Cl}_2(\text{g}) + \text{Br}_2(\text{g})$   
(c)  $\text{CO}(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons \text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g})$   
(d) All of the above

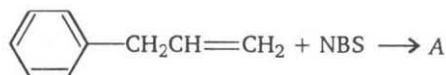
97. For the reaction (at 1240 K and 1 atm.)



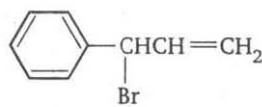
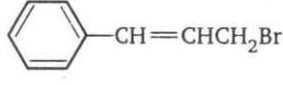
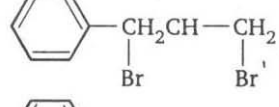
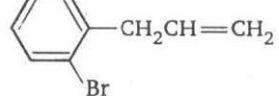
$\Delta H = 176 \text{ kJ/mol}$ ;  $\Delta E$  will be :





- (a) 160 kJ (b) 165.6 kJ  
(c) 186.4 kJ (d) 180 kJ

98. Following compound is treated with NBS



Compound formed A is :

- (a)   
(b)   
(c)   
(d) 

99. The standard reduction potential of the reaction,  $\text{H}_2\text{O} + e^- \longrightarrow \frac{1}{2} \text{H}_2 + \text{OH}^-$  at 298 K is:
- (a)  $E^\circ = \frac{RT}{F} \ln K_w$   
 (b)  $E^\circ = -\frac{RT}{F} \ln [P_{\text{H}_2}]^{1/2} [\text{OH}^-]$   
 (c)  $E^\circ = -\frac{RT}{F} \ln \frac{[P_{\text{H}_2}]^{1/2}}{[\text{H}^+]}$   
 (d)  $E^\circ = -\frac{RT}{F} \ln K_w$
100. Glycerol is oxidised by bismuth nitrate to produce:
- (a) oxalic acid (b) meso-oxalic acid  
 (c) glyceric acid (d) glyoxalic acid
101. Unit of frequency factor ( $A$ ) is :
- (a) mol/L  
 (b) mol/L  $\times$  s  
 (c) depends upon order  
 (d) it does not have any unit
102. The change in pressure will not affect the equilibrium constant for :
- (a)  $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$   
 (b)  $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$   
 (c)  $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$   
 (d) all of the above
103. The volume strength of 1.5 N  $\text{H}_2\text{O}_2$  solution is :
- (a) 4.8 (b) 8.4  
 (c) 4.2 (d) 2.4
104. Bicyclo (1, 1, 0) butane is :
- (a)  (b)   
 (c)  (d) 
105. How many hydrogen bonds are present between pair of thymine and adenine in DNA?
- (a) 1-hydrogen bond  
 (b) 2-hydrogen bonds  
 (c) 3-hydrogen bonds  
 (d) No bonds occur
106. Graham's law deals with the relation between :
- (a) pressure and volume  
 (b) density and rate of diffusion  
 (c) rate of diffusion and volume  
 (d) rate of diffusion and viscosity
107. The rms speed of hydrogen is  $\sqrt{7}$  times the rms speed of nitrogen. If  $T$  is the temperature of the gas, then:
- (a)  $T_{\text{H}_2} = T_{\text{N}_2}$  (b)  $T_{\text{H}_2} > T_{\text{N}_2}$   
 (c)  $T_{\text{H}_2} < T_{\text{N}_2}$  (d)  $T_{\text{H}_2} = \sqrt{7} T_{\text{N}_2}$
108. In  $\text{P}_4\text{O}_{10}$ , the :
- (a) second bond in  $\text{P}=\text{O}$  is formed by  $p\pi-d\pi$  back bonding  
 (b)  $\text{P}=\text{O}$  bond is formed by  $p\pi-p\pi$  bonding  
 (c)  $\text{P}=\text{O}$  bond is formed by  $d\pi-d\pi$  bonding  
 (d)  $\text{P}=\text{O}$  bond is formed by  $d\pi-d\pi-3\sigma$  back bonding
109. Grignard reagent reacts with HCHO to produce:
- (a) secondary alcohol  
 (b) anhydride  
 (c) acid  
 (d) primary alcohol
110. Dacron is polymer of :
- (a) glycol and formaldehyde  
 (b) glycol and phenol  
 (c) glycol and phthalic acid  
 (d) glycol and terephthalic acid
111. The product obtained by heating diethyl ether with HI is :
- (a)  $\text{C}_2\text{H}_5\text{I}$   
 (b)  $\text{C}_2\text{H}_5\text{OH}$   
 (c)  $\text{C}_2\text{H}_5\text{OH} + \text{C}_2\text{H}_5\text{I}$   
 (d)  $\text{C}_2\text{H}_5-\text{C}_2\text{H}_5$
112. For the gaseous reaction involving the complete combustion of isobutane:
- (a)  $\Delta H = \Delta E$  (b)  $\Delta H > \Delta E$   
 (c)  $\Delta H < \Delta E$  (d) none of these
113. Natural rubber is a polymer of :
- (a) styrene (b) isoprene  
 (c) ethylene (d) butadiene
114. Charles' law is represented mathematically as :
- (a)  $V_t = KV_0 t$  (b)  $V_t = \frac{KV_0}{t}$   
 (c)  $V_t = V_0 \left(1 + \frac{273}{t}\right)$  (d)  $V_t = V_0 \left(1 + \frac{t}{273}\right)$
115. Cyanohydrin of which of the following forms lactic acid:
- (a) HCHO (b)  $\text{CH}_3\text{CHO}$   
 (c)  $\text{CH}_3\text{CH}_2\text{CHO}$  (d)  $\text{CH}_3\text{COCH}_3$
116. Dinitrogen pentoxide ( $\text{N}_2\text{O}_5$ ), a colourless solid, is prepared by :
- (a) heating  $\text{NH}_4\text{NO}_2$  with an excess of oxygen  
 (b) dehydrating  $\text{HNO}_3$  with CaO  
 (c) dehydrating  $\text{HNO}_3$  with  $\text{P}_4\text{O}_{10}$   
 (d) heating a mixture of  $\text{HNO}_2$  and  $\text{Ca}(\text{NO}_3)_2$



117. Which gas has the highest partial pressure in atmosphere?  
 (a)  $\text{CO}_2$  (b)  $\text{H}_2\text{O}$   
 (c)  $\text{O}_2$  (d)  $\text{N}_2$
118. Acetone and acetaldehyde can be distinguished by :  
 (a) Molisch test (b) Tollen's test  
 (c) Schiff's test (d) Iodoform test
119. Incorrect statement for pyrophosphorus acid  $\text{H}_4\text{P}_2\text{O}_5$  is :  
 (a) contains P in +5 oxidation state  
 (b) it is dibasic acid  
 (c) it is strongly reducing in nature  
 (d) it contains one P—O—P bond
120. Which of the following compounds is not an "interseudohalogen"?  
 (a)  $\text{Cl}_2\text{N}_3$  (b)  $\text{BrCN}$   
 (c)  $\text{ClCN}$  (d)  $\text{ICN}$
121. The oxidation number of oxygen in hydrogen peroxide is :  
 (a) +1 (b) -1  
 (c) +2 (d) -2
122. Isopropyl bromide on Wurtz reaction gives:  
 (a) hexane  
 (b) propane  
 (c) 2, 3-dimethyl butane  
 (d) neo-hexane
123. Tetraethyl lead is a:  
 (a) solvent (b) petroleum additive  
 (c) oxidising agent (d) fire extinguisher
124. Solvay process is used for the manufacture of :  
 (a)  $\text{NaOH}$  (b)  $\text{Na}_2\text{CO}_3$   
 (c)  $\text{NH}_3$  (d)  $\text{NaCl}$
125. Milk of magnesia is used as:  
 (a) antichlor (b) antacid  
 (c) antiseptic (d) food preservative

## English

**Directions :** Choose the correct meanings of Phrases/Idioms, out of the four responses given under each.

126. To meet one's Waterloo :  
 (a) To meet a strong adversary  
 (b) To meet with humiliation  
 (c) To die fighting  
 (d) To meet one's final defeat
127. Through thick and thin :  
 (a) Big and small  
 (b) Large object  
 (c) Under all conditions  
 (d) Thin and fat
128. An axe to grind :  
 (a) Difficult job  
 (b) Hard labour  
 (c) Private ends to serve  
 (d) Punishment
129. His wit's end :  
 (a) Finished  
 (b) Confused  
 (c) Comedy  
 (d) Very intelligent
130. It is not advisable to take heavy luggages while on journey these days.  
 (a) (b)  
 (c) No error. (d)
131. Mr. Bose accompanied by his wife and children were present there.  
 (a) (b)  
 (c) No error. (d)
132. You must pay respect to those who has respect for you.  
 (a) (b)  
 (c) No error. (d)

**Directions :** Choose the word that is most nearly opposite in meaning to the word given in capital letters at the question place.

133. DREARY :  
 (a) Drab (b) Dangerous  
 (c) Beautiful (d) Bright
134. GREGARIOUS:  
 (a) Antisocial  
 (b) Horrendous  
 (c) Similar  
 (d) Glorious

**Directions :** Find out the part which contains an error in the following sentences. If there is no error, the answer is (d).

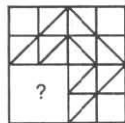
135. MISERLY:  
 (a) Charitable (b) Spendthrift  
 (c) Liberal (d) Generous  
**Directions :** Choose the word that is most nearly the same in meaning to the word given in capital letters at the question place.
136. DILIGENT:  
 (a) Industrious (b) Energetic  
 (c) Modest (d) Intelligent
137. RENOUNCE:  
 (a) Reform (b) Revoke  
 (c) Retain (d) Resign
138. PROLIFIC:  
 (a) Plenty (b) Competent  
 (c) Predominant (d) Fertile

**Directions :** In each of the following questions four parts of a sentence are given as P, Q, R and S. Put them in proper order to produce the correct sentence.

139. P: I decided to call on him  
 Q : at the earliest opportunity  
 R : having heard of the palmist  
 S : before I came into town  
 (a) RSPQ (b) PQRS  
 (c) SQPR (d) QPRS
140. P : when a chemical substance  
 Q : the food poisoning occurred  
 R : in the food preparations  
 S : was mistaken for salt and used  
 (a) RQPS (b) SRQP  
 (c) QPSR (d) PSRQ

## Reasoning

141. Victory is related to *Happiness* in the same way as *Failure* is related to :  
 (a) Defeat (b) Anger  
 (c) Frustration (d) Sadness
142. In the following question, four groups of letters are given. Three of them are alike in a certain way while one is different. Select the one which is different.  
 (a) RSXY (b) NOUV  
 (c) MNST (d) DEJK
143. Complete the pattern in fig (x) by selecting one of the figures from the four alternatives:



(X)

- (a) (b)
- (c) (d)

144. In the following question, a statement/ group of statements is given followed by some conclusions. Choose the conclusion which logically follows from the given statement.

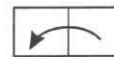
### Statements :

- Only students can participate in the race.
- Some participants in the race are females.
- All female participants in the race are invited for coaching.

### Conclusions :

- All participants in the race are invited for coaching.
- All participants in the race are males.
- All students are invited for coaching.
- All participants in the race are students.

145. Consider the figures X and Y showing a rectangular sheet of paper folded in fig. X and punched in fig. Y. From amongst the answer figures a, b, c and d, select the figure, which will most closely resemble the unfolded position of fig. Y.



(X)

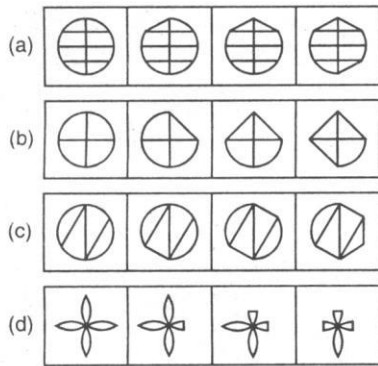


(A)

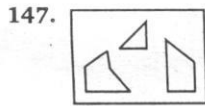
- (a) (b) (c) (d)

146. Which one of the given sets of figures follows the following rule.

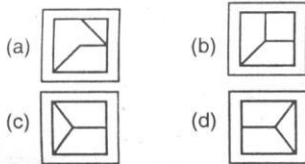
**Rule :** "Sectors get converted to triangles one by one".



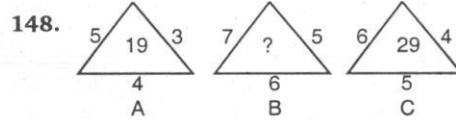
**Direction :** In the following question find out which of the figures (a), (b), (c) and (d) can be formed from the pieces given in (X).



(X)



**Direction :** Find the missing character from among the given alternatives.



- (a) 25 (b) 37  
(c) 41 (d) 47

149. What terms will fill the blank spaces?

Z, X, V, T, R, (...), (...)

- (a) O, K (b) N, M  
(c) K, S (d) P, N

**Direction :** In the following question, choose the set of figures which follows the given rule.

150. **Rule :** Closed figures become more and more open and open figures become more and more closed.

