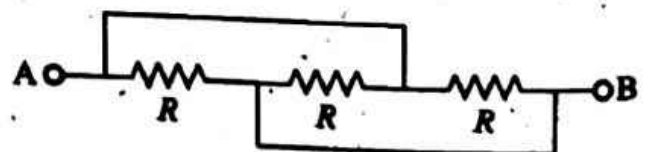


# QUESTIONS & ANSWERS (2017)

## PHYSICS

- Given that  $M$  is the mass suspended from a spring of force constant  $k$ . The dimensional formula for  $\sqrt{\frac{M}{k}}$  is same for that of
  - frequency
  - time period
  - velocity
  - wave length
- The side of a cubical block when measured with a vernier caliper is 2.50 cm. The vernier constant is 0.01 cm. The maximum possible error in the area of the side of the block is :
  - $\pm 0.01 \text{ cm}^2$
  - $\pm 0.02 \text{ cm}^2$
  - $\pm 0.05 \text{ cm}^2$
  - $\pm 0.10 \text{ cm}^2$
- The time ( $t$ ) and displacement ( $x$ ) are related as :  $t = ax^2 + bx$ . What is the acceleration of the particle at the origin of the coordinate axes ?
  - $-2ab^3$
  - $-2ab$
  - $-\frac{2a}{b^3}$
  - $-\frac{2a}{b}$
- Consider three vectors  $\vec{A} = \hat{i} + \hat{j} - 2\hat{k}$ ,  $\vec{B} = \hat{i} - \hat{j} + \hat{k}$  and  $\vec{C} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ . A vector  $\vec{X}$  of the form  $\alpha\vec{A} + \beta\vec{B}$  (where  $\alpha$  and  $\beta$  are numbers) is perpendicular to  $\vec{C}$ . The ratio of  $\alpha$  and  $\beta$  is
  - 1 : 1
  - 2 : 1
  - 1 : 1
  - 3 : 1
- A particle located at  $x = 0$  at a time  $t = 0$ , starts moving along the positive X-direction with a velocity  $v$  that varies as  $v = \alpha\sqrt{x}$ . The displacement of the particle varies with time as
  - $t$
  - $t^{1/2}$
  - $t^3$
  - $t^2$
- In the stable equilibrium position, a body has
  - maximum potential energy
  - minimum potential energy
  - minimum kinetic energy
  - neither maximum nor minimum potential energy
- A constant torque acting on a uniform circular wheel changes its angular momentum from  $L$  to  $4L$  in 4 second. The magnitude of this torque will be
  - $L$
  - $4L$
  - $\frac{3L}{4}$
  - $12L$
- For a given material the Young's modulus is 2.4 times that of rigidity modulus. Its Poisson's ratio is
  - 2.4
  - 1.2
  - 0.4
  - 0.2
- The range of a projection is maximum. If the range is  $R$ , what is the maximum height ?
  - $2R$
  - $R$
  - $\frac{R}{2}$
  - $\frac{R}{4}$
- The instantaneous height  $y$  and the horizontal distance  $x$  covered by a particle are as follows  $y = bt^2$  and  $x = ct^2$ . What is the speed of the particle one second after the firing ?
  - $2(b + c)$
  - $2(b - c)$
  - $2(b^2 + c^2)^{1/2}$
  - $2(b^2 - c^2)^{1/2}$
- An automobile engine of mass  $M$  accelerates and a constant power  $p$  is applied by the engine. The instantaneous speed of the engine will be
  - $\sqrt{\frac{Pt}{M}}$
  - $\sqrt{\frac{2Pt}{M}}$
  - $\sqrt{\frac{Pt}{2M}}$
  - $\sqrt{\frac{Pt}{4M}}$

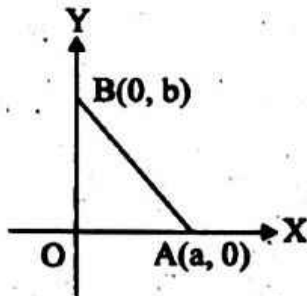
12. A long spring when stretched by  $x$  cm has a potential energy  $U$ . On increasing the stretching to ' $nx$ ' the potential energy stored in the spring will be
- (a)  $n^2U$                       (b)  $\frac{U}{n^2}$   
(c)  $\frac{U}{n}$                           (d)  $nU$
13. A body initially at rest explodes and breaks into three fragments in the ratio 1 : 1 : 3. The two pieces of equal mass fly off perpendicular to each other with a velocity of  $30\text{ms}^{-1}$ . What is the velocity of the heavier fragment ?
- (a)  $10\sqrt{2}\text{ms}^{-1}$               (b)  $10.5\text{ms}^{-1}$   
(c)  $11.4\text{ms}^{-1}$                 (d)  $10.95\text{ms}^{-1}$
14. A material has Poisson's ratio 0.50. If a uniform rod of it suffers a longitudinal strain of  $2 \times 10^{-3}$ , then the percentage change in volume is
- (a) 0.6                              (b) 0.4  
(c) 0.2                              (d) zero
15. A body is moving along a circular path with constant speed. If the direction of rotation is reversed and the speed is doubled, then
- (a) the direction of centripetal acceleration is doubled  
(b) the magnitude of centripetal acceleration is doubled  
(c) the direction of centripetal acceleration remains unchanged  
(d) the magnitude of centripetal acceleration is halved.
16. A ring and a disc of different masses are rotating with the same kinetic energy. If we apply a retarding torque  $\tau$  on the ring it stops after making  $n$  revolution. After how many revolution will the disc stop if the retarding torque on it is also  $\tau$  ?
- (a)  $\frac{n}{2}$                               (b)  $n$   
(c)  $2n$                               (d)  $4n$
17. The ratio of radii of two spheres of the same mass, having the same moment of inertia about their diameters, one hollow and other solid is :
- (a) 9 : 25                          (b) 25 : 9  
(c)  $\sqrt{5} : \sqrt{3}$                       (d)  $\sqrt{3} : \sqrt{5}$
18. If  $g$  is the acceleration due to gravity on the surface of the earth, the gain in potential energy of an object of mass  $m$  raised from the earth's surface to a height equal to the radius  $R$  of the earth is :
- (a)  $\frac{mgR}{4}$                           (b)  $\frac{mgR}{2}$   
(c)  $mgR$                               (d)  $2mgR$
19. A body floats in water with 40% of its volume outside water. When the same body floats in an oil, 60% of its volume remains outside oil. The relative density of oil is :
- (a) 0.9                              (b) 1.0  
(c) 1.2                              (d) 1.5
20. If the Earth were to suddenly contract to  $\frac{1}{n}$ th of its present radius without any change in its mass, the duration of the new day will be nearly.
- (a) 24 / nhr.                      (b) 24 n hr.  
(c)  $24 / n^2$  hr.                      (d)  $24 n^2$  hr.
21. Two temperature scales  $A$  and  $B$  are related by  $\frac{A-42}{110} = \frac{B-72}{220}$ . At which temperature two scales have the same reading ?
- (a)  $-42^\circ$                           (b)  $42^\circ$   
(c)  $12^\circ$                               (d)  $-40^\circ$
22. The resistance across  $A$  and  $B$  in the figure below will be :



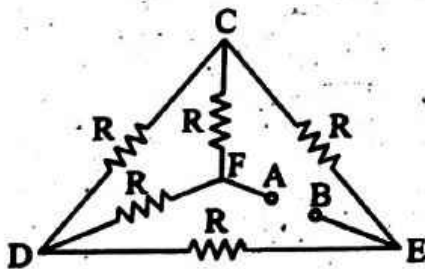
- (a)  $3R$                               (b)  $R$   
(c)  $\frac{R}{3}$                               (d) None of these

23. Air inside a closed container is saturated with water vapour. The air pressure is  $p$  and the saturated vapour pressure of water is  $\vec{p}$ . If the mixture is compressed to one half of its volume by maintaining temperature constant, the pressure becomes
- (a)  $2(p + \vec{p})$       (b)  $2p + \vec{p}$   
(c)  $(p + \vec{p})/2$       (d)  $p + 2\vec{p}$
24. What happens when the prongs of a vibrating tuning fork are immersed in water? Which of the following statements is TRUE about the waves propagating outwards?
- (a) The velocity decreases  
(b) The amplitude increases  
(c) The frequency decreases  
(d) The wavelength increases
25. Steel has Young's modulus  $21 \times 10^{11}$  dyne/cm<sup>2</sup> and density 7.8 gm/cc. The velocity of sound through steel is:
- (a) 350 m/s      (b) 700 m/s  
(c) 5000 m/s      (d) 5189 m/s
26. The coefficient of cubical expansion of sulphur is 0.000223 per °C. A piece of sulphur is found to displace 48 cc of water at 0°C. It will displace the volume of water at 35°C
- (a) 48.374 cc      (b) 48.743 cc  
(c) 49.374 cc      (d) 49.743 cc
27. The equation of displacement of two waves are given as  $y_1 = 10 \sin\left(3\pi t + \frac{\pi}{3}\right)$  and  $y_2 = 5 \sin\left(3\pi t + \sqrt{3} \cos 3\pi t\right)$  then what is the ratio of their amplitude?
- (a) 1 : 2      (b) 2 : 1  
(c) 1 : 1      (d) 1 : 4
28. An iron rod of length 100 cm and 10 cm<sup>2</sup> cross-section is heated from 0°C to 100°C. If it is not allowed to bend or expand, what force is developed in it? Given that  $Y = 10^{12}$  dyne/cm<sup>2</sup> and  $\alpha = 10^{-5}/^\circ\text{C}$
- (a)  $10^8$  dyne      (b)  $10^9$  dyne  
(c)  $10^{10}$  dyne      (d)  $10^{11}$  dyne
29. A thin glass bulb is sealed at 27°C, the internal pressure being 1 atmosphere. The maximum internal pressure the bulb can withstand is 95 cm of mercury. At the temperature at which the bulb will burst, is
- (a) 101°C      (b) 102°C  
(c) 374°C      (d) 375°C
30. A string in a musical instrument is 50 cm long and its fundamental frequency is 800 Hz. If a frequency of 1000 Hz is to be produced, then required length of string is
- (a) 37.5 cm      (b) 40 cm  
(c) 50 cm      (d) 62.5 cm
31. An ideal mono-atomic gas of given mass is heated at constant pressure. In this process, the fraction of supplied heat energy used for the increase of the internal energy of the gas is
- (a) 3/8      (b) 3/5  
(c) 3/4      (d) 2/5
32. Water is flowing in streamline motion through a horizontal tube. The pressure at a point in the tube is  $p$  where the velocity of flow is  $v$ . At another point, where the pressure is  $p/2$ , the velocity of flow is [density of water =  $\rho$ ]
- (a)  $\sqrt{v^2 + \frac{p}{\rho}}$       (b)  $\sqrt{v^2 - \frac{p}{\rho}}$   
(c)  $\sqrt{v^2 + \frac{2p}{\rho}}$       (d)  $\sqrt{v^2 - \frac{2p}{\rho}}$
33. If the terminal speed of a sphere of gold [density = 19.5 g/cm<sup>3</sup>] is 0.2 m/s in a viscous liquid [density = 1.5 g/cm<sup>3</sup>], find the terminal speed of a sphere of silver [density = 10.5 g/cm<sup>3</sup>] of the same size in the same liquid.
- (a) 0.133 m/s  
(b) 0.1 m/s  
(c) 0.2 m/s  
(d) 0.4 m/s

34. A charge  $+q$  is placed at the origin  $O$  of  $X$ - $Y$  axes as shown in figure below. The work done in taking a charge  $Q$  from  $A$  to  $B$  along the straight line  $AB$  is



- (a)  $\frac{qQ}{4\pi\epsilon_0} \left( \frac{a-b}{ab} \right)$  (b)  $\frac{qQ}{4\pi\epsilon_0} \left( \frac{b-a}{ab} \right)$   
 (c)  $\frac{qQ}{4\pi\epsilon_0} \left( \frac{b}{a^2} - \frac{1}{b} \right)$  (d)  $\frac{qQ}{4\pi\epsilon_0} \left( \frac{a}{b^2} - \frac{1}{b} \right)$
35. Two spherical conductors A and B of radii 1 mm and 2 mm are separated by a distance 5 cm and are uniformly charged. If the spheres are connected by a conducting wire then in the equilibrium condition, ratio of the magnitude of electric fields at the surfaces of sphere A and B is :
- (a) 1 : 2 (b) 2 : 1  
 (c) 1 : 4 (d) 4 : 1
36. Five equal resistances, each of resistance  $R$ , are connected as shown in figure below :



A battery of  $V$  volt is connected between  $A$  and  $B$ . The current flowing in  $FC$  will be

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

37. The magnetic field at the point of intersection of diagonals of a square wire loop of side  $L$  carrying a current  $I$  is

- (a)  $\frac{\mu_0 I}{\pi L}$  (b)  $\frac{2\mu_0 I}{\pi L}$   
 (c)  $\frac{\sqrt{2}\mu_0 I}{\pi L}$  (d)  $\frac{2\sqrt{2}\mu_0 I}{\pi L}$

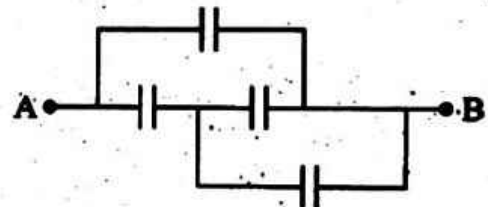
38. An electric dipole is placed at an angle  $30^\circ$  to a non-uniform electric field. The dipole will experience a

- (a) translational force only in a direction normal to the direction of the field  
 (b) torque as well as a translational force  
 (c) torque only  
 (d) translational force only in the direction of the field

39. An electric bulb marked as 50 W–200 V is connected across a 100 V supply. The present power of the bulb is :

- (a) 37.5 W (b) 25 W  
 (c) 12.5 W (d) 10 W

40. In the figure below, the capacitance of each capacitor is  $3 \mu\text{F}$ . The effective capacitance between  $A$  and  $B$  is :



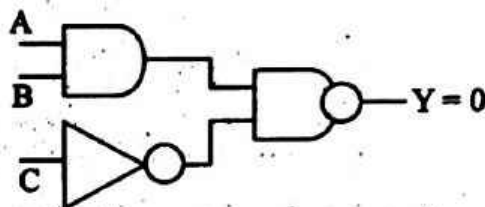
- (a)  $\frac{3}{4} \mu\text{F}$  (b)  $-3 \mu\text{F}$   
 (c)  $6 \mu\text{F}$  (d)  $5 \mu\text{F}$

41. The ratio of magnetic field and magnetic moment at the centre of a current carrying circular loop is  $x$ . When both the current and radius is doubled the ratio will be

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

42. The decimal equivalent of the binary number  $(11010.101)_2$  is
- (a) 9.625                      (b) 25.262  
(c) 26.625                      (d) 29.265
43. In a common emitter configuration, a transistor has  $\beta = 50$  and input resistance  $1 \text{ k}\Omega$ . If the peak value of ac. input is  $0.01 \text{ V}$  then the peak value of collector current is
- (a)  $0.01 \mu\text{A}$                       (b)  $0.25 \mu\text{A}$   
(c)  $100 \mu\text{A}$                       (d)  $500 \mu\text{A}$
44. 3 moles of a mono-atomic gas ( $\gamma = 5/3$ ) is mixed with 1 mole of a diatomic gas ( $\gamma = 7/3$ ). The value of  $\gamma$  for the mixture will be
- (a)  $\frac{9}{11}$                       (b)  $\frac{11}{6}$   
(c)  $\frac{12}{7}$                       (d)  $\frac{15}{7}$
45. Some water drops of radius  $r$  each coalesce to form a big drop of radius  $R$ . Then rise in temperature is given by
- (a)  $\frac{rT}{J}$                       (b)  $\frac{3T}{Jr}$   
(c)  $\frac{3T}{J}\left(\frac{1}{r} - \frac{1}{R}\right)$                       (d)  $\frac{3T}{J}\left(\frac{1}{r} + \frac{1}{R}\right)$
46. Which of the following statement is INCORRECT?
- (a) All reversible cycles have same efficiency  
(b) Reversible cycle has more efficiency than an irreversible one.  
(c) Carnot cycle is a reversible one  
(d) Carnot cycle has the maximum efficiency in all cycles
47. In which of the process, internal energy of system remains constant?
- (a) Adiabatic                      (b) Isochoric  
(c) Isobaric                      (d) Isothermal

48. In Young's double slit experiment, an interference pattern is obtained on a screen by a light of wavelength  $6000 \text{ \AA}$  coming from the coherent sources  $S_1$  and  $S_2$ . At certain point  $P$  on the screen third fringe is formed. Then the path difference  $S_1P - S_2P$  in microns is
- (a) 0.75                      (b) 1.8  
(c) 3.0                      (d) 4.0
49. In compound microscope the intermediate image is :
- (a) virtual, inverted and magnified  
(b) real, inverted and diminished  
(c) virtual, erect and magnified  
(d) real, inverted and magnified
50. In the following circuit the output  $Y$  becomes zero for the inputs



- (a)  $A = 1, B = 0, C = 0$   
(b)  $A = 0, B = 0, C = 0$   
(c)  $A = 1, B = 1, C = 1$   
(d)  $A = 1, B = 1, C = 0$
51. In n - p - n transistor the collector current is  $10 \text{ mA}$ . If 90% of the electrons emitted reach the collector, then
- (a) emitter current is  $9 \text{ mA}$   
(b) emitter current is  $11.1 \text{ mA}$   
(c) base current is  $0.1 \text{ mA}$   
(d) base current is  $0.01 \text{ mA}$
52. The r. m. s. value of the electric field of the light coming from the sun is  $720 \text{ N/C}$ . The average total energy density of the electromagnetic wave is :
- (a)  $6.37 \times 10^{-9} \text{ J/m}^3$   
(b)  $81.35 \times 10^{-12} \text{ J/m}^3$   
(c)  $3.3 \times 10^{-3} \text{ J/m}^3$   
(d)  $4.58 \times 10^{-6} \text{ J/m}^3$

53. A bar magnet of magnetic moment  $p_m$  is divided into two equal parts by cutting parallel to its length. The magnetic moment of either part will be
- (a)  $\frac{p_m}{4}$  (b)  $\frac{p_m}{2}$   
 (c)  $p_m$  (d)  $2p_m$
54. If the electron in a hydrogen atom jumps from an orbit with level  $n_1 = 2$  to an orbit with level  $n_2 = 1$ , the emitted radiation has a wavelength given by
- (a)  $\lambda = \frac{5}{3}R$  (b)  $\lambda = \frac{4}{3}R$   
 (c)  $\lambda = \frac{R}{4}$  (d)  $\lambda = \frac{3}{4}R$
55. In frequency modulation
- (a) the amplitude of modulated wave varies as frequency of carrier wave  
 (b) the frequency of modulated wave varies as amplitude of the modulating wave  
 (c) the amplitude of modulated wave varies as amplitude of carrier  
 (d) the frequency of modulated wave varies as frequency of modulating wave
56. Audio signal CANNOT be transmitted because
- (a) the signal has more noise  
 (b) the signal cannot be amplified for distance communication  
 (c) the transmitting antenna length is very small to design  
 (d) the transmitting antenna length is very large and impracticable
57. Which of the following is NOT electromagnetic in nature?
- (a) X-rays (b) Gamma rays  
 (c) Cathode rays (d) Microwaves
58. A ray of light enters from a denser medium into the rarer medium. The speed of light in the rarer medium is twice that in denser medium. What is the critical angle for total internal reflection to take place?
- (a)  $30^\circ$  (b)  $45^\circ$   
 (c)  $60^\circ$  (d)  $75^\circ$
59. Focal length of a convex lens of refractive index 1.5 is 2 cm. Focal length of lens when immersed in a liquid of refractive index of 1.25 will be
- (a) 10 cm (b) 2.5 cm  
 (c) 5 cm (d) 7.5 cm
60. The least distance of vision of a longsighted person is 60 cm. By using a spectacle lens, this distance is reduced to 12 cm. The power of the lens is :
- (a) +5.0 D (b) +(20/3) D  
 (c) -(10/3) D (d) +2.0 D
61. A thin prism ( $\mu = 1.5$ ) in the position of minimum deviation deviates the monochromatic light ray by  $10^\circ$ , the refracting angle of prism is :
- (a)  $10^\circ$  (b)  $20^\circ$   
 (c)  $30^\circ$  (d)  $45^\circ$
62. If the work function of a metal is 4.2 eV, the cut off wavelength is :
- (a) 8000 Å (b) 7000 Å  
 (c) 1472 Å (d) 2950 Å
63. A nucleus ruptures into two nuclear parts which have their velocity ratio equal to 2 : 1. What will be the ratio of their nuclear size (nuclear radius) ?
- (a)  $2^{1/3} : 1$  (b)  $1 : 2^{1/3}$   
 (c)  $3^{1/2} : 1$  (d)  $1 : 3^{1/2}$
64. What is the de Broglie wavelength of the alpha particle accelerated through a potential difference V ?
- (a)  $\frac{0.287}{\sqrt{V}}$  (b)  $\frac{12.27}{\sqrt{V}}$   
 (c)  $\frac{0.010}{\sqrt{V}}$  (d)  $\frac{0.202}{\sqrt{V}}$

65. Fusion reaction takes place at high temperature because
- atoms are ionised at high temperature
  - molecules break up at high temperature
  - nuclei break up at high temperature
  - kinetic energy is high enough to overcome repulsion between nuclei
66. A radioactive substance decays to  $\frac{1}{16}$ th of its initial activity in 40 days. The half life of the radioactive substance expressed in days is :
- 2.5
  - 5
  - 10
  - 20

## CHEMISTRY

67. Which one of the following statements is FALSE ?
- Work is a state function
  - Temperature is a state function
  - Change in the state is completely defined when the initial and final states are specified.
  - Work appears at the boundary of the system.
68. The enthalpy of vaporisation of liquid water using the data
- $$\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l}),$$
- $$\Delta H = -285.77 \text{ kJ/mol}$$
- $$\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{g}),$$
- $$\Delta H = -241.84 \text{ kJ/mol}$$
- is
- +43.93 kJ/mol
  - 43.93 kJ/mol
  - +527.61 kJ/mol
  - 527.61 kJ/mol
69. An aqueous solution of 6.3 g oxalic acid dehydrate is made up to 250 ml. The volume of 0.1 N NaOH required to completely neutralise 10 ml of this solution is :
- 10 ml
  - 20 ml
  - 40 ml
  - 4 ml
70. Equimolar solutions in the same solvents have
- same boiling point but different freezing point.
  - same freezing point but different boiling point.
  - same boiling point but same freezing point.
  - different boiling point and different freezing point.
71. The freezing point of equimolar aqueous solution will be highest for
- $\text{C}_6\text{H}_5\text{NH}_4 + \text{Cl}^-$
  - $\text{Ca}(\text{NO}_3)_2$
  - $\text{La}(\text{NO}_3)_2$
  - $\text{C}_6\text{H}_{12}\text{O}_6$
72. The standard reduction potential for  $\text{Fe}^{2+} | \text{Fe}$  and  $\text{Sn}^{2+} | \text{Sn}$  electrodes are -0.44 and -0.14 V respectively for the cell reaction :
- $$\text{Fe}^{2+} + \text{Sn} \rightarrow \text{Fe} + \text{Sn}^{2+}$$
- the standard *emf* is :
- +0.30 V
  - 0.58 V
  - +0.58 V
  - 0.30 V
73. Equivalent conductance of NaCl, HCl and  $\text{C}_2\text{H}_5\text{COONa}$  at infinite dilution are 126.45, 426.16 and 91  $\text{ohm}^{-1} \text{cm}^2$  respectively. The equivalent conductance of  $\text{C}_2\text{H}_5\text{COOH}$  is :
- 201.28  $\text{ohm}^{-1} \text{cm}^2$
  - 390.71  $\text{ohm}^{-1} \text{cm}^2$
  - 698.28  $\text{ohm}^{-1} \text{cm}^2$
  - 540.48  $\text{ohm}^{-1} \text{cm}^2$
74. Saturated solution of  $\text{KNO}_3$  is used to make 'salt bridge' because
- velocity of  $\text{K}^+$  is greater than that of  $\text{NO}_3^-$
  - velocity of  $\text{K}^+$  is less than that of  $\text{NO}_3^-$
  - velocity of both  $\text{K}^+$  and  $\text{NO}_3^-$  are nearly the same
  - $\text{KNO}_3$  is highly soluble in water

75.  $\text{Zn(s)} + \text{Cl}_2(1 \text{ atm}) \rightarrow \text{Zn}^{2+} + 2\text{Cl}^-$ . The  $E^\circ$  of the cell is 2.12 V. To increase E
- $\text{Zn}^{2+}$  concentration should be increased
  - $\text{Zn}^{2+}$  concentration should be decreased
  - $\text{Cl}^-$  concentration should be increased
  - partial pressure of  $\text{Cl}_2$  should be decreased
76. Alums purify muddy water by
- dialysis
  - adsorption
  - coagulation
  - forming a true solution
77. Which of the following is correctly matched?
- Emulsion-Card
  - Foam-Mist
  - Aerosol-Smoke
  - Solid sol-Cake
78. The coagulating power of an electrolyte for arsenious sulphide sol decreases in the order.
- $\text{Na}^+ > \text{Al}^+ > \text{Ba}^{2+}$
  - $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^{2+}$
  - $\text{Na}^+ > \text{Al}^+ > \text{Ba}^{2+}$
  - $\text{Na}^+ > \text{Ba}^{2+} > \text{PO}_4^{3-}$
79. The electronic configuration of gadolinium (At. No. 64) is :
- $[\text{Xe}]4f^8 5d^0 6s^2$
  - $[\text{Xe}]4f^7 5d^1 6s^2$
  - $[\text{Xe}]4f^3 5d^5 6s^2$
  - $[\text{Xe}]4f^6 5d^2 6s^2$
80. Which of the following does NOT react with  $\text{AgCl}$ ?
- $\text{Na}_2\text{SO}_3$
  - $\text{NH}_4\text{OH}$
  - $\text{NaNO}_3$
  - $\text{Na}_2\text{CO}_3$
81. The number of moles of  $\text{KMnO}_4$  that will be needed to react with one mole of sulphite in an acidic solution is :
- 2 / 5
  - 3 / 5
  - 4 / 5
  - 1
82. Which of the following is NOT an actinide?
- Curium
  - Californium
  - Uranium
  - Terbium
83. Reaction of ethyl formate with excess of  $\text{CH}_3\text{MgI}$  followed by hydrolysis gives
- n-Propyl alcohol
  - Ethanal
  - Propanal
  - Isopropylalcohol
84. The reaction of an ester  $\text{ROOR}'$  with an alcohol  $\text{R}''\text{OH}$  in presence of an acid gives
- $\text{R}'\text{COOR}''$
  - $\text{R}'\text{COOH}$
  - $\text{RCOOR}''$
  - $\text{R}''\text{COOR}$
85. In the diazotisation of aniline with the sodium nitrate and hydrochloric acid, the excess of hydrochloric acid is used primarily to
- suppress the concentration of free aniline
  - suppress the hydrolysis of phenol
  - ensure a stoichiometric amount of nitrous acid
  - neutralise the base liberated
86. Benzene diazonium chloride on reaction with phenol in weakly basic medium gives
- Diphenyl ether
  - p-Hydroxyazobenzene
  - Chlorobenzene
  - Benzene
87. Which is correct statement?
- Starch is polymer of  $\alpha$ -glucose
  - Amylose is a component of cellulose
  - Proteins are composed of only one type of amino acid
  - In cyclic structure of furanose, there are four carbons and one oxygen atom.
88. The number of chiral carbons in  $\beta$ -D(+)-glucose is
- three
  - four
  - five
  - six
89. The reason for double helical structure of DNA is operation of
- electrostatic attraction
  - hydrogen bonding
  - van der Waals' forces
  - dipole-dipole interaction
90. Number of atoms of oxygen present in 10.6 g  $\text{Na}_2\text{CO}_3$  will be
- $6.02 \times 10^{22}$
  - $12.04 \times 10^{22}$
  - $1.806 \times 10^{23}$
  - $31.80 \times 10^{28}$



91. If 30 ml of  $H_2$  and 20 ml of  $O_2$  react to form water, what is left at the end of the reaction ?  
 (a) 10 ml of  $H_2$  (b) 5 ml of  $H_2$   
 (c) 10 ml of  $O_2$  (d) 5 ml of  $O_2$
92. 2.76 g of silver carbonate (At. Mass = 108) on being heated strongly yields a residue weighing  
 (a) 2.16 g (b) 2.48 g  
 (c) 2.32 g (d) 2.64 g
93. What mass of silver nitrate will react with 5.85 g of sodium chloride to produce 14.35 g of silver chloride and 8.5 g of sodium nitrate, if the law of conservation of mass is TRUE ?  
 (a) 7.15 g (b) 17.0 g  
 (c) 3.3 g (d) 4.88 g
94. Which of the following polymers is used for making switch board, heater handle ?  
 (a) Polythene (b) Rubber  
 (c) PET (d) Bakelite
95. Isoprene is the monomeric unit of which of the following polymers ?  
 (a) Dacron (b) Natural rubber  
 (c) Bakelite (d) Polyvinyl chloride
96. Indium doped Silicon is an ——— semiconductor.  
 (a) *p*-type (b) *n*-type  
 (c) *p-n*-type (d) None of these
97. Schottky defect is due to missing of  
 (a) anion from lattice  
 (b) cation from lattice  
 (c) cation and anion both from lattice  
 (d) None of these
98. Out of the following compounds, which one would have a zero dipole moment ?  
 (a) 1, 1-Dichloroethylene  
 (b) *cis*-1, 2-Dichloroethylene  
 (c) *trans*-1, 2-Dichloroethylene  
 (d) None of these compounds
99. 1-Chlorobutane on reaction with alcoholic potash gives  
 (a) 1-Butene (b) 1-Butanol  
 (c) 2-Butene (d) 2-Butanol
100. Among the following compounds, the strongest acid is  
 (a)  $HC \equiv CH$  (b)  $C_6H_6$   
 (c)  $C_2H_6$  (d)  $CH_3OH$
101. Identify the correct statement below concerning the structure of  $CH_2 = C = CH_2$   
 (a) The molecule is planar  
 (b) One of the three carbon atoms is in an  $sp^3$  hybridised state  
 (c) The molecule is non-planar with the two  $CH_2$  groups being in planar perpendicular to each other.  
 (d) All the carbon atoms are *sp*-hybridised.
102. Which of the following is correct regarding the -I-effect of the substituents ?  
 (a)  $-NR_2 < -OR < -F$   
 (b)  $-NR_2 > -OR < -F$   
 (c)  $-NR_2 < -OR > -F$   
 (d)  $-NR_2 > -OR > -F$
103. Which of the following is NOT is Ca ore ?  
 (a) Gypsum (b) Magnesite  
 (c) Dolomite (d) Carnallite
104. Among  $KO_2$ ,  $AlO_2^-$ ,  $BaO_2$  and  $NO_2^+$ , unpaired electron is present in  
 (a)  $NO_2^+$  and  $BaO_2$  (b)  $KO_2$  and  $AlO_2^-$   
 (c)  $KO_2$  only (d)  $BaO_2$  only
105. pH of water is 7. When a substance Y is dissolved in water, the pH becomes 13. The substance Y is a salt of :  
 (a) weak acid and weak base  
 (b) strong acid and strong base  
 (c) strong acid and weak base  
 (d) weak acid and strong base
106. Which of the following sulphides has the lowest solubility product ?  
 (a) FeS (b) MnS  
 (c) PbS (d) SnS
107. In a mixture of a weak acid and salt, the ratio of the concentration of acid to salt is increased ten-fold. The pH of the solution  
 (a) decreases by one  
 (b) decreases by one-tenth  
 (c) increases by one  
 (d) increases by ten-fold

108. The solubility of  $\text{CaCO}_3$  in water is  $3.05 \times 10^{-4}$  moles / litre. Its solubility product will be  
 (a)  $6.1 \times 10^{-4}$  (b) 9.3  
 (c)  $3.05 \times 10^{-4}$  (d)  $9.3 \times 10^{-8}$
109. Which of the following solutions will have pH close to 1.0 ?  
 (a) 100 ml of (M / 10) HCl + 100 ml of (M / 10) NaOH  
 (b) 55 ml of (M / 10) HCl + 45 ml of (M / 10) NaOH  
 (c) 10 ml of (M / 10) HCl + 90 ml of (M / 10) NaOH  
 (d) 75 ml of (M / 5) HCl + 25 ml of (M / 5) NaOH
110. One mole of  $\text{N}_2\text{O}_4(\text{g})$  at 300 K is kept in a closed container under one atmospheric pressure. It is heated to 600 K when 20% by mass of  $\text{N}_2\text{O}_4(\text{g})$  decomposes to  $\text{NO}_2(\text{g})$ . The resultant pressure is  
 (a) 1.2 atm (b) 2.4 atm  
 (c) 2.0 atm (d) 1.0 atm
111.  $\text{A}(\text{g}) + 3\text{B}(\text{g}) \rightleftharpoons 4\text{C}$ . The initial concentration of A is equal to that of B. The equilibrium concentrations of A and C are equal,  $K_c = ?$   
 (a) 0.08 (b) 0.8  
 (c) 8 (d) 80
112. For a weak acid with  $\alpha$  as its degree of dissociation, the value of dissociation constant is given by (C is concentration of acid in mole per litre)  
 (a)  $K_a = C\alpha$  (b)  $K_a = C\alpha^2$   
 (c)  $K_a = C^2\alpha$  (d)  $K_a = C^2\alpha^2$
113. A litre of solution containing 0.1 mole of  $\text{CH}_3\text{COOH}$  and 0.1 mole of  $\text{CH}_3\text{COONa}$  provide a buffer of pH 4.74. Calculate the pH of the solution after the addition of 0.02 mole of NaOH.  $K_a = 1.8 \times 10^{-5}$   
 (a) 4.92 (b) 4.03  
 (c) 8.56 (d) 5.32
114. Calculate the pH of 0.625M solution of  $\text{CH}_3\text{COONa}$  ( $K_a$  value of  $\text{CH}_3\text{COOH}$  is  $1.754 \times 10^{-5}$ )  
 (a) 8.25 (b) 9.28  
 (c) 10.2 (d) 11.26
115. The dissociation constant  $K_b$ , the hydrolysis constant  $K_h$  and ionic product  $K_w$  are related to each other by the relation  
 (a)  $K_w / K_b = K_h$  (b)  $K_w / K_h = K_b$   
 (c)  $K_w = K_h \times K_b$  (d) All of these
116. In Hittorf method for determination of transport numbers we make use of a(n)  
 (a) H-tube (b) V-tube  
 (c) U-tube (d) L-tube
117. The mass in grams of copper will be deposited from a solution of  $\text{Cu}^{2+}$  by a current of 2.50 A in 2 hours, is  
 (a) 23.7 (b) 0.187  
 (c) 1.65 (d) 5.93
118. Which of the following sets contains only isoelectronic ions ?  
 (a)  $\text{Na}^+, \text{Ca}^{2+}, \text{Ga}^{3+}, \text{Al}^{3+}$   
 (b)  $\text{K}^+, \text{Ca}^{2+}, \text{Sc}^{3+}, \text{Cl}^-$   
 (c)  $\text{P}^{3-}, \text{Sc}^{3+}, \text{Cl}^-, \text{K}^+$   
 (d)  $\text{Na}^+, \text{Al}^{3+}, \text{Mg}^{2+}, \text{Cl}^-$
119. The values of the van der Waals constant a for the gases  $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{NH}_3$  and  $\text{CH}_4$  are 1.39, 1.36, 4 and  $2.25 \text{ dm}^6 \text{ atm mol}^{-2}$  respectively. The most easily liquefiable gas is  
 (a)  $\text{N}_2$  (b)  $\text{O}_2$   
 (c)  $\text{NH}_3$  (d)  $\text{CH}_4$
120. A gas would show maximum deviation from ideal behaviour at  
 (a)  $150^\circ\text{C}, 2 \text{ atm}$  (b)  $10^\circ\text{C}, 1 \text{ atm}$   
 (c)  $75^\circ\text{C}, 0.5 \text{ atm}$

121. Of the following pairs, each of 0.1 m solution, the isotonic solution at the same temperature will be  
 (a) glucose and KCl  
 (b)  $MgCl_2$  and NaCl  
 (c) urea and  $ZnSO_4$   
 (d)  $Na_2SO_4$  and  $Ca(NO_3)_2$
122. A gaseous mixture contains 56 g  $N_2$ , 44 g  $CO_2$  and 16 g  $CH_4$ . The total pressure of the mixture is 720 mm Hg. What is the partial pressure of  $CH_4$ ?  
 (a) 160 mm (b) 394 mm  
 (c) 180 mm (d) 225 mm
123. The first use of quantum theory to explain the structure of atoms was made by  
 (a) Heisenberg (b) Bohr  
 (c) Plank (d) Einstein
124. Which of the following complexes is non-conducting?  
 (a)  $CoCl_3 \cdot 3NH_3$  (b)  $CoCl_3 \cdot 6NH_3$   
 (c)  $CoCl_3 \cdot 4NH_3$  (d)  $CoCl_3 \cdot 5NH_3$
125. the IUPAC name  $Na_2[Fe(CN)_5NO]$  the IUPAC name is :  
 (a) sodium pentacyanonitrate  
 (b) sodium pentacyanonitrosylferrous(II)  
 (c) sodium pentacyanonitrosylferrate(II)  
 (d) disodium pentacyanonitrosylferrate(II)
126. A catalyst increases the rate of reaction because it  
 (a) increases the activation energy  
 (b) lowers the energy barrier for reaction  
 (c) decreases the collision diameter  
 (d) increases the temperature coefficient
127. Inert pair effect is exhibited by  
 (a) Pb (b) B  
 (c) Si (d) Al
128. The isotope used for dating archaeological finding is :  
 (a)  ${}_1H^3$  (b)  ${}_6C^{14}$   
 (c)  ${}_8O^{18}$  (d)  ${}_{92}U^{235}$
129. Isomers which can be interconverted through rotation around a single bond are :  
 (a) conformers (b) diastereomers  
 (c) enantiomers (d) positional isomers
130. The reagent used for separation of acetaldehyde and acetophenone is  
 (a)  $NaHSO_3$  (b)  $C_6H_5NHNH_2$   
 (c)  $NH_2OH$  (d)  $NaOH-I_2$
131. Number of sigma bonds in  $P_4O_{10}$  is  
 (a) 6 (b) 7  
 (c) 16 (d) 17
132. One molé of a perfect gas expands isothermally to ten times its original volume. The change in entropy is  
 (a) 0.1 R (b) 2.303 R  
 (c) 10.0 R (d) 100.0 R

## MATHEMATICS

133. If X is a tautology and Y is any other formula, then  $(X \vee Y)$  is a :  
 (a) Tautology  
 (b) Contradiction  
 (c) Well-formed formula  
 (d) None of these
134. Which of the following is ODD function?  
 (a)  $f(x) = \frac{(e^{x^2} - 1)}{(e^{-x^2} + 1)}$   
 (b)  $f(x) = \log \frac{(1-x)}{(1+x)}$   
 (c)  $f(x) = \sqrt{1+x+x^2} + \sqrt{1-x+x^2}$   
 (d) None of these
135. Principal value of  $\cot^{-1}(-1) = ?$   
 (a)  $3\pi/4$  (b)  $\pi/4$   
 (c)  $-\pi/4$  (d) None of these
136. Which of the following curves are symmetrical about x-axis only?  
 (a)  $5x^2 + 7y - 6 = 0$   
 (b)  $y^2 = x + 9$  (c)  $xy = 1$   
 (d)  $x^2 + y^2 - 4xy + 3 = 0$

137. The sides of an equilateral triangle are increasing at rate of 2 cm/sec. The rate at which the area increases, when side is 10 cm, is :

(a)  $10 \text{ cm}^2/\text{s}$       (b)  $\sqrt{3} \text{ cm}^2/\text{s}$

(c)  $10\sqrt{3} \text{ cm}^2/\text{s}$       (d)  $\frac{10}{3} \text{ cm}^2/\text{s}$

138.  $\int e^{3 \log x} dx = ?$

(a)  $x^3 + c$       (b)  $\frac{x^6}{6} + c$

(c)  $6x^6 + c$       (d)  $x^6 + c$

139. If the position vector  $\vec{a}$  of the point  $(5, n)$  is such that  $|\vec{a}| = 13$ , then what is the value of  $n$  ?

(a)  $\pm 12$       (b) 0

(c)  $\pm 1$       (d) 4

140. How many solutions does the following system of linear equations have ?

$-x + 5y = -1, x - y = 2, x + 3y = 3$

(a) Infinitely many

(b) Two distinct solutions

(c) Unique solution

(d) No solution

141. Consider the following propositional statements :

$P_1 : ((A \wedge B) \rightarrow C) \equiv ((A \rightarrow C) \wedge (B \rightarrow C))$

$P_2 : ((A \vee B) \rightarrow C) \equiv ((A \rightarrow C) \vee (B \rightarrow C))$

Which one of the following is TRUE ?

(a)  $P_1$  is a tautology, but not  $P_2$

(b)  $P_2$  is a tautology, but not  $P_1$

(c)  $P_1$  and  $P_2$  are both tautologies

(d) Both  $P_1$  and  $P_2$  are not tautologies

142. If  $f(x) = \begin{cases} 1+x; 0 \leq x \leq 2 \\ 3-x; 2 \leq x \leq 3 \end{cases}$

Determine  $[f(x)]$ , where  $[ ]$  represents the greatest integer function.

(a)  $[f(x)] = \begin{cases} 1; 0 \leq x < 1 \\ 2; 1 \leq x < 2 \\ 3; x = 2 \\ 0; x = 3 \end{cases}$

(b)  $[f(x)] = \begin{cases} 1; 0 \leq x < 1 \\ 2; 1 \leq x < 2 \\ 3; x = 2 \\ 0; 2 < x \leq 3 \end{cases}$

(c)  $[f(x)] = \begin{cases} 1; 0 < x < 1 \\ 2; 1 < x \leq 2 \\ 3; x = 2 \\ 0; 2 < x \leq 3 \end{cases}$

(d) None of these

143. The value of  $\tan 75^\circ - \cot 75^\circ = ?$

(a)  $2\sqrt{3}$       (b)  $2 + \sqrt{3}$

(c)  $2 - \sqrt{3}$       (d) 1

144. Identify the curve  $x^2 + y^2 + 6x - 2y + 10 = 0$ .

(a) Parabola

(b) Ellipse

(c) Pair of straight lines

(d) A unique point

145. What is the value of

$\lim_{x \rightarrow 0} \left( \frac{e^x - (1 + x + x^2)}{x^3} \right) ?$

(a) 0      (b)  $\frac{1}{6}$

(c)  $\frac{1}{3}$       (d) 1

146.  $\int_0^1 \frac{1-x}{1+x} dx = ?$

(a)  $\log 2 + 1$       (b)  $2 \log 2 + 1$

(c)  $\log(2e)$       (d)  $\log\left(\frac{4}{e}\right)$

147. Find a vector of magnitude 9, which is perpendicular to both the vectors

$$\vec{a} = 4\hat{i} - \hat{j} + 3\hat{k} \text{ and } \vec{b} = -2\hat{i} + \hat{j} - 2\hat{k}$$

- (a)  $\frac{1}{3}(\hat{i} + \hat{j} + \hat{k})$  (b)  $3(\hat{i} - \hat{j} + \hat{k})$   
 (c)  $3\hat{i} - 6\hat{j} - 6\hat{k}$  (d)  $-3\hat{i} + 6\hat{j} + 6\hat{k}$
148. Let A, B, C, D be  $n \times n$  matrices, each with non-zero determinant, if  $ABCD = I$ , then  $B^{-1} = ?$

- (a)  $D^{-1}C^{-1}A^{-1}$  (b) CDA  
 (c) ADC (d) None of these

149. Which of the following is NOT correct?

- (a)  $A - (B \cup C) = (A - B) \cap (A - C)$   
 (b)  $A \cup (B - C) = (A \cup B) - (A \cup C)$   
 (c)  $A \times (B - C) = (A \times B) - (A \times C)$   
 (d) None of these

150. Find the values of  $x$  for which the functions  $f(x) = 3x^2 - 1$  and  $g(x) = 3 + x$  are equal.

- (a) 1, 4/3 (b) 1, -4/3  
 (c) -1, -4/3 (d) -1, 4/3

151. Which of the following is correct?

- (a)  $\sin 1^\circ > \sin 1$  (b)  $\sin 1^\circ < \sin 1$   
 (c)  $\sin 1^\circ = \sin 1$  (d)  $\sin 1^\circ = \frac{\pi}{180} \sin 1$

152. For specifying a straight line, how many geometrical parameters should be known?

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

153. Which of the following functions are strictly increasing on  $\mathbb{R}$ ?

- (a)  $x^3 - 6x^2 + 12x - 9, x \in \mathbb{R}$   
 (b)  $x^3 - 6x^2 - 9, x \in \mathbb{R}$   
 (c)  $x^3 - 6x^2 + 12, x \in \mathbb{R}$   
 (d)  $-x^3 - 6x^2 - 12x - 9, x \in \mathbb{R}$

154. The area enclosed between the curves  $y^2 = 4x$  and  $x^2 = 4y$  is

- (a)  $\frac{16}{3}$  (b) 8  
 (c)  $\frac{22}{3}$  (d) 16

155. The area of triangle formed by the tips of vectors  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  is:

(a)  $\frac{1}{2}(\vec{a} - \vec{b}) \cdot (\vec{a} - \vec{c})$

(b)  $\frac{1}{2}(\vec{a} - \vec{b}) \times (\vec{a} - \vec{c})$

(c)  $\frac{1}{2}|\vec{a} \times \vec{b} \times \vec{c}|$

(d)  $\frac{1}{2}(\vec{a} \times \vec{b}) \cdot \vec{c}$

156. Consider the matrices  $X_{4 \times 3}$ ,  $Y_{4 \times 3}$  and  $P_{2 \times 3}$ .

The order of  $[P(X^T Y)^{-1} P^T]^T$  will be:

- (a)  $(2 \times 2)$  (b)  $(3 \times 3)$   
 (c)  $(4 \times 3)$  (d)  $(3 \times 4)$

157. The sets A and B are having elements 10 and 8,  $n(A \cap B) = 2$ , then  $n(A \cup B)$  is:

- (a) 16 (b) 10  
 (c) 8 (d) 20

158. Range of  $\operatorname{cosec}^{-1}(x)$  is:

(a)  $\left[-\frac{\pi}{2}, 0\right] \cup \left[0, \frac{\pi}{2}\right]$

(b)  $\left[-\frac{\pi}{2}, 0\right) \cup \left(0, \frac{\pi}{2}\right]$

(c)  $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

(d)  $\left[-\frac{\pi}{2}, 0\right) \cup \left(0, \frac{\pi}{2}\right]$

159. If  $\tan A = \frac{1}{2}$ ,  $\tan B = \frac{1}{3}$  then  $\tan(2A + B)$  is equal to

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

160. Equations of diagonals of the square formed by the lines  $x=0, y=0, x=1$  and  $y=1$  are :  
 (a)  $y=x, y+x=1$   
 (b)  $y=x, y+x=2$   
 (c)  $y=2x, y+2x=1$   
 (d)  $2y=x, y+x=\frac{1}{3}$
161. Find the absolute maximum value of  $f(x) = \sin x + \frac{1}{2} \cos 2x$  in  $\left[0, \frac{\pi}{2}\right]$ .  
 (a)  $\frac{4}{3}$  (b)  $\frac{3}{4}$   
 (c)  $\frac{1}{2}$  (d) None of these
162. If  $\tan y \, dx + \sec^2 y \tan x \, dy = 0$ , then  
 (a)  $\frac{\sin x}{\tan y} = c$   
 (b)  $(\sin x)(\tan y) = c$   
 (c)  $\cos x = c$   
 (d)  $\frac{\sin^2 x}{\cos y} = c$
163. Distance of the point  $(\alpha, \beta, \gamma)$  from x-axis is :  
 (a)  $|\beta|$  (b)  $|\alpha|$   
 (c)  $\sqrt{\beta^2 + \gamma^2}$  (d) None of these
164. For what values of  $\alpha$  and  $\beta$ , the following simultaneous equations have infinite number of solutions ?  
 $x+y+z=5, x+3y+3z=9, x+2y+\alpha z=\beta$   
 (a) 2, 7 (b) 3, 8  
 (c) 8, 3 (d) 7, 2
165. Which of the following is correct ?  
 (a) If  $A \subset B$  and  $B \subset C$  then  $A \subset C$   
 (b) If  $A \subset B$  and  $B \subset C$  then  $A \subset C$   
 (c) If  $A \not\subset B$  and  $B \not\subset C$  then  $A \not\subset C$   
 (d) If  $x \in A$  and  $A \subset B$  then  $x \in B$
166. Range of  $y = \frac{1}{4 - \sin 2x}$  is :  
 (a)  $[1/5, 1]$  (b)  $[1/5, 1/3]$   
 (c)  $[1/3, 1]$  (d)  $[1/5, 1/3]$
167.  $\cos 2\phi \cos 2\theta + \sin^2(\theta - \phi) - \sin^2(\theta + \phi)$  is equal to :  
 (a)  $\sin 2(\theta + \phi)$  (b)  $\sin 2(\theta - \phi)$   
 (c)  $\cos 2(\theta + \phi)$  (d)  $\cos 2(\theta - \phi)$
168. The distance between the lines  $y = mx + c_1$  and  $y = mx + c_2$  is :  
 (a)  $\frac{c_2 - c_1}{\sqrt{m^2 + 1}}$  (b)  $\frac{|c_2 - c_1|}{\sqrt{m^2 + 1}}$   
 (c)  $\frac{c_1 - c_2}{\sqrt{m^2 + 1}}$  (d) 0
169. The general solution of the differential equation  $y = x \frac{dy}{dx} + \sqrt{3\left(\frac{dy}{dx}\right)^2 + 7}$  is :  
 (a)  $x - cy + 5 = 0$   
 (b)  $y = cx + \sqrt{3c^2 + 7}$   
 (c)  $y^2 = cx + \sqrt{3c^2 + 7}$   
 (d) None of these
170. The plane  $2x - 3y + 6z = 11$  makes angle  $\sin^{-1} \alpha$  with x-axis. The value of  $\alpha$  is :  
 (a)  $\frac{\sqrt{3}}{4}$  (b)  $\frac{\sqrt{2}}{2}$   
 (c)  $\frac{12}{7}$  (d) None of these
171. In how many ways can the word MANAGEMENT be arranged ?  
 (a) 226800 (b) 453600  
 (c) 113400 (d) None of these
172. If  $i^2 = -1$  then sum of  $i + i^2 + i^3 + i^4 + \dots$  to 1000 terms is :  
 (a) 1 (b) 0  
 (c) -1 (d)  $i$
173.  $\lim_{x \rightarrow \infty} \left(1 + \frac{2}{x^2}\right) = ?$   
 (a) 1 (b) 0  
 (c)  $\infty$  (d)  $-\infty$

174. Mean of first  $n$  natural numbers is :

(a)  $\frac{n(n+1)}{2}$       (b)  $\frac{n+1}{2n}$

(c)  $\frac{n+1}{2}$       (d)  $\frac{n^2(n+1)}{2}$

175. Equation of the circle with centre on the y-axis and passing through the origin and the point (2, 3) is :

(a)  $x^2 + y^2 + 13y = 0$

(b)  $3x^2 + 3y^2 + 13x + 3 = 0$

(c)  $6x^2 + 6y^2 - 13x = 0$

(d)  $x^2 + y^2 + 13x + 3 = 0$

176. The order and degree of the differential

equation  $\frac{d^2y}{dx^2} = \left\{ y + \left( \frac{dy}{dx} \right)^2 \right\}^{\frac{1}{4}}$  are :

(a) 4, 2      (b) 1, 4

(c) 2, 4      (d) 1, 2

177. The feasible region is :

(a) a convex set

(b) the optimal solution

(c) always unbounded for minimization problem

(d) None of these

178. Out of 4 officers and 10 clerks in a business firm, a committee consisting of 2 officers and 3 clerks is to be formed. In how many ways can this be done if one particular clerk must be on the committee ?

(a) 216      (b) 416

(c) 36      (d) None of these

179. The value of  $i^n + i^{n+1} + i^{n+2} + i^{n+3}$  (where  $i = \sqrt{-1}$ ,  $n \geq 1$ ) is :

(a) 1      (b) -1

(c) 0      (d) None of these

180.  $\lim_{x \rightarrow 3} \left( \frac{x^n - 3^n}{x - 3} \right) = 27n$ , then the value of  $n$  is :

(a) 3      (b) 2

(c) 4      (d) 5

181. The variance for the following data : 6, 7, 10, 12, 13, 4, 8, 12 is :

(a) 9.25      (b) 9.15

(c) 8.25      (d) None of these

182. The area of the circle centered at (1, 2) and passing through (4, 6) is :

(a)  $5\pi$       (b)  $10\pi$

(c)  $25\pi$       (d) None of these

183. Without repetition of the numbers, four digit numbers are formed with the numbers 0, 2, 3, 5. The probability of such a number divisible by 5 is :

(a)  $1/5$       (b)  $4/5$

(c)  $1/30$       (d)  $5/9$

184. If  $\omega$  is cube root of unity then

$\left( \frac{x\omega + y + z\omega^2}{x\omega^2 + y\omega + z} \right)^2$  is :

(a) 1      (b)  $\omega^2$

(c)  $\omega$       (d) None of these

185. If  $y = \sin^2\left(\frac{x}{2}\right)$ , then  $\frac{dy}{dx} = ?$

(a)  $\sin x$       (b)  $\frac{1}{2} \sin x$

(c)  $\cos x$       (d)  $\frac{1}{2} \cos x$

186. 3A2F in hexadecimal represents :

(a) 14895      (b) 14880

(c) 15150      (d) 15151

187. If  $e$  is the eccentricity of the ellipse

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , ( $a < b$ ) then

(a)  $b^2 = a^2(1 - e^2)$

(b)  $a^2 = b^2(1 - e^2)$

(c)  $a^2 = b^2(e^2 - 1)$

(d)  $b^2 = a^2(e^2 - 1)$

188. 6 boys and 6 girls sit in a row at random. The probability that all the girls sit together is :

(a)  $1/432$       (b)  $12/431$

(c)  $1/132$       (d) None of these

189. Principal argument of  $(-2 - 2i)$  is :
- (a)  $\frac{3\pi}{4}$  (b)  $\frac{3\pi}{4}$   
(c)  $\frac{\pi}{4}$  (d) None of these
190. If  $n < 1$  then  $\frac{dx^n}{dx}$  exists when
- (a)  $x = -1$  (b)  $x = 1$   
(c)  $x = 0$  (d)  $x \neq 0$
191. Which of the following is unary operation ?
- (a) Addition (b) Multiplication  
(c) Square root (d) None of these
192. The distance between the foci of a hyperbola is 16 and its eccentricity is  $\sqrt{2}$ . Its equation is :
- (a)  $x^2 - y^2 = 32$  (b)  $x^2 - y^2 = 23$   
(c)  $2x^2 - y^2 = 32$  (d) None of these
193.  $\alpha, \beta$  be two roots of  $ax^2 + bx + c = 0$ , then the value of  $\frac{a\alpha^2}{b\alpha + c} - \frac{a\beta^2}{b\beta + c}$  is :
- (a) 0 (b) -2  
(c) 2 (d) 1
194. If  $e^{x+y} = xy$ , then  $\frac{dy}{dx} = ?$
- (a)  $\frac{y(1-x)}{x(y-1)}$  (b)  $\frac{y(x-1)}{x(1+y)}$   
(c)  $\frac{y(1+x)}{x(1+y)}$  (d) None of these
195. When 1100010 is divided by 0101 what will be the decimal remainder ?
- (a) 5 (b) 4  
(c) 2 (d) 3
196. The length of the latus rectum of the ellipse  $3x^2 + y^2 = 12$  is :
- (a) 4 (b) 3  
(c) 8 (d)  $\frac{4}{\sqrt{3}}$
197. If  $b^3 + a^2c + ac^2 = 3abc$ , then the relation between two roots of the equation  $ax^2 + bx + c = 0$  is :
- (a)  $\alpha = \beta^2$  or  $\beta = \alpha^2$   
(b)  $\alpha = 2\beta$  or  $\beta = 2\alpha$   
(c)  $\alpha^2 - \beta^2 = 0$   
(d) None of these
198.  $\frac{d}{dx}|x| = ?$
- (a)  $|x|$   
(b)  $x^2$   
(c)  $\frac{x}{|x|}, x \neq 0$   
(d) 1
199.  $a \neq b$  but  $a^2 = 5a - 3$  and  $b^2 = 5b - 3$ , then find a equation whose roots are  $\frac{a}{b}$  and  $\frac{b}{a}$ .
- (a)  $3x^2 - 19x + 3 = 0$   
(b)  $x^2 - 19x + 1 = 0$   
(c)  $3x^2 - 19x + 2 = 0$   
(d)  $x^2 + 19x + 1 = 0$
200.  $n \in \mathbb{N}$  then  $n(n+1)(n+2)$  and  $n(n+1)(n+5)$  both are divisible by :
- (a) 5, 4, 2  
(b) 2, 3, 6  
(c) 3, 4, 5  
(d) 5, 3, 2

## BIOLOGY

133. Spirulina belongs to :
- (a) Xanthophyceae  
(b) Cyanophyceae  
(c) Rhodophyceae  
(d) Pheophyceae
134. By the statement 'survival of the fittest', Darwin meant that :
- (a) the strongest of all species survives  
(b) the most intelligent of the species survives  
(c) the cleverest of the species survives  
(d) the most adaptable of the species to changes survives
135. BT-brinjal is an example of transgenic crops. In this, BT refers to :
- (a) Bacillus tuberculosis  
(b) Biotechnology  
(c) Betacarotene  
(d) Bacillus thuringiensis



136. Which of the following is related to humoral immunity ?  
 (a) T-lymphocyte (b) B-lymphocyte  
 (c) I-lymphocyte (d) P-lymphocyte
137. Which one of the following animal phyla does NOT possess a coelom ?  
 (a) Platyhelminthes  
 (b) Annelida  
 (c) Mollusca  
 (d) Echinodermata
138. Which of the following would be in insignificant amount in xylem sap ?  
 (a) Nitrates (b) Phosphates  
 (c) Water (d) Sugar
139. Which of the following two hormones are essential for induced breeding of fishes ?  
 (a) TSH and ACTH  
 (b) Oestrogen and Progesterone  
 (c) FSH and LH  
 (d) Vasopressin and oxytocin
140. Which of the following is the correct pathway for propagation of cardiac impulse ?  
 (a) SA node - AV node - Bundle of His - Purkinje fibers  
 (b) AV node - Bundle of His - SA node - Purkinje fibers  
 (c) SA node - Purkinje fibers - AV node - Bundle of His  
 (d) Purkinje fibers - AV node - SA node - Bundle of His
141. When DNA replication starts ?  
 (a) the hydrogen bonds between the nucleotides of two strands breaks  
 (b) the phosphodiester bonds between the adjacent nucleotides break  
 (c) the bonds between the nitrogen base and deoxyribose sugar break  
 (d) the leading strand produces okazaki fragments
142. What is a genophore ?  
 (a) DNA in prokaryotes  
 (b) DNA and RNA in prokaryotes  
 (c) DNA and protein in prokaryotes  
 (d) RNA in prokaryotes
143. Transpiration facilitates :  
 (a) opening of stomata  
 (b) absorption of water by roots  
 (c) excretion of minerals  
 (d) electrolyte balance
144. The types of ribosomes found in prokaryotic cell are :  
 (a) 100 S (b) 80 S  
 (c) 60 S (d) 70 S
145. The space between the plasma membrane and the cell wall of a plasmolyzed cell surrounded by a hypertonic solution is occupied by the :  
 (a) hypotonic solution  
 (b) isotonic solution  
 (c) hypertonic solution  
 (d) water
146. The single horned Rhinoceros is protected at  
 (a) Kaziranga National Park  
 (b) Kanha National Park  
 (c) Rajiv Gandhi National Park  
 (d) Anashi National Park
147. The part of the brain where the centre for hunger and thirst is located is :  
 (a) Cerebrum  
 (b) Hypothalamus  
 (c) Cerebellum  
 (d) Medulla Oblongata
148. The rosette habit of cabbage can be changed by application of  
 (a) IAA (b) GA  
 (c) ABA (d) Ethaphon
149. The presence of corollary corona, sagittate anthers and dumb-bell shaped stigma are the characteristic features of :  
 (a) *Hibiscus rosa-sinensis*  
 (b) *Musa paradisiaca*  
 (c) *Ravenala madagascariensis*  
 (d) *Catheranthus roseus*
150. The greatest threat to genetic diversity in agricultural crops is :  
 (a) extensive mixed cropping  
 (b) introduction of high yielding varieties  
 (c) extensive use of fertilisers  
 (d) extensive use of insecticides and pesticides

151. Structural lipids of cell membrane are :  
 (a) simple lipids (b) chromolipids  
 (c) steroid (d) phospholipids
152. Longest phase of meiosis is :  
 (a) Prophase I (b) Prophase II  
 (c) Anaphase I (d) Metaphase II
153. Inulin is a polymer of :  
 (a) glucose (b) galactose  
 (c) fructose (d) arabinose
154. Kupffer's cells are :  
 (a) Phagocytic (b) Actin  
 (c) Myosin (d) Fibrin
155. In which stage of the first meiotic division two sister chromatids are formed ?  
 (a) Leptotene (b) Zygotene  
 (c) Pachytene (d) Diplotene
156. In the absence of acrosome, the sperm CANNOT :  
 (a) get energy  
 (b) penetrate the egg  
 (c) swim  
 (d) get food
157. In genetic code, 61 codons code for 20 different types of amino acids. This is called :  
 (a) colinearity (b) commaless  
 (c) degeneracy (d) non-ambiguity
158. In C<sub>4</sub> pathway, the CO<sub>2</sub> fixation in mesophyll cells is carried out by the enzyme :  
 (a) Rubisco  
 (b) PEP carboxylase  
 (c) Pyruvate decarboxylase  
 (d) Pyruvate dehydrogenase
159. In a tissue culture media, the resource of the phytohormone is :  
 (a) agar agar  
 (b) glucose  
 (c) micronutrients  
 (d) coconut milk
160. Glucose and amino acids are reabsorbed in the :  
 (a) proximal tubule  
 (b) distal tubule  
 (c) collecting duct  
 (d) loop of Henle
161. Fertilization occurs in :  
 (a) uterus (b) ureter  
 (c) vagina (d) fallopian tube
162. An animal which has both exoskeletal and endoskeletal structures is  
 (a) tortoise  
 (b) frog  
 (c) jelly fish  
 (d) fresh water mussel
163. How many pairs of contrasting characters in pea pod were chosen by Mendel ?  
 (a) 7 (b) 5  
 (c) 3 (d) 9
164. Gametophyte is the dominant phase in the lifecycle of :  
 (a) Hibiscus (b) Nephrolepis  
 (c) Cycas (d) Funaria
165. Gastrula has a pore which is known as :  
 (a) Gonophore (b) Blastophore  
 (c) Oospore (d) Zoospore
166. In the absence of enterokinase, the digestion of \_\_\_\_\_ would be affected in our intestine.  
 (a) amino acid (b) albumin  
 (c) starch (d) maltose
167. Mitotic stages are NOT observed in :  
 (a) Cosmarium  
 (b) E. coli  
 (c) Saccharomyces  
 (d) Chlorella
168. Which stage of malarial parasite is infective to man ?  
 (a) Gametocyte  
 (b) Merozoite  
 (c) Cryptomerozoite  
 (d) Sporozoite
169. Which one of the following reactions is an example of oxidative decarboxylation ?  
 (a) Conversion of succinate to fumarate  
 (b) Conversion of fumarate to malate  
 (c) Conversion of pyruvate to acetyl CoA  
 (d) Conversion of cit

170. Spindle fibre is made up of :  
 (a) Humulin  
 (b) Intermediate filament  
 (c) Flagellin  
 (d) Tubulin
171. Restriction enzymes are used to cut :  
 (a) single stranded RNA  
 (b) double stranded DNA  
 (c) single stranded DNA  
 (d) double stranded RNA
172. The respiratory quotient during cellular respiration would depend on the :  
 (a) nature of the substrate  
 (b) amount of carbon dioxide released  
 (c) amount of oxygen utilised  
 (d) nature of enzymes involved
173. The name of Smt. Thimmakka is associated with the :  
 (a) planting and conservation of avenue trees  
 (b) agitations against hydroelectric project  
 (c) 'Appiko' movement  
 (d) conservation of fauna and flora of the western ghats
174. When a fresh water protozoan is placed in marine water :  
 (a) the contractile vacuole disappears  
 (b) the contractile vacuole increases in size  
 (c) a number of the contractile vacuoles appear  
 (d) the contractile vacuole remains unchanged
175. Which of the following is a mineralocorticoid ?  
 (a) Testosterone (b) Progesterone  
 (c) Adrenalin (d) Aldosterone
176. Which one of the following is polysaccharide ?  
 (a) Glycogen (b) Sucrose  
 (c) Lactose (d) Maltose
177. Which one of the following is an example of chlorophyllous thallophyte ?  
 (a) Volvariella (b) Spirogyra  
 (c) Nephrolepis (d) Gnetum
178. Hybridoma technique was first discovered by :  
 (a) Kohler and Milstein  
 (b) Robert Koch  
 (c) 'D' Herelle  
 (d) Land Steiner
179. Approximately what percentage of human genome encodes protein ?  
 (a) 2% (b) 25%  
 (c) 90% (d) 99%
180. Cycas belongs to the class  
 (a) Gentopsida (b) Cycadopsida  
 (c) Coniferopsida (d) Sphenopsida
181. Which group is meant for Endemic species of birds ?  
 (a) Nilgiri pipit, Rufous babbler, Lesser-Florican  
 (b) Lesser-Florican, Nilgiri wood pigeon, Malabar parakeet  
 (c) Malabar parakeet, Nilgiri pipit, Rufous babbler  
 (d) Flycatcher, Jungle babbler, Nilgiri pipit
182. Species diversity is responsible for which phenomena ?  
 (a) Process of Evolution  
 (b) Speciation  
 (c) For alternative types (allele) of gene  
 (d) For stability and normal function of Ecosystem
183. Flax fibre is obtained from  
 (a) *Cannabis sativa*  
 (b) *Crotalaria juncea*  
 (c) *Cocos nucifera*  
 (d) *Linum usitatissimum*
184. An embryo may sometimes develop from cell of an embryo sac other than egg is called :  
 (a) apospory  
 (b) parthenogenesis  
 (c) parthenocarpy  
 (d) apogamy

185. The roots which develop from any portion of the plant EXCEPT the radical are known as :
- tap roots
  - stilt roots
  - fibrous roots
  - adventitious roots
186. Angiosperms differ from gymnosperms :
- being ever green
  - being smaller size
  - having compound leaves.
  - having ovules enclosed in ovary
187. Osteomalacia is a deficiency disease of :
- infants due to protein energy malnutrition
  - adults due to protein energy malnutrition
  - adults due to vitamin D deficiency
  - infants due to vitamin K deficiency
188. The function of vitamin K is in :
- regulation of Ca and P metabolism.
  - carbohydrate metabolism
  - blood clotting
  - respiration
189. Liver is characterized by presence of :
- Glisson's capsule
  - Kupffer's cells
  - Both (a) and (b)
  - None of these
190. Vertebral column is derived from :
- Dorsal nerve cord
  - Ventral nerve cord
  - Notochord
  - Outgrowth
191. *Cosmopolites stordidus* is the pest of :
- sugarcane
  - jowar
  - banana
  - cotton
192. The sterile male technique comes under \_\_\_\_\_ control.
- chemical
  - mechanical
  - biological
  - autocidal
193. \_\_\_\_\_ is the resinous material collected from trees.
- Royal jelly
  - Honey
  - Propolis
  - Venom
194. When colony is in danger worker bee performs :
- circular dance
  - wriggle dance
  - DVAV
  - alarm dance
195. Number of flower visited per minute is called as :
- Foraging rate
  - Foraging speed
  - Foraging flow
  - Foraging
196. Mammary glands are modified :
- Sebaceous glands
  - Sudorific glands / Sweat
  - Cutaneous glands
  - Scant glands
197. Hair, nails, hoofs and horns are formed with the help of protein, known as :
- Keratin
  - Globulin
  - Chitin
  - Histone
198. The poison glands of poisonous snake are modified :
- Buccal glands
  - Palantine glands
  - Salivary glands
  - Lacrymal glands
199. Sex-linked genes refers to :
- present in a particular sex
  - controlling secondary sexual characters
  - controlling both primary and secondary sexual characters
  - present on sex chromosomes
200. Clover-leaf model of tRNA was proposed by
- Khorana
  - Lederberg
  - Nirenberg
  - Holley