

# SOLVED PAPER

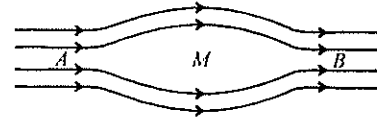
## AIIMS - 2010

Time : 3½ Hours

Max. Marks : 200

### PHYSICS

1. Transmission lines transmit a voltage of  $V$  volt to our houses from power stations, then the power  $P$  supplied by them is proportional to
  - (a)  $\frac{1}{V}$
  - (b)  $V$
  - (c)  $V^2$
  - (d)  $\frac{1}{V^2}$
2. Whenever a stream of electrons collides with a stream of photons, in this collision, which of the following is not conserved?
  - (a) Linear momentum
  - (b) Total energy
  - (c) No. of photons
  - (d) No. of electrons
3. The logic gate represented in following figure is
 
  - (a) OR Gate
  - (b) NOT Gate
  - (c) NAND Gate
  - (d) XOR Gate
4. For a person near point of vision is 100 cm. Then the power of lens he must wear so as to have normal vision, should be
  - (a) +1 D
  - (b) -1 D
  - (c) +3 D
  - (d) -3 D
5. Two projectiles of same mass have their maximum kinetic energies in ratio 4 : 1 and ratio of their maximum heights is also 4 : 1 then what is the ratio of their ranges ?
  - (a) 2 : 1
  - (b) 4 : 1
  - (c) 8 : 1
  - (d) 16 : 1
6. An uncharged particle is moving with a velocity of  $\vec{v}$  in non-uniform magnetic field as shown.



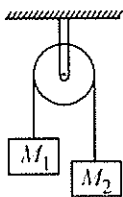
Velocity  $\vec{v}$  would be

- (a) Maximum at A & B
  - (b) Minimum at A & B
  - (c) Maximum at M
  - (d) Same at all points
7. Which of the following is true regarding diamagnetic substances (symbols have their usual meaning)
    - (a)  $\mu_r > 1, \chi_m > 1$
    - (b)  $\mu_r > 1, \chi_m < 1$
    - (c)  $\mu_r < 1, \chi_m < 0$
    - (d)  $\mu_r < 1, \chi_m > 0$
  8. What is moment of inertia of a cylinder of radius  $r$ , along its height ?
    - (a)  $mr^2$
    - (b)  $\frac{mr^2}{2}$
    - (c)  $\frac{2mr^2}{5}$
    - (d)  $\frac{mr^2}{5}$
  9. A uniform string is vibrating with a fundamental frequency ' $f$ '. The new frequency, if radius & length both are doubled would be
    - (a)  $2f$
    - (b)  $3f$
    - (c)  $\frac{f}{4}$
    - (d)  $\frac{f}{3}$
  10. Two spherical soap bubbles of radii  $a$  and  $b$  in vacuum coalesce under isothermal conditions. The resulting bubbles has a radius given by
    - (a)  $\frac{(a+b)}{2}$
    - (b)  $\frac{ab}{a+b}$
    - (c)  $\sqrt{a^2+b^2}$
    - (d)  $a+b$
  11. What would be the voltage across  $C_3$ ?
 

- (a)  $\frac{(C_1+C_2)V}{C_1+C_2+C_3}$
    - (b)  $\frac{C_1V}{C_1+C_2+C_3}$

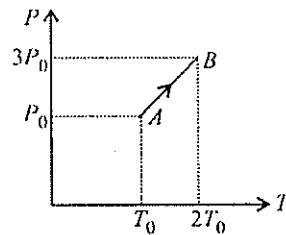
(c)  $\frac{C_2 V}{C_2 + C_2 + C_3}$   
 (d)  $\frac{C_3 V}{C_1 + C_2 + C_3}$

12. What would be maximum wavelength for Brackett series of hydrogen-spectrum?  
 (a) 74583 Å (b) 22790 Å  
 (c) 40519 Å (d) 18753 Å
13. What would be the radius of second orbit of He<sup>+</sup> ion?  
 (a) 1.058 Å (b) 3.023 Å  
 (c) 2.068 Å (d) 4.458 Å
14. The position of a particle moving in the  $x$ - $y$  plane at any time  $t$  is given by;  $x = (3t^3 - 6t)$  metres;  $y = (t^2 - 2t)$  metres. Select the correct statement.  
 (a) acceleration is zero at  $t = 0$   
 (b) velocity is zero at  $t = 0$   
 (c) velocity is zero at  $t = 1$ s  
 (d) velocity and acceleration of the particle are never zero.
15. Two masses  $M_1 = 5$  kg and  $M_2 = 10$  kg are connected at the ends of an inextensible string passing over a frictionless pulley as shown. When the masses are released, then the acceleration of the masses will be

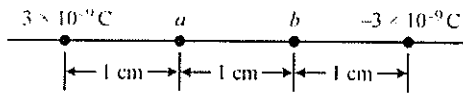


- (a)  $g$  (b)  $g/2$   
 (c)  $g/3$  (d)  $g/4$
16. A block of mass  $m$  is pulled along a horizontal surface by applying a force at an angle  $\theta$  with the horizontal. If the block travels with a uniform velocity and has a displacement  $d$  and the coefficient of friction is  $\mu$ , then the work done by the applied force is  
 (a)  $\frac{\mu mgd}{\cos \theta + \mu \sin \theta}$  (b)  $\frac{\mu mgd \cos \theta}{\cos \theta + \mu \sin \theta}$   
 (c)  $\frac{\mu mgd \sin \theta}{\cos \theta + \mu \sin \theta}$  (d)  $\frac{\mu mgd \cos \theta}{\cos \theta - \mu \sin \theta}$

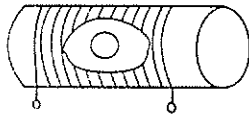
17. Pressure versus temperature graph of an ideal gas is as shown in figure. Density of the gas at point  $A$  is  $\rho_0$ . Density at point  $B$  will be



- (a)  $\frac{3}{4}\rho_0$  (b)  $\frac{3}{2}\rho_0$   
 (c)  $\frac{4}{3}\rho_0$  (d)  $2\rho_0$
18. The latent heat of vaporisation of a substance is always  
 (a) greater than its latent heat of fusion  
 (b) greater than its latent heat of sublimation  
 (c) equal to its latent heat of sublimation  
 (d) less than its latent heat of fusion
19. A reversible engine converts one-sixth of the heat input into work. When the temperature of the sink is reduced by 62°C, the efficiency of the engine is doubled. The temperatures of the source and sink are  
 (a) 99°C, 37°C (b) 80°C, 37°C  
 (c) 95°C, 37°C (d) 90°C, 37°C
20. Graph of specific heat at constant volume for a monoatomic gas is  
 (a) (b)   
 (c) (d)
21. In figure, a particle having mass  $m = 5$  g and charge  $q' = 2 \times 10^{-9}$  C starts from rest at point  $a$  and moves in a straight line to point  $b$ . What is its speed  $v$  at point  $b$ ?



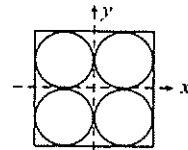
- (a)  $2.65 \text{ cms}^{-1}$                       (b)  $3.65 \text{ cms}^{-1}$   
 (c)  $4.65 \text{ cms}^{-1}$                       (d)  $5.65 \text{ cms}^{-1}$
22. A galvanometer has a current sensitivity of 1 mA per division. A variable shunt is connected across the galvanometer and the combination is put in series with a resistance of  $500 \Omega$  and cell of internal resistance  $1 \Omega$ . It gives a deflection of 5 division for shunt of 5 ohm and 20 division for shunt of 25 ohm. The emf of cell is
- (a) 47.1 V                                  (b) 57.1 V  
 (c) 67.1 V                                  (d) 77.1 V
23. A circular coil with a cross-sectional area of  $4 \text{ cm}^2$  has 10 turns. It is placed at the center of a long solenoid that has 15 turns/cm and a cross-sectional area of  $10 \text{ cm}^2$ , as shown in the figure. The axis of the coil coincides with the axis of the solenoid. What is their mutual inductance ?



- (a)  $7.54 \mu\text{H}$                               (b)  $8.54 \mu\text{H}$   
 (c)  $9.54 \mu\text{H}$                               (d)  $10.54 \mu\text{H}$
24. If  $K_1$  and  $K_2$  are maximum kinetic energies of photoelectrons emitted when lights of wavelengths  $\lambda_1$  and  $\lambda_2$  respectively incident on a metallic surface. If  $\lambda_1 = 3\lambda_2$ , then
- (a)  $K_1 > (K_2/3)$                       (b)  $K_1 < (K_2/3)$   
 (c)  $K_1 = 2K_2$                               (d)  $K_2 = 2K_1$
25. Two radioactive substances  $A$  and  $B$  have decay constants  $5\lambda$  and  $\lambda$  respectively. At  $t = 0$ , they have the same number of nuclei. The ratio of number of nuclei of  $A$  to those of  $B$  will be  $(1/e^2)$  after a time
- (a)  $4\lambda$                                       (b)  $2\lambda$   
 (c)  $\frac{1}{2\lambda}$                                       (d)  $\frac{1}{4\lambda}$
26. The intensity of gamma radiation from a given source is  $I$ . On passing through 36 mm of lead, it is reduced to  $I/8$ . The thickness of lead which will reduce the intensity to  $I/2$  will be

- (a) 18 mm                                  (b) 12 mm  
 (c) 6 mm                                    (d) 9 mm

27. An electric charge  $10^{-3} \mu\text{C}$  is placed at the origin  $(0, 0)$  of  $(x-y)$  co-ordinate system. Two points  $A$  and  $B$  are situated at  $(\sqrt{2}, \sqrt{2})$  and  $(2, 0)$  respectively. The potential difference between the points  $A$  and  $B$  will be
- (a) 4.5 volt                                  (b) 9 volt  
 (c) zero                                      (d) 2 volt
28. If the energy,  $E = G^p h^q c^r$ , where  $G$  is the universal gravitational constant,  $h$  is the Planck's constant and  $c$  is the velocity of light, then the values of  $p$ ,  $q$  and  $r$  are, respectively
- (a)  $-1/2, 1/2$  and  $5/2$  (b)  $1/2, -1/2$  and  $-5/2$   
 (c)  $-1/2, 1/2$  and  $3/2$  (d)  $1/2, -1/2$  and  $-3/2$
29. Four holes of radius  $R$  are cut from a thin square plate of side  $4R$  and mass  $M$ . The moment of inertia of the remaining portion about  $z$ -axis is



- (a)  $\frac{\pi}{12} MR^2$                               (b)  $\left(\frac{4}{3} - \frac{\pi}{4}\right) MR^2$   
 (c)  $\left(\frac{4}{3} - \frac{\pi}{6}\right) MR^2$                       (d)  $\left(\frac{8}{3} - \frac{10\pi}{16}\right) MR^2$
30. A liquid is kept in a cylindrical vessel which is being rotated about a vertical axis through the centre of the circular base. If the radius of the vessel is  $r$  and angular velocity of rotation is  $\omega$ , then the difference in the heights of the liquid at the centre of the vessel and the edge is
- (a)  $\frac{r\omega}{2g}$                                       (b)  $\frac{r^2\omega^2}{2g}$   
 (c)  $\sqrt{2gr}\omega$                               (d)  $\frac{\omega^2}{2gr^2}$
31. A block of mass 10 kg is moving in  $x$ -direction with a constant speed of 10 m/s. It is subjected to a retarding force  $F = 0.1x$  joule/metre during its travel from  $x = 20 \text{ m}$  to  $x = 30 \text{ m}$ . Its final K.E. will be
- (a) 475 J                                      (b) 450 J  
 (c) 275 J                                      (d) 250 J

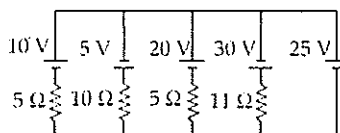
32. A capillary tube of radius  $r$  is immersed in water and water rises in it to a height  $h$ . The mass of water in the capillary tube is 5 g. Another capillary tube of radius  $2r$  is immersed in water. The mass of water that will rise in this tube is
- (a) 2.5 g (b) 5.0 g  
(c) 10 g (d) 20 g

33. Which of the following pairs does not have same dimensions ?
- (a) impulse and momentum  
(b) moment of inertia and moment of force  
(c) angular momentum and Planck's constant  
(d) work and torque.

34. The wavelength of Lyman series for first number is

- (a)  $\frac{4 \times 1.097 \times 10^7}{3}$  m (b)  $\frac{3}{4 \times 1.097 \times 10^7}$  m  
(c)  $\frac{4}{3 \times 1.097 \times 10^7}$  m (d)  $\frac{3}{4} \times 1.097 \times 10^7$  m

35. In the circuit shown, current flowing through 25 V cell is



- (a) 7.2 A (b) 10 A  
(c) 12 A (d) 14.2 A
36. Five sinusoidal waves have the same frequency 500 Hz but their amplitudes are in the ratio  $2 : \frac{1}{2} : \frac{1}{2} : 1 : 1$  and their phase angles  $0, \frac{\pi}{6}, \frac{\pi}{3}, \frac{\pi}{2}$  and  $\pi$  respectively. The phase angle of resultant wave obtained by the superposition of these five waves is
- (a)  $30^\circ$  (b)  $45^\circ$   
(c)  $60^\circ$  (d)  $90^\circ$
37. The second overtone of an open pipe has the same frequency as the first overtone of a closed pipe 2 m long. The length of the open pipe is
- (a) 8 m (b) 4 m  
(c) 2 m (d) 1 m
38. Let  $T_1$  and  $T_2$  be the time periods of springs A and B when mass  $M$  is suspended from one end of each

spring. If both springs are taken in series and the same mass  $M$  is suspended from the series combination, the time period is  $T$ , then

- (a)  $T_1 + T_2 + T_3$  (b)  $\frac{1}{T} = \frac{1}{T_1} + \frac{1}{T_2}$   
(c)  $T^2 = T_1^2 + T_2^2$  (d)  $\frac{1}{T^2} = \frac{1}{T_1^2} + \frac{1}{T_2^2}$

39. Alternating current cannot be measured by D.C. ammeter because
- (a) A.C. cannot pass through D.C. ammeter  
(b) A.C. changes direction  
(c) average value of current for complete cycle is zero  
(d) D.C. ammeter will get damaged
40. The core of any transformer is laminated so as to
- (a) reduce the energy loss due to eddy currents  
(b) make it light weight  
(c) make it robust & strong  
(d) increase the secondary voltage

**Directions :** In the following questions (41-60), a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion  
(b) If both assertion and reason are true but reason is not the correct explanation of assertion  
(c) If assertion is true but reason is false  
(d) If both assertion and reason are false.
41. **Assertion :** Two balls of different masses are thrown vertically upward with same speed. They will pass through their point of projection in the downward direction with the same speed.  
**Reason :** The maximum height and downward velocity attained at the point of projection are independent of the mass of the ball.
42. **Assertion :** In javelin throw, the athlete throws the projectile at an angle slightly more than  $45^\circ$ .  
**Reason :** The maximum range does not depend upon angle of projection.

43. **Assertion** : The apparent weight of a body in an elevator moving with some downward acceleration is less than the actual weight of a body.  
**Reason** : The part of the weight is spent in producing downward acceleration, when body is in elevator.
44. **Assertion** : An electric field is preferred in comparison to magnetic field for detecting the electron beam in a television picture tube.  
**Reason** : Electric field requires low voltage.
45. **Assertion** : A horse has to pull a cart harder during the first few steps of his motion.  
**Reason** : The first few steps are always difficult.
46. **Assertion** : The magnetic poles of earth do not coincide with the geographic poles.  
**Reason** : The discrepancy between the orientation of a compass and true north-south direction is known as magnetic declination.
47. **Assertion** : Electromagnetic waves are transverse in nature  
**Reason** : The electric and magnetic fields of an e.m. wave are perpendicular to each other and also perpendicular to the direction of wave propagation.
48. **Assertion** : A wheel moving down a perfectly frictionless inclined plane will undergo slipping (not rolling motion)  
**Reason** : For perfect rolling motion, work done against friction is zero.
49. **Assertion** : A hollow shaft is found to be stronger than a solid shaft made of same material.  
**Reason** : The torque required to produce a given twist in hollow cylinder is greater than that required to twist a solid cylinder of same size and material.
50. **Assertion** : Water kept in an open vessel will quickly evaporate on the surface of the moon.  
**Reason** : The temperature at the surface of the moon is much higher than boiling point of water.
51. **Assertion** : A pure semiconductor has negative temperature coefficient of resistance.  
**Reason** : On raising the temperature, more charge carriers are released, conductance increases and resistance decreases.
52. **Assertion** : At a fixed temperature, silicon will have a minimum conductivity when it has a smaller acceptor doping.  
**Reason** : The conductivity of an intrinsic semiconductor is slightly higher than that of a lightly doped  $p$ -type
53. **Assertion** : Communication in UHF/VHF regions can be established by space wave or tropospheric wave.  
**Reason** : Communication in UHF/VHF regions is limited to line of sight distance.
54. **Assertion** : If objective and eye lenses of a microscope are interchanged then it can work as telescope.  
**Reason** : The objective lens of telescope has small focal length.
55. **Assertion** : If a proton and an  $\alpha$ -particle enter a uniform magnetic field perpendicularly with the same speed, the time period of revolution of  $\alpha$ -particle is double that of proton.  
**Reason** : In a magnetic field, the period of revolution of a charged particle is directly proportional to the mass of the particle and is inversely proportional to charge of particle.
56. **Assertion** : If momentum of a body increases by 50%, its kinetic energy will increase by 125%.  
**Reason** : Kinetic energy is proportional to square of velocity.

57. **Assertion** : The difference in the value of acceleration due to gravity at pole and equator is proportional to square of angular velocity of earth.

**Reason** : The value of acceleration due to gravity is minimum at the equator and maximum at the pole.

58. **Assertion** : It is advantageous to transmit electric power at high voltage.

**Reason** : High voltage implies high current.

59. **Assertion** : X-ray astronomy is possible only from satellites orbiting the earth.

**Reason** : Efficiency of X-rays telescope is large as compared to any other telescope.

60. **Assertion** : The de Broglie equation has significance for any microscopic or sub-microscopic particles.

**Reason** : The de Broglie wavelength inversely proportional to the mass of the object if velocity is constant.

### CHEMISTRY

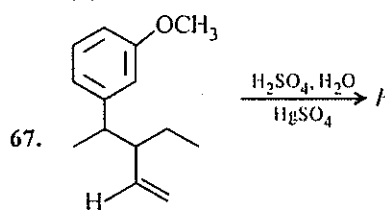
61. Butter is an example of which type of colloid?  
 (a) Solid in liquid (b) Liquid in solid  
 (c) Liquid in liquid (d) Gas in liquid.
62. What are constituents of 'Mischmetal'?  
 (a) La, Fe (b) La, Ce  
 (c) Fe, Ce (d) Ce, Cu
63. For a 1<sup>st</sup> order reaction if concentration is doubled then rate of reaction becomes  
 (a) doubles (b) half  
 (c) four times (d) remains same.
64. In tetragonal crystal system, which of following is not true?  
 (a) All axial lengths and all axial angles are equal.  
 (b) All three axial lengths are equal.  
 (c) All three axial angles are equal.  
 (d) Two axial angles are equal but the third is different.
65. Which of the following is correct?  
 (a) Ionic radius is proportional to atomic number.  
 (b) Ionic radius is inversely proportional to atomic mass.

(c) Ionic radius is inversely proportional to effective nuclear charge.

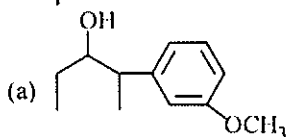
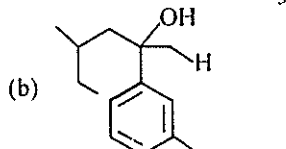
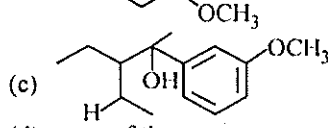
(d) All are correct.

66. The strained tetracyclic alkane is isomerize thermally to the cyclic alkene. The reaction involves

- (a) free radical (b) carbocation  
 (c) carbanion (d) carbene.



The product P is

- (a) 
- (b) 
- (c) 
- (d) none of these.

68. For a reaction  $X \longrightarrow Y$ , the graph of the product concentration ( $x$ ) versus time ( $t$ ) came out to be a straight line passing through the origin. Hence

the graph of  $\frac{-d[X]}{dt}$  and time would be

- (a) straight line with a negative slope and an intercept on y-axis  
 (b) straight line with a positive slope and an intercept on y-axis  
 (c) a straight line parallel to x-axis  
 (d) a hyperbola.
69. A factory produces 40 kg of calcium in two hours by electrolysis. How much aluminium can be produced by same current in 2 hours if current efficiency is 50%?  
 (a) 22 kg (b) 18 kg  
 (c) 9 kg (d) 27 kg.

70. Equal weight of CO and CH<sub>4</sub> are mixed together in an empty container at 300 K. The fraction of total pressure exerted by CH<sub>4</sub> is

- (a)  $\frac{16}{17}$  (b)  $\frac{7}{11}$   
 (c)  $\frac{8}{9}$  (d)  $\frac{5}{16}$

71. Match list I with list II and select the correct answer using the codes given below the lists.

	List I Metal ion		List II Magnetic moment(BM)
A.	Cr <sup>3+</sup>	1.	$\sqrt{35}$
B.	Fe <sup>2+</sup>	2.	$\sqrt{30}$
C.	Ni <sup>2+</sup>	3.	$\sqrt{24}$
D.	Mn <sup>2+</sup>	4.	$\sqrt{15}$
		5.	$\sqrt{8}$

**Codes**

- (a) A-1, B-3, C-5, D-4  
 (b) A-2, B-3, C-5, D-1  
 (c) A-4, B-3, C-5, D-1  
 (d) A-4, B-5, C-3, D-1
72. Which of the following reactions does not yield an amine?
- (a)  $R-X + NH_3 \longrightarrow$   
 (b)  $R-CH=NOH + [H] \xrightarrow{Na/C_2H_5OH}$   
 (c)  $R-CN + H_2O \xrightarrow{H^+}$   
 (d)  $R-CONH_2 \xrightarrow{LiAlH_4}$
73. The chemical name for melamine is
- (a) 1,3,5-Triamino-2,4,6-triazine  
 (b) 2,4,6-Triamino-1,3,5-triazine  
 (c) 2-Amino-1,3,5-triazine  
 (d) 2,4-Diamino-1,3,5-triazine.
74. Bromine is added to cold dilute aqueous solution of NaOH. The mixture is boiled. Which of the following statements is not true?
- (a) During the reaction bromine is present in four different oxidation states.  
 (b) The greatest difference between the various oxidation states of bromine is 5.  
 (c) On acidification of the final mixture bromine is formed.  
 (d) Disproportionation of bromine occurs during the reaction.

75. A complex PtCl<sub>4</sub>.5NH<sub>3</sub> shows a molar conductance of 402 ohm<sup>-1</sup> cm<sup>2</sup> mol<sup>-1</sup> in water and precipitates three moles of AgCl with AgNO<sub>3</sub> solution. The formula of the complex is

- (a) [Pt(NH<sub>3</sub>)<sub>6</sub>]Cl<sub>4</sub> (b) [Pt(NH<sub>3</sub>)<sub>4</sub>Cl<sub>2</sub>]Cl<sub>2</sub>  
 (c) [Pt(NH<sub>3</sub>)<sub>5</sub>Cl]Cl<sub>3</sub> (d) [Pt(NH<sub>3</sub>)<sub>3</sub>Cl<sub>3</sub>]Cl.

Electrolyte	KCl	KNO <sub>3</sub>	HCl	NaOAc	NaCl
$\Lambda^\infty$ (S cm <sup>2</sup> mol <sup>-1</sup> )	149.9	145.0	426.2	91.0	126.5

76.

Calculate  $\Lambda^\infty_{HOAc}$  using appropriate molar conductances of the electrolytes listed above at infinite dilution in H<sub>2</sub>O at 25°C.

- (a) 517.2 (b) 552.7  
 (c) 390.7 (d) 217.5

77. In the ground state of Cu<sup>+</sup>, the number of shells occupied, subshells occupied, filled orbitals and unpaired electrons respectively are

- (a) 4, 8, 15, 0 (b) 3, 6, 15, 1  
 (c) 3, 6, 14, 0 (d) 4, 7, 14, 2

78. Which of the following conditions is not correct for resonating structures?

- (a) The contributing structures must have the same number of unpaired electrons.  
 (b) The contributing structures should have similar energies.  
 (c) The contributing structures should be so written that unlike charges reside on atoms that are far apart.  
 (d) The positive charge should be present on the electropositive element and the negative charge on the electronegative element.

79. CaO and NaCl have the same crystal structure and approximately the same ionic radii. If  $U$  is the lattice energy of NaCl, the approximate lattice energy of CaO is

- (a)  $U/2$  (b)  $U$   
 (c)  $2U$  (d)  $4U$

80. The phosphate of a metal has the formula  $MHPO_4$ . The formula of its chloride would be

- (a)  $MCl$  (b)  $MCl_2$   
 (c)  $MCl_3$  (d)  $M_2Cl_3$

81. Two flasks  $X$  and  $Y$  have capacity 1L and 2L respectively and each of them contains 1 mole of a gas. The temperatures of the flasks are so adjusted that average speed of molecules in  $X$  is

twice as those in  $Y$ . The pressure in flask  $X$  would be

- (a) same as that in  $Y$  (b) half of that in  $Y$   
(c) twice of that in  $Y$  (d) 8 times of that in  $Y$ .

82. Match List I with List II and select the correct answer using the codes given below the lists:

List I		List II	
A.	$\left(\frac{\delta G}{\delta P}\right)_T$	1.	$\mu_{JT}$
B.	$\left(\frac{\delta G}{\delta T}\right)_P$	2.	$T$
C.	$\left(\frac{\delta H}{\delta S}\right)_P$	3.	$-S$
D.	$\left(\frac{\delta T}{\delta P}\right)_H$	4.	$P$

	A	B	C	D
(a)	5	1	2	4
(b)	5	3	2	4
(c)	3	5	2	1
(d)	5	3	2	1

83. What is the pH of 0.01 M glycine solution?

For glycine  $K_{a_1} = 4.5 \times 10^{-3}$  and  $K_{a_2} = 1.7 \times 10^{-10}$  at 298 K.

- (a) 3.0 (b) 10.0  
(c) 7.06 (d) 8.2

84. Which of the following sequence contains atomic number of only representative elements?

- (a) 55, 12, 48, 53 (b) 13, 33, 54, 80  
(c) 3, 33, 53, 87 (d) 22, 33, 55, 66.

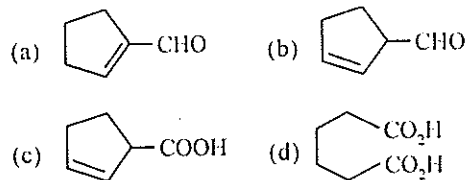
85. 100 cm<sup>3</sup> of a given sample of H<sub>2</sub>O<sub>2</sub> gives 1000 cm<sup>3</sup> of O<sub>2</sub> at S.T.P. The given sample is

- (a) 10% H<sub>2</sub>O<sub>2</sub> (b) 90% H<sub>2</sub>O<sub>2</sub>  
(c) 10 volume H<sub>2</sub>O<sub>2</sub> (d) 100 volume H<sub>2</sub>O<sub>2</sub>

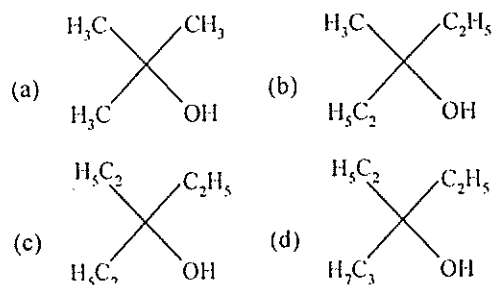
86. Beryllium and aluminium exhibit many properties which are similar. But the two elements differ in

- (a) maximum covalency in compounds  
(b) exhibiting amphoteric nature in their oxides  
(c) forming covalent halides  
(d) forming polymeric hydrides

87. Cyclohexene on ozonolysis followed by reaction with zinc dust and water gives compound  $E$ . Compound  $E$  on further treatment with aqueous KOH yields compound  $F$ . Compound  $F$  is



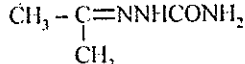
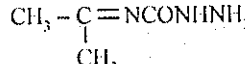
88. Ethyl ester  $\xrightarrow[\text{excess}]{\text{CH}_3\text{MgBr}}$   $P$ . The product  $P$  will be



89. The compound which on reaction with aqueous nitrous acid at low temperature produces an oily nitrosoamine is

- (a) methyl amine (b) ethyl amine  
(c) diethyl amine (d) triethyl amine

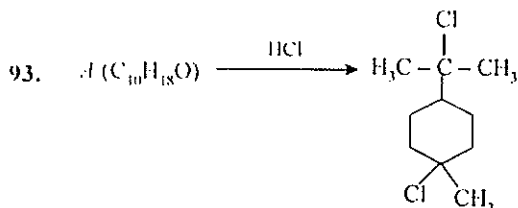
90. Compound  $A$  (molecular formula C<sub>3</sub>H<sub>8</sub>O) is treated with acidified potassium dichromate to form a product  $B$  (molecular formula C<sub>3</sub>H<sub>6</sub>O).  $B$  forms a shining silver mirror on warming with ammoniacal silver nitrate.  $B$  when treated with an aqueous solution of H<sub>2</sub>NCONHNH<sub>2</sub>, HCl and sodium acetate gives a product  $C$ . Identify the structure of  $C$ .

- (a) CH<sub>3</sub>CH<sub>2</sub>CH = NNHCONH<sub>2</sub>  
(b)   
(c)   
(d) CH<sub>3</sub>CH<sub>2</sub>CH = NCONHNH<sub>2</sub>

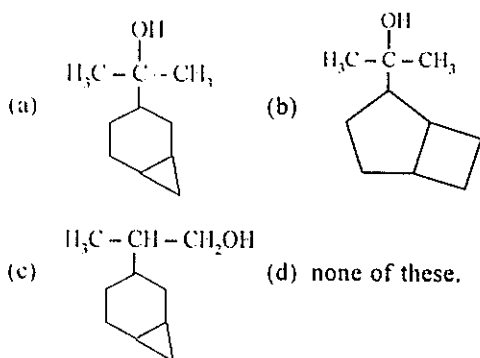
91. Assume that you are travelling at a speed of 90 km/h in a small car with a mass of 1050 kg. If the uncertainty in the velocity of the car is 1% ( $\Delta v = 0.9$  km/h), what is the uncertainty (in meters) in the position of the car?



- (a)  $\Delta x \geq 1 \times 10^{-35}$  m (b)  $\Delta x \geq 2 \times 10^{-37}$  m  
 (c)  $\Delta x \geq 2 \times 10^{-36}$  m (d)  $\Delta x \geq 4 \times 10^{-38}$  m
92. When 25 g of  $\text{Na}_2\text{SO}_4$  is dissolved in  $10^3$  kg of solution, its concentration will be  
 (a) 2.5 ppm (b) 25 ppm  
 (c) 250 ppm (d) 100 ppm

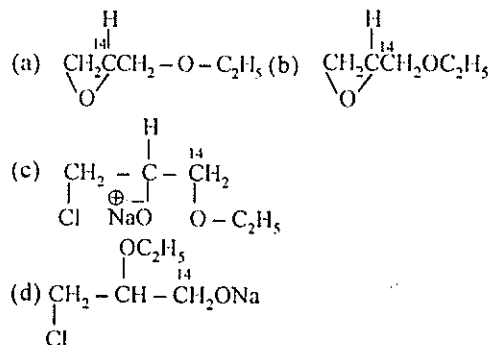
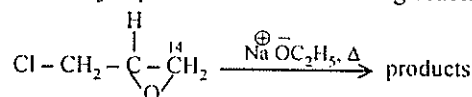


Degree of unsaturation of  $A = 2$ , it contains no double or triple bonds.



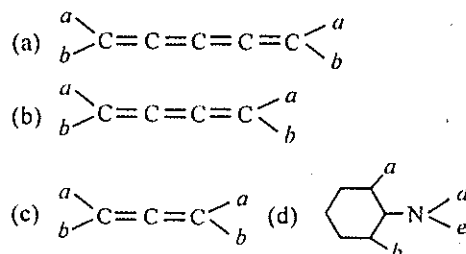
94. The shape and hybridisation of some xenon oxyfluorides are given. Choose the wrong set.  
 (a)  $\text{XeOF}_2$  - T-Shape -  $sp^3d$   
 (b)  $\text{XeOF}_4$  - Square pyramidal -  $sp^3d^2$   
 (c)  $\text{XeO}_2\text{F}_2$  - Distorted trigonal bipyramidal -  $sp^3d$   
 (d)  $\text{XeO}_3\text{F}_2$  - Octahedral -  $sp^3d$
95. The standard half-cell reduction potential for  $\text{Ag}^+|\text{Ag}$  is 0.7991 V at  $25^\circ\text{C}$ . Given the experimental value  $K_{sp} = 1.56 \times 10^{-10}$  for  $\text{AgCl}$ , calculate the standard half-cell reduction potential for the  $\text{Ag}|\text{AgCl}$  electrode.  
 (a) 0.2192 V (b) -0.2192 V  
 (c) -1.2192 V (d) 1.2192 V
96. Which of the following acids will not evolve  $\text{H}_2$  gas on reaction with alkali metals?  
 (a) hydrazoic acid (b) perxenic acid  
 (c) boric acid (d) none of these

97. The major product of the following reaction is



98. Stomach acid, a dilute solution of  $\text{HCl}$  in water, can be neutralized by reaction with sodium hydrogen carbonate,  
 $\text{NaHCO}_3(aq) + \text{HCl}(aq) \rightarrow \text{NaCl}(aq) + \text{H}_2\text{O}(l) + \text{CO}_2(g)$   
 How many milliliters of 0.125 M  $\text{NaHCO}_3$  solution are needed to neutralize 18.0 mL of 0.100 M  $\text{HCl}$ ?  
 (a) 14.4 mL (b) 12.0 mL  
 (c) 14.0 mL (d) 13.2 mL
99. For the electrochemical cell,  $M | M^+ || X^- | X$ ,  $E^\circ(M^+|M) = 0.44$  V and  $E^\circ(X|X^-) = 0.33$  V. From this data one can deduce that  
 (a)  $M + X \rightarrow M^+ + X^-$  is the spontaneous reaction  
 (b)  $M^+ + X^- \rightarrow M + X$  is the spontaneous reaction  
 (c)  $E_{\text{cell}} = 0.77$  V (d)  $E_{\text{cell}} = -0.77$  V

100. Which is optically inactive?



Directions : In the following questions (101-120), a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion  
 (b) If both assertion and reason are true but reason is not the correct explanation of assertion

- (c) If assertion is true but reason is false  
 (d) If both assertion and reason are false.

101. **Assertion** : Magnesium is extracted by the electrolysis of fused mixture of  $MgCl_2$ ,  $NaCl$  and  $CaCl_2$ .  
**Reason** : Calcium chloride acts as a reducing agent.
102. **Assertion** : The equilibrium constant is fixed and a characteristic for any given chemical reaction at a specified temperature.  
**Reason** : The composition of the final equilibrium mixture at a particular temperature depends upon the starting amount of reactants.
103. **Assertion** :  $PCl_5$  is covalent in gaseous and liquid states but ionic in solid state.  
**Reason** :  $PCl_5$  in solid state consists of tetrahedral  $PCl_4^+$  cation and octahedral  $PCl_6^-$  anion.
104. **Assertion** : Zinc displaces copper from copper sulphate solution.  
**Reason** : The  $E^\circ$  of zinc is  $-0.76$  V and that of copper is  $+0.34$  V.
105. **Assertion** :  $CH_2=C(CH_2COOC_2H_5)COOH$  is 3-carbethoxy-2-butenoic acid.  
**Reason** : Principal functional group gets lowest number followed by double bond or triple bond.
106. **Assertion** : Helium has the highest value of ionisation energy among all the elements known.  
**Reason** : Helium has the highest value of electron affinity among all the elements known.
107. **Assertion** : The nuclear isomers are the atoms with the same atomic number and same mass number, but with different radioactive properties.  
**Reason** : The nucleus in the excited state will evidently have a different half-life as compared to that in the ground state.
108. **Assertion** : Conductivity of silicon increases by doping it with group-15 elements.  
**Reason** : Doping means introduction of small amount of impurities like P, As or Bi into the pure crystal.
109. **Assertion** : The overall order of the reaction is the sum of the exponents of all the reactants in the rate expression.  
**Reason** : There are many higher order reactions.
110. **Assertion** : Transition metals are poor reducing agents.  
**Reason** : Transition metals form numerous alloys with other metals.
111. **Assertion** : Aldol condensation can be catalysed both by acids and bases.  
**Reason** :  $\beta$ -Hydroxy aldehydes or ketones readily undergo acid catalysed dehydration.
112. **Assertion** : The position of an element in periodic table after emission of one  $\alpha$ - and two  $\beta$ - particles remains unchanged.  
**Reason** : Emission of one  $\alpha$ - and two  $\beta$ -particles give isotope of the element which acquires same position in periodic table.
113. **Assertion** : S.I. unit of atomic mass and molecular mass is kilograms.  
**Reason** : Atomic mass is equal to the mass of  $6.023 \times 10^{24}$  atoms.
114. **Assertion** : Bond energy and bond dissociation energy have identical value for diatomic molecules.  
**Reason** : Greater the bond dissociation energy, less reactive is the bond.
115. **Assertion** : The degree of complex formation in actinides decreases in the order  $M^{4+} > MO_2^{2+} > M^{3+} > MO_2^+$ .  
**Reason** : Actinides form complexes with  $\pi$ -bonding ligands such as alkyl phosphines and thioethers.
116. **Assertion** : Benzene on heating with conc.  $H_2SO_4$  gives benzenesulphonic acid which when heated with superheated steam under pressure gives benzene.

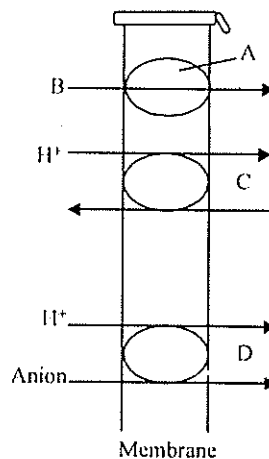
- Reason** : Sulphonation is a reversible process.
117. **Assertion** : The molality of the solution does not change with change in temperature.
- Reason** : The molality is expressed in units of moles per 1000 g of solvent.
118. **Assertion** : Due to Frenkel defect, density of the crystalline solid decreases.
- Reason** : In Frenkel defect, cation or anion leaves the crystal.
119. **Assertion** :  $\left[ (en)_2Co \begin{array}{c} \diagup NH \\ \diagdown OH \end{array} Co(en)_2 \right]^{3+}$  is named as tetrakis (ethylenediamine) $\mu$ -hydroxo- $\mu$ -imido dicobalt (III) ion.
- Reason** : In naming polynuclear complexes *i.e.*, containing two or more metal atoms joined by bridging ligands, the word  $\mu$  is added with hyphen before the name of such ligands.
120. **Assertion** : 2,3-Dimethylbut-2-ene is more stable than but-2-ene.
- Reason** : Six hyperconjugation structures can be written for 2, 3-dimethylbut-2-ene while but-2-ene has twelve.

### BIOLOGY

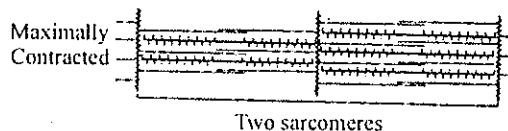
121. Vitamin B<sub>6</sub> is also called
- (a) thiamine (b) pantothenic acid  
(c) pyridoxine (d) retinol.
122. Protista differs from monera in having
- (a) cell wall (b) autotrophic nutrition  
(c) flagella (d) nuclear membrane
123. What does 'T' stands for in DPT vaccine?
- (a) tuberculosis (b) typhoid  
(c) trachoma (d) tetanus
124. Why are vascular bundles closed in monocots?
- (a) xylem and phloem are present  
(b) xylem and phloem occur in separate bundles  
(c) vascular cambium is present between xylem and phloem  
(d) vascular cambium is not present.
125. Who invented electron microscope?
- (a) Janssen (b) Edison

(c) Knoll & Ruska (d) Landsteiner

126. What do A, B, C, and D represent in the following figure?

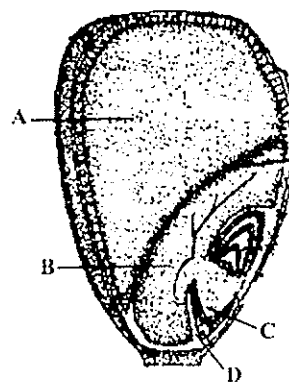


- (a) A : carrier protein, B : symport, C : uniport, D : antiport  
(b) A : carrier protein, B : uniport, C : antiport, D : symport  
(c) A : carrier protein, B : antiport, C : symport, D : uniport  
(d) A : carrier protein, B : uniport, C : symport, D : antiport
127. Gametophyte and sporophyte are independent of each other in which of the following groups?
- (a) pteridophytes (b) angiosperms  
(c) gymnosperms (d) bryophytes
128. Which of the following is correct?
- (a) paneth cells secrete pepsinogen  
(b) parietal cells secrete hydrochloric acid  
(c) argentaffin cells secrete mucus  
(d) chief cells secrete gastrin
129. Which of the following has highest diversity in India?
- (a) mango (b) dolphin  
(c) tiger (d) orchids
130. Which of the following is correct about the given figure?



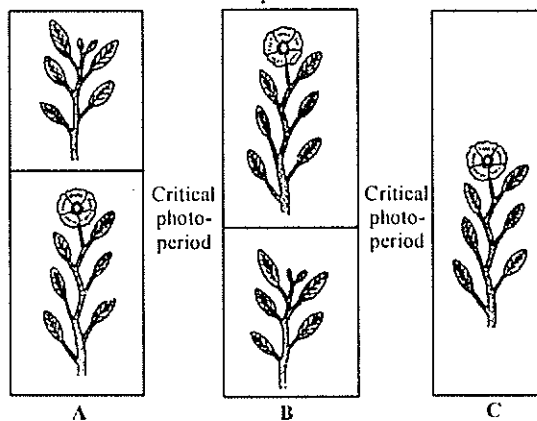
- (a) the length of the thick and thin myofilaments has changed.

- (b) length of both anisotropic and isotropic band has changed.
- (c) the myosin cross-bridges move on the surface of actin and the thin and thick myofilaments slide past each other.
- (d) length of the sarcomere remains same.
131. Which of the following disorders are caused due to recessive autosomal mutations?
- (a) Turner's syndrome and sickle cell anaemia  
 (b) Edward's syndrome and Down's syndrome  
 (c) cystic fibrosis and phenylketonuria  
 (d) Alzheimer's disease and Huntington's chorea.
132. What is correct about the movement of substance across the membrane in facilitated diffusion?
- (a) it is an active transport  
 (b) it doesn't cause transport of molecules from low concentration to high concentration  
 (c) it is insensitive to inhibitors  
 (d) it is a very specific transport
133. Which one is correct?
- (a) *Salmonella typhi* and *Haemophilus influenzae* cause pneumonia  
 (b) Widal test is done for malaria  
 (c) *Entamoeba histolytica* causes amoebiasis  
 (d) *Wuchereria* causes enterobiasis.
134. What is the Greek word for ecology?
- (a) ethology (b) oekologie  
 (c) synecology (d) hexicology
135. Which of the following is correct regarding genetic code?
- (a) UUU is the initiation codon which also codes for phenylalanine.  
 (b) there are 64 triplet codons and only 20 amino acids.  
 (c) three random nitrogen bases specify the placement of one amino acid.  
 (d) UAA is the nonsense codon which also codes for methionine.
136. The given figure shows L.S of the seed of maize. What do A, B, C and D represent?



- (a) A : endosperm B : scutellum  
 C : plumule D : coleoptile  
 (b) A : scutellum B : pericarp  
 C : radicle D : coleoptile  
 (c) A : endosperm B : scutellum  
 C : radicle D : coleorrhiza  
 (d) A : scutellum B : pericarp  
 C : plumule D : coleorrhiza

137. Refer the given figures on photoperiodism and select the correct option.



- (a) no correlation between light period and flowering    long light-exposure period    short light-exposure period
- (b) long light-exposure period    no correlation between light period and flowering    short light-exposure period
- (c) short light-exposure period    long light-exposure period    no correlation between light period and flowering



151. Cyclic photophosphorylation involves  
 (a) PS I (b) PS II  
 (c) PS I and PS II (d)  $P_{680}$
152. Which animal has the longest gestation period?  
 (a) shark (b) walrus  
 (c) elephant (d) dog
153. What is a plasmid?  
 (a) bacterial, linear, dsDNA  
 (b) extrachromosomal linear RNA  
 (c) extrachromosomal circular dsDNA  
 (d) autonomously replicating circular RNA.
154. The concept of chemical evolution is based on  
 (a) interaction of water, air and clay under intense heat  
 (b) effect of solar radiation on chemicals  
 (c) possible origin of life by combination of chemicals under suitable environmental conditions  
 (d) crystallization of chemicals.
155. Which of the following is a correct match between crop, variety and resistance to diseases?
- | Crop                | Variety        | Resistance to diseases |
|---------------------|----------------|------------------------|
| (a) wheat           | hingiri        | white rust             |
| (b) <i>Brassica</i> | Pusa sadabahar | black rot              |
| (c) cowpea          | Pusa komal     | bacterial blight       |
| (d) chilli          | Pusa swarnim   | chilly mosaic virus    |
156. Recombinant DNA technology involves several steps in which initial step is of isolation of the DNA. Which enzymes are used in the process for the break down of fungal cell, plant cell and bacterial cell respectively?  
 (a) lysozyme, lipases, trypsin  
 (b) chitinase, cellulase, lysozyme  
 (c) chitinase, cellulase, trypsin  
 (d) trypsin, lipases, cellulase
157. The taxon which includes related species is  
 (a) class (b) order  
 (c) family (d) genus
158. Match the following columns and select the correct option

## Column I

## Column II

- |                                  |                         |
|----------------------------------|-------------------------|
| (A) <i>Panthera tigris</i>       | (i) Mango               |
| (B) <i>Mangifera indica</i>      | (ii) Common Indian frog |
| (C) <i>Musca domestica</i>       | (iii) Cockroach         |
| (D) <i>Periplaneta americana</i> | (iv) Tiger              |
| (E) <i>Rana tigerina</i>         | (v) House fly           |
- (a) A - (ii), B - (v), C - (i), D - (iii), E - (iv)  
 (b) A - (iv), B - (i), C - (v), D - (iii), E - (ii)  
 (c) A - (ii), B - (v), C - (iii), D - (i), E - (iv)  
 (d) A - (iv), B - (i), C - (v), D - (ii), E - (iii)
159. Which of the following is correct regarding HIV, hepatitis B, gonorrhoea, trichomoniasis?  
 (a) trichomoniasis is a STD whereas other are not  
 (b) gonorrhoea is a viral disease whereas others are bacterial  
 (c) HIV is a pathogen whereas others are diseases  
 (d) Hepatitis B is eradicated completely whereas others are not.
160. The first stable product of Calvin cycle is  
 (a) 3-phosphoglycerate  
 (b) 1, 3 biphosphoglycerate  
 (c) glyceraldehyde - 3 phosphate  
 (d) ribulose - 5- phosphate

**Directions :** In the following questions (161-180), a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion  
 (b) If both assertion and reason are true but reason is not the correct explanation of assertion  
 (c) If assertion is true but reason is false  
 (d) If both assertion and reason are false.
161. Assertion : Adrenaline is called an emergency hormone.  
 Reason : It acts on the cells of skeletal, cardiac, smooth muscles, blood vessels and fat cells.
162. Assertion : Cork prevents the loss of water by evaporation.  
 Reason : Cork cells contain tannins.
163. Assertion : In cockroach respiratory gases directly comes in contact with the various organs of the body.

- Reason** : Cockroaches do not have respiratory pigment.
164. **Assertion** : Interferons are antiviral proteins.  
**Reason** : Interferons are secreted by virus infected cells.
165. **Assertion** : While on going down the loop of Henle, the filtrate becomes hypotonic.  
**Reason** : The descending limb of loop of Henle is impermeable to both water and electrolytes.
166. **Assertion** : Shrinkage of the protoplast of a cell occurs under the influence of hypertonic solution.  
**Reason** : Hypertonic solution causes plasmolysis.
167. **Assertion** : Inbreeding produces pureline.  
**Reason** : It causes homozygosity.
168. **Assertion** : Parturition is induced by neural signal in maternal pituitary.  
**Reason** : At the end of gestation period, the maternal pituitary release prolactin which causes uterine contractions.
169. **Assertion** : *Commelina* shows cleistogamy.  
**Reason** : This reduces chances of inbreeding.
170. **Assertion** : *Antirrhinum* is a good example to understand incomplete dominance.  
**Reason** : Heterozygotes show characteristics of both the alleles.
171. **Assertion** : Presence of large amounts of nutrients in water body causes excessive growth of planktonic algae.  
**Reason** : It is due to biomagnification.
172. **Assertion** : Bile is essential for the digestion of lipids.  
**Reason** : Bile juice contains enzymes bilirubin and biliverdin.
173. **Assertion** : Emphysema is a chronic disorder in which alveolar walls are damaged.  
**Reason** : Emphysema is closely related to cigarette smoking.
174. **Assertion** : DNA fingerprinting involves identifying differences in specific regions in DNA sequence.  
**Reason** : DNA fingerprinting is the basis of paternity testing.
175. **Assertion** : All pathogens are parasites but all parasites are not pathogens.  
**Reason** : Majority of the parasites confer benefits to the host.
176. **Assertion** : Due to pollution atmospheric concentration of CO<sub>2</sub> is increasing which will be harmful for C<sub>4</sub> plants whereas productive for C<sub>3</sub> plants.  
**Reason** : C<sub>4</sub> plants have greater efficiency for CO<sub>2</sub> as CO<sub>2</sub> is fixed by PEP oxygenase.
177. **Assertion** : Insulin is antagonistic to glucagon.  
**Reason** : It is an anabolic hormone.
178. **Assertion** : Auditory ossicles are small bones present in the cavity of inner ear.  
**Reason** : Auditory ossicles maintain the balance of air pressure between two sides of ear drum.
179. **Assertion** : Pharyngeal nephridia play a role in the conservation of water in the earthworm.  
**Reason** : They help the earthworm in keeping the skin moist for cutaneous respiration.
180. **Assertion** : Pantothenic acid deficiency is probably the most common vitamin deficiency.  
**Reason** : Macrocytic anaemia is a characteristic feature of pantothenic acid deficiency.

### GENERAL KNOWLEDGE

181. Which country has three capitals?  
(a) S. Africa (b) Switzerland  
(c) Netherland (d) Australia
182. Which is the largest desert in the world?  
(a) Atacama (b) Thar  
(c) Sahara (d) Kalahri
183. Which is the largest lake in the world?  
(a) Caspian sea (b) Wular  
(c) Lake superior (d) Baikal

184. Which country has won 'Fifa World Cup' maximum times?  
(a) Germany (b) Brazil  
(c) France (d) Italy
185. 'World population day' is on  
(a) 8th March (b) 21st March  
(c) 11th July (d) 3rd October
186. Who invented the stethoscope?  
(a) Reni Laennec (b) Hopkins  
(c) Louis Pasteur (d) Hausen
187. Which country has largest number of coal reserves?  
(a) USA (b) Russia  
(c) China (d) India
188. What term is given to the relationship between culture and food?  
(a) astronomy (b) agronomy  
(c) gastronomy (d) geology
189. One-rupee note bears the signature of the  
(a) Governor of Reserve Bank of India  
(b) Finance ministry  
(c) Secretary, Ministry of Finance  
(d) President of India
190. Which one of the following classical dance forms originated in Andhra Pradesh?  
(a) bharatnatyam (b) kathakali  
(c) kuchipudi (d) odissi
191. On adding salt to water, the boiling point and freezing point of water will  
(a) increase  
(b) increase and decrease respectively  
(c) decrease  
(d) decrease and increase respectively.
192. Chocolates can be bad for health because of a high content of  
(a) cobalt (b) nickel  
(c) zinc (d) lead
193. The novel Coolie is written by  
(a) R. K. Narayan (b) Prem Chand  
(c) Jainendra Kumar (d) Mulk Raj Anand
194. Beirut is the capital of  
(a) Syria (b) Jordan  
(c) Lebanon (d) Libya
195. The first month of Saka year is  
(a) vaisakh (b) chaitra  
(c) jyeshtha (d) push
196. Chameli Devi Award is given to an outstanding woman who is a  
(a) vocalist (b) lawyer  
(c) journalist (d) scientist
197. "Olive Branch" is a sign of  
(a) war (b) peace  
(c) defeat (d) conquest
198. 800 in Roman number is written as  
(a) DDCC (b) DDDC  
(c) DCCC (d) DCCD.
199. Santosh Trophy is associated with  
(a) hockey (b) cricket  
(c) badminton (d) football
200. Which river carries maximum quantity of water in the world?  
(a) Nile (b) Amazon  
(c) Thames (d) Mississippi