

# SOLVED PAPER

## AIIMS - 2008

Time : 3½ Hours

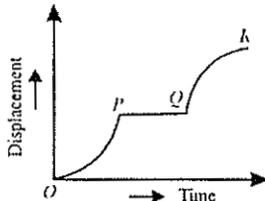
Max. Marks : 200

### PHYSICS

1. In an electrical circuit containing  $L$ ,  $C$  and  $R$  which of the following does not denote the dimensions of frequency?

- (a)  $LC$                       (b)  $\frac{1}{\sqrt{LC}}$   
 (c)  $\frac{1}{RC}$                       (d)  $\frac{R}{L}$

2. The displacement time graph of a particle moving along a straight line is drawn below.



The accelerations of the particle during the regions  $OP$ ,  $PQ$  and  $QR$  are

- |     | $OP$ | $PQ$ | $QR$ |
|-----|------|------|------|
| (a) | -    | 0    | +    |
| (b) | +    | 0    | +    |
| (c) | +    | 0    | -    |
| (d) | -    | 0    | -    |

3. A particle of mass  $m$  moves with constant speed along a circular path of radius  $r$  under the action of force  $F$ . Its speed is

- (a)  $\sqrt{\frac{Fr}{m}}$                       (b)  $\sqrt{\frac{F}{r}}$   
 (c)  $\sqrt{Fmr}$                       (d)  $\sqrt{\frac{F}{mr}}$

4. A bullet is fired from a rifle and the rifle recoils. Kinetic energy of rifle is

- (a) less than K.E. of bullet  
 (b) greater than K.E. of bullet

- (c) equal to K.E. of bullet  
 (d) none of the above

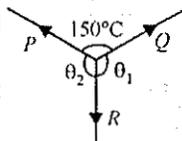
5. Side of an equilateral triangle is  $l$ . Three point masses, each of magnitude  $m$ , are placed at the three vertices of the triangle. Moment of inertia of this system about one side of the triangle as axis is given by

- (a)  $\frac{3ml^2}{4}$                       (b)  $\frac{4}{3}ml^2$   
 (c)  $\frac{3}{2}ml^2$                       (d)  $\frac{2}{3}ml^2$

6.  $P$ ,  $Q$  and  $R$  are three coplanar forces acting at a point and are in equilibrium.

Given  $P = 1.9318$  kg wt [ $\sin\theta_1 = 0.9659$ ], the value of  $R$  (in kg wt) is

- (a) 0.9659                      (b) 2  
 (c) 1                              (d) 1/2.



7. Suppose the gravitational force varies inversely as the  $n^{\text{th}}$  power of distance. Then the time period of a planet in circular orbit of radius  $R$  around the sun will be proportional to

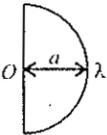
- (a)  $R^{\frac{n+1}{2}}$                       (b)  $R^{\frac{n-1}{2}}$   
 (c)  $R^n$                               (d)  $R^{\frac{n-2}{2}}$

8. A Ge specimen is doped with Al. The concentration of acceptor atoms is  $\sim 10^{21}$  atoms/ $m^3$ . Given that the intrinsic concentration of electron hole pairs is  $10^{19}/m^3$ , the concentration of electrons in the specimen is

- (a)  $10^{17}/m^3$                       (b)  $10^{15}/m^3$   
 (c)  $10^4/m^3$                       (d)  $10^2/m^3$ .

9. A slab consists of two layers of different materials of the same thickness and having thermal conductivities  $K_1$  and  $K_2$  are connected in series.

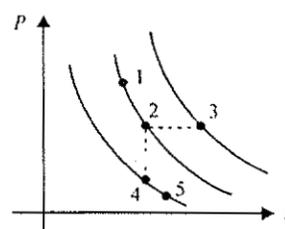
The equivalent thermal conductivity of the slab is

- (a)  $\frac{2K_1K_2}{K_1+K_2}$  (b)  $\sqrt{K_1K_2}$   
 (c)  $\frac{K_1K_2}{K_1+K_2}$  (d)  $K_1+K_2$
10. In Young's double slit experiment, the distance between two slits is made three times then the fringe width will become  
 (a) 9 times (b) 1/9 times  
 (c) 3 times (d) 1/3 times.
11. A laser beam is used for carrying out surgery because, it  
 (a) is highly monochromatic  
 (b) is highly coherent  
 (c) is highly directional  
 (d) can be sharply focussed.
12. A converging lens forms a real image  $I$  of an object on its principal axis. A rectangular slab of refractive index  $\mu$  and thickness  $x$  is introduced between  $I$  and the lens,  $I$  will move  
 (a) towards the lens  $(\mu - 1)x$   
 (b) towards the lens by  $\left(1 - \frac{1}{\mu}\right)x$   
 (c) away from the lens by  $(\mu - 1)x$   
 (d) away from the lens by  $\left(1 - \frac{1}{\mu}\right)x$ .
13. The velocity of electromagnetic radiation in a medium of permittivity  $\epsilon_0$  and permeability  $\mu_0$  is given by  
 (a)  $\frac{1}{\sqrt{\mu_0\epsilon_0}}$  (b)  $\sqrt{\frac{\mu_0}{\epsilon_0}}$   
 (c)  $\sqrt{\frac{\epsilon_0}{\mu_0}}$  (d)  $\sqrt{\mu_0\epsilon_0}$
14. Electric field at centre of a uniformly charged semicircle of radius  $a$  is   
 (a)  $\frac{\lambda}{2\pi\epsilon_0 a^2}$  (b)  $\frac{\lambda}{4\pi^2\epsilon_0 a^2}$   
 (c)  $\frac{\lambda^2}{2\pi\epsilon_0 a}$  (d)  $\frac{\lambda}{2\pi\epsilon_0 a}$
15. If frequency of  $R-L$  circuit is  $f$  then impedance will be

- (a)  $\sqrt{R^2 + (2\pi fL)^2}$  (b)  $R^2 + (2\pi f)^2$   
 (c)  $\sqrt{(R^2 + L\pi f^2)}$  (d)  $R^2 + (2\pi f)^2$

16. Two closed organ pipes of length 100 cm and 101 cm produces 16 beats in 20 sec. When each pipe is sounded in its fundamental mode calculate the velocity of sound.  
 (a) 303  $\text{ms}^{-1}$  (b) 332  $\text{ms}^{-1}$   
 (c) 323.2  $\text{ms}^{-1}$  (d) 300  $\text{ms}^{-1}$ .

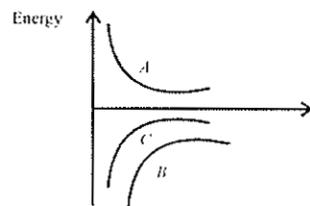
17. A certain gas is taken to the five states represented by dots in the graph. The plotted lines are isotherms. Order of the most probable speed  $v_p$



- of the molecules at these five states is  
 (a)  $v_{p \text{ at } 3} > v_{p \text{ at } 1} = v_{p \text{ at } 2} > v_{p \text{ at } 4} = v_{p \text{ at } 5}$   
 (b)  $v_{p \text{ at } 1} > v_{p \text{ at } 2} = v_{p \text{ at } 3} > v_{p \text{ at } 4} = v_{p \text{ at } 5}$   
 (c)  $v_{p \text{ at } 3} > v_{p \text{ at } 2} = v_{p \text{ at } 4} > v_{p \text{ at } 1} = v_{p \text{ at } 5}$   
 (d) insufficient information to predict the result.

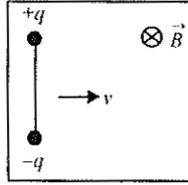
18.  $N_1$  atoms of a radioactive element emit  $N_2$  beta particles per second. The decay constant of the element is (in  $\text{s}^{-1}$ )  
 (a)  $N_1/N_2$  (b)  $N_2/N_1$   
 (c)  $N_1(\ln 2)$  (d)  $N_2(\ln 2)$

19. Figure shows the variation of energy with the orbit radius  $r$  of a satellite in a circular motion. Mark the correct statement.

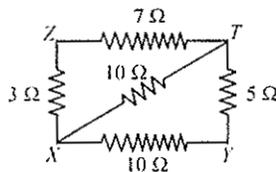


- (a)  $C$  is total energy,  $B$  kinetic energy and  $A$  is potential energy  
 (b)  $A$  is kinetic energy,  $B$  total energy and  $C$  potential energy  
 (c)  $A$  and  $B$  are the kinetic and potential energies and  $C$  the total energy of the satellite.  
 (d)  $C$  and  $A$  are kinetic and potential energy respectively and  $B$  the total energy of the satellite.

20. Two charges  $+q$  and  $-q$  are attached to the two ends of a light rod of length  $L$ , as shown in figure. The system is given a velocity  $v$  perpendicular to magnetic field  $\vec{B}$ . The magnetic force on the system of charges and magnitude of force on one charge by the rod, are respectively



- (a) zero, zero (b) zero,  $qvB$   
 (c)  $2qvB$ , 0 (d)  $2qvB$ ,  $qvB$
21. If a wire is extended to a new length  $l$ , the work done is
- (a)  $\frac{YA}{l}(l-l')$  (b)  $\frac{YA}{l}(l-l')^2$   
 (c)  $\frac{1}{2} \frac{YA}{l}(l-l')^2$  (d)  $2 \cdot \frac{YA}{l}(l-l')^2$
22. The equivalent resistance between the points  $X$  and  $Y$  in the following circuit diagram will be



- (a) 10  $\Omega$  (b) 5  $\Omega$   
 (c) 7  $\Omega$  (d) 3  $\Omega$
23. The intensity of magnetic field due to an isolated pole of strength  $m_p$ , at a point distant  $r$  from it will be
- (a)  $m_p/r^2$  (b)  $m_p r^2$   
 (c)  $r^2/m_p$  (d)  $m_p/r$
24. A bulb and a condenser are connected in series with an A.C. source. On increasing the frequency of the source its brightness will
- (a) increase (b) decrease  
 (c) sometimes increase and sometimes decrease  
 (d) neither increase nor decrease.
25. Two heater wires, made of the same material and having the same length and the same radius, are first connected in series and then in parallel to a constant potential difference. If the rates of heat produced in the two cases are  $H_s$  and  $H_p$  respectively, then  $H_s/H_p$  will be

- (a) 1/2 (b) 2  
 (c) 1/4 (d) 4.

26. The ratio of magnetic fields on the axis of a circular current carrying coil of radius  $a$  to the magnetic field at its centre will be

- (a)  $\frac{1}{\left(1 + \frac{x^2}{a^2}\right)^{3/2}}$  (b)  $\frac{1}{\left(1 + \frac{a^2}{x^2}\right)^{1/2}}$   
 (c)  $\frac{1}{\left(1 + \frac{a^2}{x^2}\right)^2}$  (d)  $\frac{1}{\left(1 + \frac{a^2}{x^2}\right)^3}$

27. Lumen is the unit of

- (a) luminous flux (b) luminosity  
 (c) illumination (d) quantity of light.

28. A charge  $q$  is uniformly distributed on a ring of radius  $r$ . A sphere of an equal radius is constructed with its centre lying on the periphery of the ring. The flux of electric field through the surface of the sphere will be

- (a)  $\frac{q}{\epsilon_0}$  (b)  $\frac{q}{2\epsilon_0}$   
 (c)  $\frac{q}{3\epsilon_0}$  (d)  $\frac{q}{4\epsilon_0}$

29. When 100 V d.c. is applied across a coil, a current of 1 A flows through it. When 100 V a.c. of 50 Hz is applied to the same coil only 0.5 A flows. The inductance of the coil is

- (a) 0.55 H (b) 5.5 mH  
 (c) 0.55 mH (d) 55 mH.

30. A bulb of 25 W, 200 V and another bulb of 100 W, 200 V are connected in series with a supply line of 220 V. Then

- (a) both bulbs will glow with same brightness  
 (b) both bulbs will get fused  
 (c) 25 W bulb will glow more brightly  
 (d) 100 W bulb will glow more brightly.

31. Which of the following is matched wrongly?

- (a) oil drop experiment  $\rightarrow$  Millikan  
 (b) dual nature of light  $\rightarrow$  de Broglie  
 (c) uncertainty principle  $\rightarrow$  Heisenberg  
 (d) none of these

32. The forbidden gap in the energy bands of silicon is

- (a) 2.6 eV (b) 1.1 eV  
(c) 0.1 eV (d) 6 eV

33. When white light passes through a prism, the deviation is maximum for

- (a) violet light (b) green light  
(c) red light (d) yellow light

34. Which of the following gates correspond to the truth table given below?

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

- (a) NAND (b) OR  
(c) XOR (d) NOR

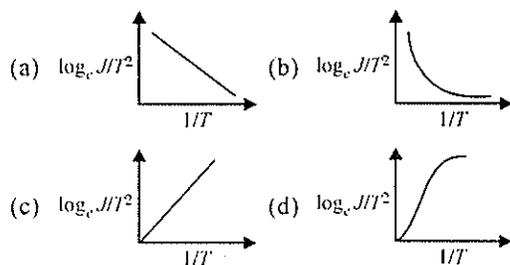
35. Light is incident normally on a diffraction grating through which the first diffraction is seen at  $32^\circ$ . In this case the second order diffraction will be

- (a) at  $80^\circ$  (b) at  $64^\circ$   
(c) at  $48^\circ$   
(d) there is no second order diffraction

36. If there were no atmosphere, the average temperature on earth surface would be

- (a) lower (b) higher  
(c) same (d)  $0^\circ\text{C}$ .

37. The current curve between  $\log_e \frac{J}{T^2}$  and  $\frac{1}{T}$  is



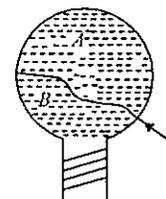
38. An object 5 cm tall is placed 1 m from a concave spherical mirror which has a radius of curvature of 20 cm. The size of the image is

- (a) 0.11 cm (b) 0.50 cm  
(c) 0.55 cm (d) 0.60 cm.

39. The magnifying power of a compound microscope increase with

- (a) the focal length of objective lens is increased and that of eye lens is decreased  
(b) the focal length of eye lens is increased and that of objective lens is decreased  
(c) focal lengths of both objects and eye-piece are increased  
(d) focal lengths of both objects and eye-piece are decreased.

40. A thread is tied slightly loose to a wire frame as in figure and the frame is dropped into a soap solution and taken out. The frame is completely covered with the film. When the portion A is punctured with a pin, the thread



- (a) becomes concave towards A  
(b) becomes convex towards A  
(c) either (a) or (b) depending on the size of A with respect to B  
(d) remains in the initial position.

**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** : In the relation  $f = \frac{1}{2i} \sqrt{\frac{T}{\mu}}$ , where symbols have standard meaning,  $m$  represent linear mass density.

**Reason** : The frequency has the dimensions of inverse of time.

42. **Assertion** : When the velocity of projection of a body is made  $n$  times, its time of flight becomes  $n$  times.

**Reason** : Range of projectile does not depend on the initial velocity of a body.

43. **Assertion** : A needle placed carefully on the

- surface of water may float, whereas a ball of the same material will always sink.
- Reason** : The buoyancy of an object depends both on the material and shape of the object.
44. **Assertion** : The colour of the green flower seen through red glass appears to be dark.
- Reason** : Red glass transmits only red light.
45. **Assertion** : The alternating current lags behind the e.m.f. by a phase angle of  $\pi/2$ , when AC flows through an inductor.
- Reason** : The inductive reactance increases as the frequency of AC source decreases.
46. **Assertion** : A spark occur between the poles of a switch when the switch is opened.
- Reason** : Current flowing in the conductor produces magnetic field.
47. **Assertion** : X-rays can penetrate through the flesh but not through the bones.
- Reason** : The penetrating power of X-rays depends on voltage.
48. **Assertion** : It is essential that all the lines available in the emission spectrum will also be available in the absorption spectrum.
- Reason** : The spectrum of hydrogen atom is only absorption spectrum.
49. **Assertion** : A double convex lens ( $\mu = 1.5$ ) has focal length 10 cm. When the lens is immersed in water ( $\mu = 4/3$ ) its focal length becomes 77 cm.
- Reason** : 
$$\frac{1}{f} = \frac{\mu_v - \mu_m}{\mu_m} \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$$
50. **Assertion** : Diode lasers are used as optical sources in optical communication.
- Reason** : Diode lasers consume less energy.
51. **Assertion** : We cannot think of magnetic field configuration with three poles.
- Reason** : A bar magnet does exert a torque on itself due to its own field.
52. **Assertion** : In a SHM, kinetic and potential energies become equal when the displacement is  $1/\sqrt{2}$  times the amplitude.
- Reason** : In SHM, kinetic energy is zero when potential energy is maximum.
53. **Assertion** : A bird perches on a high power line and nothing happens to the bird.
- Reason** : The level of bird is very high from the ground.
54. **Assertion** : Stopping potential depends upon the frequency of incident light but is independent of the intensity of the light.
- Reason** : The maximum kinetic energy of the photoelectrons is proportional to stopping potential.
55. **Assertion** : Inductance coils are usually made of thick copper wire.
- Reason** : Induced current is more in wire having less resistance.
56. **Assertion** : When radius of circular loop carrying current is doubled, its magnetic moment becomes four times.
- Reason** : Magnetic moment depends on area of the loop.
57. **Assertion** : In the following circuit, emf is 2 V and internal resistance of the cell is  $1 \Omega$  and  $R = 1 \Omega$ , then reading of the voltmeter is 1 V.
- 
- Reason** :  $V = E - IR$  where  $E = 2 \text{ V}$ ,  
 $I = 2/2 = 1 \text{ A}$ .
58. **Assertion** : A domestic electrical appliance, working on a three pin will continue working even if the top pin is removed.
- Reason** : The third pin is used only as a safety device.
59. **Assertion** : The energy of charged particle

moving in a uniform magnetic field does not change.

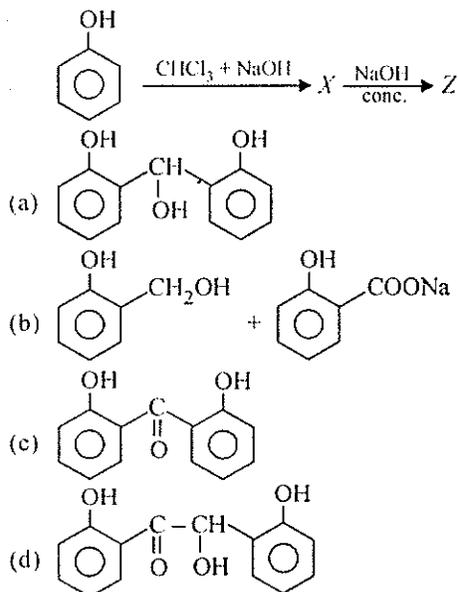
**Reason** : Work done by magnetic field on the charge is zero.

60. **Assertion** :  $^{90}\text{Sr}$  from the radioactive fall out from a nuclear bomb ends up in the bones of human beings through the milk consumed by them. It causes impairment of production of red blood cells.

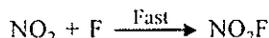
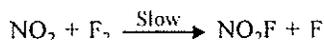
**Reason** : The energies  $\beta$ -particles emitted in the decay of  $^{90}\text{Sr}$  damage the bone marrow.

### CHEMISTRY

61. Identify Z in the reaction.



62. For the reaction,  $2\text{NO}_2 + \text{F}_2 \rightarrow 2\text{NO}_2\text{F}$ , following mechanism has been provided.



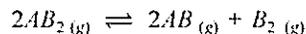
Thus, rate expression of the above reaction can be written as

- (a)  $r = K [\text{NO}_2]_2 [\text{F}_2]$  (b)  $r = K [\text{NO}_2] [\text{F}_2]$   
 (c)  $r = K [\text{NO}_2]$  (d)  $r = K [\text{F}_2]$
63. What is the correct relationship between the pHs of isomolar solutions of sodium oxide ( $\text{pH}_1$ ),

sodium sulphide ( $\text{pH}_2$ ), sodium selenide ( $\text{pH}_3$ ) and sodium telluride ( $\text{pH}_4$ )?

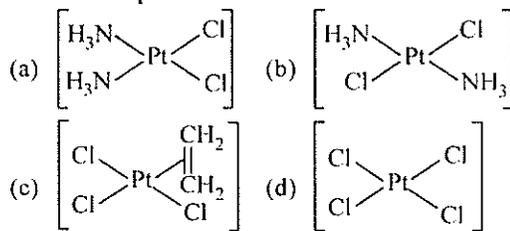
- (a)  $\text{pH}_1 > \text{pH}_2 = \text{pH}_3 = \text{pH}_4$   
 (b)  $\text{pH}_1 < \text{pH}_2 < \text{pH}_3 < \text{pH}_4$   
 (c)  $\text{pH}_1 < \text{pH}_2 > \text{pH}_3 < \text{pH}_4$   
 (d)  $\text{pH}_1 > \text{pH}_2 > \text{pH}_3 > \text{pH}_4$
64. Toluene is nitrated and the resulting product is reduced with tin and hydrochloric acid. The product so obtained is diazotised and then heated with cuprous bromide. The reaction mixture so formed contains
- (a) mixture of *o*- and *m*-bromotoluenes  
 (b) mixture of *o*- and *p*-bromotoluenes  
 (c) mixture of *o*- and *p*-dibromobenzenes  
 (d) mixture of *o*- and *p*-bromo anilines.

65. The dissociation equilibrium of a gas  $\text{AB}_2$  can be represented as

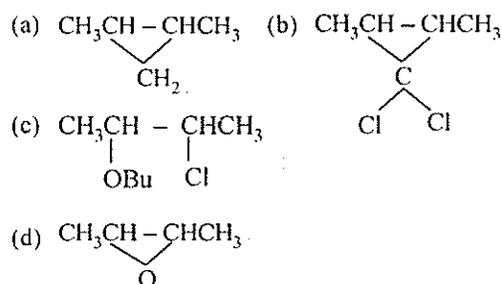


The degree of dissociation is  $x$  and is small compared to 1. The expression relating the degree of dissociation ( $x$ ) with equilibrium constant  $K_p$  and total pressure  $p$  is

- (a)  $(2K_p/p)^{1/2}$  (b)  $K_p/p$   
 (c)  $2K_p/p$  (d)  $(2K_p/p)^{1/3}$
66. Which of the following is considered as an anticancer species?

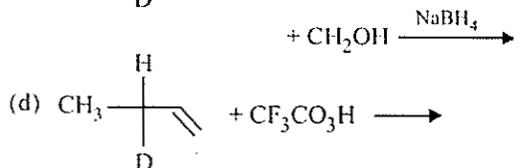
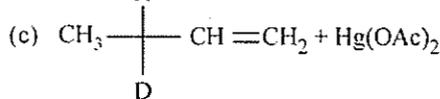
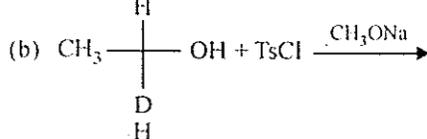
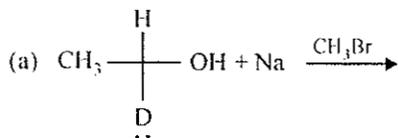


67.  $\text{CH}_3\text{CH}=\text{CHCH}_3 + \text{CHCl}_3 + t\text{-BuOK} \rightarrow \text{A}$ . A is



68. In which of the following preparations of ether,

the configuration about chiral centre is not retained?



69. Toluene on treatment with  $\text{CrO}_3$  and  $(\text{CH}_3\text{CO})_2\text{O}$  followed by hydrolysis with dil. HCl gives  
 (a) benzaldehyde (b) benzoic acid  
 (c) phenol  
 (d) phenylacetaldehyde.

70. The time period to coat a metal surface of  $80 \text{ cm}^2$  with  $5 \times 10^{-3} \text{ cm}$  thick layer of silver (density  $1.05 \text{ g cm}^{-3}$ ) with the passage of 3 A current through a silver nitrate solution is  
 (a) 115 sec (b) 125 sec  
 (c) 135 sec (d) 145 sec.

71. Correct equation of Freundlich isotherm is

(a)  $\log\left(\frac{m}{x}\right) = \log k + \frac{1}{n} \log c$

(b)  $\log\left(\frac{x}{m}\right) = \log c + \frac{1}{n} \log k$

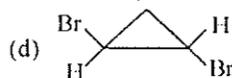
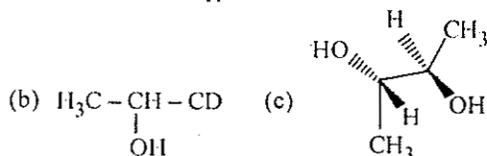
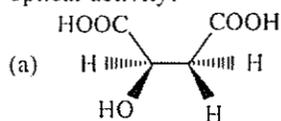
(c)  $\log\left(\frac{x}{m}\right) = \log c + \frac{1}{k} \log c$

(d)  $\log\left(\frac{x}{m}\right) = \log k + \frac{1}{k} \log c$

72. Which of the following compounds is not chiral?

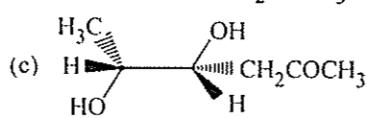
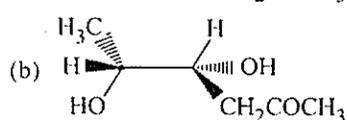
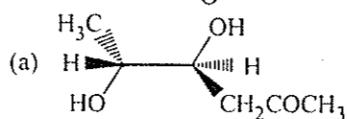
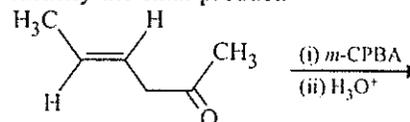
- (a) 1-Chloropentane  
 (b) 2-Chloropentane  
 (c) 1-Chloro-2-methyl pentane  
 (d) 3-Chloro-2-methyl pentane.

73. Which of the following molecules will not show optical activity?



74. Green chemistry means such reactions which  
 (a) are related to the depletion of ozone layer  
 (b) study the reactions in plants  
 (c) produce colour during reactions  
 (d) reduce the use and production of hazardous chemicals.

75. Identify the final product.

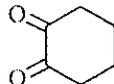


- (d) none of these.

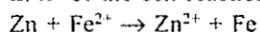
76. The flame colours of metal ions are due to  
 (a) Frenkel defect (b) Schottky defect  
 (c) metal deficiency defect  
 (d) metal excess defect.

77. The reaction of an organic compound with ammonia followed by nitration of the product gives a powerful explosive called RDX. The organic compound is

- (a) phenol (b) toluene  
 (c) glycerine (d) formaldehyde.

78. Cumene process is the most important commercial method for the manufacture of phenol. Cumene is  
 (a) *iso*-propyl benzene (b) ethyl benzene  
 (c) vinyl benzene (d) propyl benzene.
79. Prolonged exposure of fat or oil in moist air and light causes bad smell (rancidity). It is due to  
 (a) formation of  $C_6 - C_{12}$  fatty acids  
 (b) formation of ketone and aldehyde  
 (c) both of these causes  
 (d) formation of glycerol.
80. Acid hydrolysis of sucrose is a  
 (a) pseudo first order reaction  
 (b) zero order reaction  
 (c) second order reaction  
 (d) unimolecular reaction.
81. Which of these compounds is synthesised by chloral?  
 (a) DDT (b) BHC  
 (c) chloroform (d) Michlers ketone.
82. When phenol reacts with phthalic anhydride in presence of  $H_2SO_4$  and heated and hot reaction mixture is poured in NaOH solution, then product formed is  
 (a) alizarin (b) methyl orange  
 (c) fluorescein (d) phenolphthalein.
83. The function of  $AlCl_3$  in Friedel-Craft's reaction is to  
 (a) absorb HCl (b) absorb water  
 (c) produce nucleophile  
 (d) produce electrophile.
84. The correct order of increasing  $[H_3O^+]$  in the following aqueous solutions is  
 (a)  $0.01\text{ M } H_2S < 0.01\text{ M } H_2SO_4 < 0.01\text{ M } NaCl < 0.01\text{ M } NaNO_2$   
 (b)  $0.01\text{ M } NaCl < 0.01\text{ M } NaNO_2 < 0.01\text{ M } H_2S < 0.01\text{ M } H_2SO_4$   
 (c)  $0.01\text{ M } NaNO_2 < 0.01\text{ M } NaCl < 0.01\text{ M } H_2S < 0.01\text{ M } H_2SO_4$   
 (d)  $0.01\text{ M } H_2S < 0.01\text{ M } NaNO_2 < 0.01\text{ M } NaCl < 0.01\text{ M } H_2SO_4$ .
85. Percentage of Se (at. mass = 78.4) in peroxidase anhydrase enzyme is 0.5% by weight, then minimum molecular mass of peroxidase anhydrase enzyme is  
 (a)  $1.576 \times 10^4$  (b)  $1.576 \times 10^3$   
 (c) 15.76 (d)  $2.136 \times 10^4$ .
86. The number of S - S bonds in sulphur trioxide trimer ( $S_3O_9$ ) is  
 (a) three (b) two  
 (c) one (d) zero.
87. Oxidation product 1,2-cyclopentanediol with  $HIO_4$  gives  
 (a)  $HC(=O)-CH_2-CH_2-CH_2-C(=O)-H$   
  
 (b)  $O=C-CH(OH)-CH_2-CH_2-C(=O)OH$   
 (c)  $O=C-CH(OH)-CH_2-CH_2-C(=O)OH$   
 (d) none of these.
88. The correct order of dipole moment is  
 (a)  $CH_4 < NF_3 < NH_3 < H_2O$   
 (b)  $NF_3 < CH_4 < NH_3 < H_2O$   
 (c)  $NH_3 < NF_3 < CH_4 < H_2O$   
 (d)  $H_2O < NH_3 < NF_3 < CH_4$ .
89. The root mean square speed of the molecules of diatomic gas is  $u$ . When the temperature is doubled, the molecules dissociate into two atoms. The new rms speed of the atom is  
 (a)  $\sqrt{2}u$  (b)  $u$   
 (c)  $2u$  (d)  $4u$ .
90. For the following concentration cell, to be spontaneous  $Pt(H_2)P_1$  atm. |  $HCl$  |  $Pt(H_2)P_2$  atm. Which of the following is correct?  
 (a)  $P_1 = P_2$  (b)  $P_1 < P_2$   
 (c)  $P_1 > P_2$  (d) can't be predicted.
91. Which one of the following is not a surfactant?  
 (a)  $CH_3-(CH_2)_{15}-N^+(CH_3)_3Br^-$   
 (b)  $CH_3-(CH_2)_{14}-CH_2-NH_2$   
 (c)  $CH_3-(CH_2)_{16}-CH_2OSO_2^-Na^+$   
 (d)  $OHC-(CH_2)_{14}-CH_2-COO^-Na^+$ .
92. The standard oxidation potential  $E^\circ$  for the half cell reaction are  
 $Zn \rightarrow Zn^{2+} + 2e^-$ ;  $E^\circ = +0.76V$   
 $Fe \rightarrow Fe^{2+} + 2e^-$ ;  $E^\circ = +0.41V$

EMF of the cell reaction is



- (a) - 0.35 V (b) + 0.35 V  
(c) 0.17 V (d) 1.17 V.

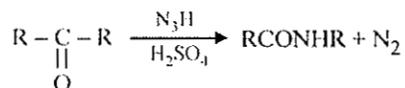
93. To observe the effect of concentration on the conductivity electrolytes of different nature were taken in two vessels *A* and *B*. *A* contains weak electrolyte  $\text{NH}_4\text{OH}$  and *B* contains strong electrolyte  $\text{NaCl}$ . In both containers, concentration of respective electrolyte was increased and conductivity observed.

- (a) in *A* conductivity increases, in *B* conductivity decreases  
(b) in *A* conductivity decreases, while in *B* conductivity increases  
(c) in both *A* and *B* conductivity increase  
(d) in both *A* and *B* conductivity decreases.

94. A unit cell of sodium chloride has four formula units. The edge length of the unit cell is 0.0564 nm. What is the density of sodium chloride?

- (a) 1.2 g/cm<sup>3</sup> (b) 2.165 g/cm<sup>3</sup>  
(c) 3.64 g/cm<sup>3</sup> (d) 4.56 g/cm<sup>3</sup>.

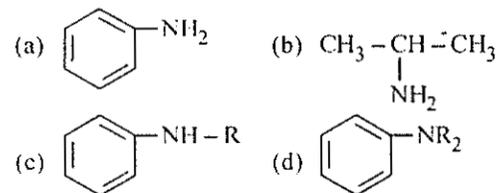
95. The reaction



is called

- (a) Claisen-Schmidt reaction  
(b) Kolbe-Schmidt reaction  
(c) Schmidt reaction  
(d) Kolbe's reaction.

96. Which of the following amines, can give N-nitrosoamine on treatment with  $\text{HNO}_2$ ?



97. The purification of alumina is called  
(a) Baeyer's process (b) Bosch process  
(c) Castner process (d) Hoop's process.

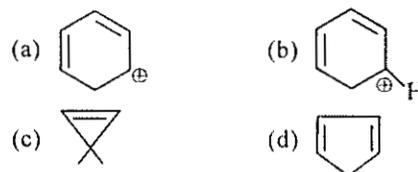
98. Which acid has P - P linkage?  
(a) Hypophosphoric acid

- (b) Pyrophosphoric acid  
(c) Metaphosphoric acid  
(d) Orthophosphoric acid.

99.  $\text{C}_6\text{H}_6 \xrightarrow[\text{H}_2\text{SO}_4]{\text{HNO}_3} \text{X} \xrightarrow[\text{FeCl}_3]{\text{Cl}_2} \text{Y}$ . In the above sequence *Y* can be

- (a) 3-nitrochlorobenzene  
(b) 1-nitrochlorobenzene  
(c) 4-nitrochlorobenzene  
(d) none of these.

100. Which of the following is aromatic?



**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 :  $(\text{CH}_3)_3\text{CCOC}(\text{CH}_3)_3$  and acetone can be distinguished by the reaction with  $\text{NaHSO}_3$ .

Reason :  $\text{HSO}_3^-$  is the nucleophile in bisulphite addition.

102. Assertion : Tertiary carbonium ions are generally formed more easily than primary carbonium ions.

Reason : Hyperconjugation as well as inductive effect due to additional alkyl groups stabilize tertiary carbonium ions.

103. Assertion : If  $\text{H}_2$  and  $\text{Cl}_2$  enclosed separately in the same vessel exert pressure of 100 and 200 mm respectively, their mixture in the same vessel at the same temperature will exert a pressure of 300 mm.

- Reason** : Dalton's law of partial pressures states that total pressure is the sum of partial pressures.
- 104. Assertion** : The quantized energy of an electron is largely determined by its principal quantum number.
- Reason** : The principal quantum number  $n$  is a measure of the most probable distance of finding the electron around the nucleus.
- 105. Assertion** : According to Le-Chatelier's principle addition of heat to an equilibrium solid  $\rightleftharpoons$  liquid results in decrease in the amount of solid.
- Reason** : Reaction is endothermic, so on heating forward reaction is favoured.
- 106. Assertion** : Cyclohexanone exhibits keto-enol tautomerism.
- Reason** : In cyclohexanone, one form contains the keto group ( $C=O$ ) while other contains enolic group ( $-C=C-OH$ ).
- 107. Assertion** : Phenol is more reactive than benzene towards electrophilic substitution reaction.
- Reason** : In the case of phenol, the intermediate carbocation is more resonance stabilised.
- 108. Assertion** : Many endothermic reactions that are not spontaneous at room temperature become spontaneous at high temperature.
- Reason** : Entropy of the system increases with increase in temperature.
- 109. Assertion** : Benzaldehyde is more reactive than ethanal towards nucleophilic attack.
- Reason** : The overall effect of  $-I$  and  $+R$  effect of phenyl group decreases the electron density on the carbon atom of  $>C=O$  group in benzaldehyde.
- 110. Assertion** : Bleaching powder reacts with dilute acids to evolve chlorine.
- Reason** : The chlorine liberated by the action of dilute acids on bleaching powder is called available chlorine.
- 111. Assertion** : Teflon has high thermal stability and chemical inertness.
- Reason** : Teflon is a thermoplastic.
- 112. Assertion** : In high spin situation, configuration of  $d^5$  ions will be  $t_{2g}^3 e_g^2$ .
- Reason** : In high spin situation, pairing energy is less than crystal field energy.
- 113. Assertion** : Copper metal gets readily corroded in acidic aqueous solution.
- Reason** : Free energy change for this process is negative.
- 114. Assertion** : When a concentrated solution is diluted by adding more water, molarity of the solution remains unchanged.
- Reason** : Product of moles of a solute and volume is equal to the molarity.
- 115. Assertion** : Anilinium chloride is more acidic than ammonium chloride.
- Reason** : Anilinium chloride is resonance stabilised.
- 116. Assertion** : Pyrrole is an aromatic heterocyclic compound.
- Reason** : It has cyclic delocalised  $6\pi$  electrons.
- 117. Assertion** : 2-Butanol on heating with  $H_2SO_4$  gives 1-butene and 2-butene.
- Reason** : Dehydration of 2-butanol follows Saytzeff's rule.
- 118. Assertion** :  $SeCl_4$  does not have a tetrahedral structure.
- Reason** : Se in  $SeCl_4$  has two lone pairs.
- 119. Assertion** : Liquid  $NH_3$  is used for refrigeration.
- Reason** : Liquid  $NH_3$  quickly vapourises.
- 120. Assertion** : Ethers behave as bases in the presence of mineral acids.
- Reason** : It is due to the presence of lone pair of electrons on the oxygen.

## BIOLOGY

121. Two opposite forces operate in the growth and development of every population. One of them is related to the ability to reproduce at a given rate. The force opposite to it is called  
 (a) fecundity  
 (b) environmental resistances  
 (c) biotic control (d) mortality.
122. Acrosome reaction in sperm is triggered by  
 (a) capacitation (b) release of lysin  
 (c) influx of  $\text{Na}^+$  (d) release of fertilizin.
123. What is a keystone species?  
 (a) a species which makes up only a small proportion of the total biomass of a community, yet has a huge impact on the community's organization and survival  
 (b) a common species that has plenty of biomass, yet has a fairly low impact on the community's organization  
 (c) a rare species that has minimal impact on the biomass and on other species in the community  
 (d) a dominant species that constitutes a large proportion of the biomass and which affects many other species.
124. Which one of the following pairs is not correctly matched?  
 (a) *Streptomyces* - Antibiotic  
 (b) *Serratia* - Drug addiction  
 (c) *Spirulina* - Single cell protein  
 (d) *Rhizobium* - Biofertilizer.
125. You are required to draw blood from a patient and to keep it in a test tube for analysis of blood corpuscles and plasma. You are also provided with the following four types of test tubes. Which of these will you not use for the purpose?  
 (a) test tube containing calcium bicarbonate  
 (b) chilled test tube  
 (c) test tube containing heparin  
 (d) test tube containing sodium oxalate.
126. Smoking addiction is harmful because it produces polycyclic aromatic hydrocarbons, which cause  
 (a) reduction in oxygen transport  
 (b) increase in blood pressure  
 (c) cancer  
 (d) retardation of growth of foetus.
127. The main reason why antibiotics could not solve all the problems of bacteria mediated diseases is  
 (a) insensitivity of the individual following prolonged exposure to antibiotics  
 (b) inactivation of antibiotics by bacterial enzymes  
 (c) decreased efficiency of the immune system  
 (d) the development of mutant strains resistant to antibiotics.
128. Which of the following sets includes the bacterial disease?  
 (a) cholera, typhoid, mumps  
 (b) tetanus, tuberculosis, measles  
 (c) malaria, mumps, poliomyelitis  
 (d) diphtheria, leprosy, plague.
129. The binding of antibodies to the antigens to produce a large insoluble complex is known as  
 (a) antibody-antigen complex  
 (b) agglutination (c) immunization  
 (d) suppressor cell reaction.
130. One of the major difficulties in the biological control of insect pest is that  
 (a) the predator develops a preference to other diets and may itself become a pest  
 (b) the predator does not always survive when transferred to a new environment  
 (c) the method is less effective as compared with the use of insecticides  
 (d) the practical difficulty of introducing the predator to specific areas.
131. Cattle fed with spoilt hay of sweet clover which contains dicumarol  
 (a) are healthier due to a good diet  
 (b) catch infections easily  
 (c) may suffer vitamin K deficiency and prolonged bleeding  
 (d) may suffer from beri-beri due to deficiency of vitamin  $\text{B}_1$ .
132. Which one of the following methods is commonly used to maintain the genetic traits of a given plant?  
 (a) by propagating through seed germination  
 (b) by propagating through vegetative multiplication  
 (c) by generating hybrids through intergeneric pollination  
 (d) by treating the seeds with gamma radiations.

133. The bacteria which attack dead animals are
- first link of the food chain and are known as primary producers
  - second link of the food chain and are herbivorous
  - third link of the food chain and are tertiary consumers
  - the end of food chain and are decomposers.
134. Which of the following statements is incorrect?
- lichen, an association of fungus and algae is an example of mutualism.
  - those epiphytes which use other plants for support only and not for water or food supply and are examples of commensalism.
  - sea-anemone on hermit-crab is an example of protocoperation.
  - mutualism, protocoperation, commensalism cannot be included under symbiosis.
135. How many sperms are formed from a secondary spermatocyte?
- |       |        |
|-------|--------|
| (a) 4 | (b) 8  |
| (c) 2 | (d) 1. |
136. Phytohormones are
- hormones regulating growth from seed to adulthood
  - growth regulators synthesised by plants and influencing physiological process
  - hormones regulating flowering
  - hormones regulating secondary growth.
137. Grey crescent is the area
- at the point of entry of sperm into ovum
  - just opposite to the site of entry of sperm into ovum
  - at the animal pole
  - at the vegetal pole.
138. Even after killing the generative cell with a laser beam, the pollen grain of a flowering plant germinates and produces normal pollen tube because
- laser beam stimulates pollen germination and pollen tube growth
  - the laser beam does not damage the region from which pollen tube emerges
  - the contents of killed generative cell permits germination and pollen tube growth
  - the vegetative cell has not been damaged.
139. One common example of simple reflex is
- tying your shoe laces while talking to another person and not looking at them
  - watering of mouth at the sight of a favourite food
  - climbing up a stairs in dark without stumbling
  - closing of eyes when strong light is flashed across them.
140. Select one of the following pairs of important features distinguishing *Gnetum* from *Cycas* and *Pinus* and showing affinities with angiosperms.
- Perianth and two integuments.
  - Embryo development and apical meristem.
  - Absence of resin duct and leaf venation.
  - Presence of vessel elements and absence of archegonia.
141. Injury to vagus nerve in humans is not likely to affect
- tongue movements
  - gastrointestinal movements
  - pancreatic secretion
  - cardiac movements.
142. Which one of the following is a matching pair?
- Lubb-Sharp closure of AV valves at the beginning of ventricular systole.
  - Dup-Sudden opening of semilunar valves at the beginning of ventricular diastole.
  - Pulsation of the radial artery-Valves in the blood vessels.
  - Initiation of the heart beat - Purkinje fibres.
143. A lake near a village suffered heavy mortality of fishes within a few days. Consider the following reasons for this?
- lots of urea and phosphate fertilizer were used in the vicinity.
  - the area was sprayed with DDT by an aircraft.
  - the lake water turned green and stinky.
  - phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesis.
144. Which one of the following pairs of plant structures has haploid number of chromosomes?

- (a) nucellus and antipodal cells.  
 (b) egg nucleus and secondary nucleus.  
 (c) megaspore mother cell and antipodal cells.  
 (d) egg cell and antipodal cells.
145. When a man inhales air containing normal concentration of  $O_2$  as well as CO he suffers from suffocation because  
 (a) CO reacts with  $O_2$  reducing its percentage in air  
 (b) haemoglobin combines with CO instead of  $O_2$  and forms carboxyhaemoglobin  
 (c) CO affects diaphragm and intercostal muscles  
 (d) CO affects the nerves of the lungs.
146. A patient of diabetes mellitus excretes glucose in urine even when he is kept in a carbohydrate free diet. It is because  
 (a) fats are catabolised in adipose tissues to form glucose  
 (b) amino acids are catabolised in kidney to form glucose  
 (c) amino acids are discharged in blood stream from liver  
 (d) glycogen from muscles is released in blood stream.
147. During the life-cycle, *Fasciola hepatica* (liver fluke) infects its intermediate host and primary host at the following larval stages respectively  
 (a) redia and miracidium  
 (b) cercaria and redia  
 (c) metacercaria and cercaria  
 (d) miracidium and metacercaria
148. Enzymes, vitamins and hormones can be classified into a single category of biological chemicals because of all of these  
 (a) enhance oxidative metabolism  
 (b) are conjugated proteins  
 (c) are exclusively synthesised in the body of a living organism as at present  
 (d) help in regulating metabolism.
149. Cut surfaces of fruit and vegetables often become dark because  
 (a) dirty knife makes it dark  
 (b) oxidation of tannic acid in the presence of trace of iron from the knife makes it dark  
 (c) dust of the air makes it dark  
 (d) none of the above.
150. *Nicotiana sylvestris* flowers only during long days and *N. tabacum* flowers only during short days. If raised in the laboratory under different photoperiods, they can be induced to flower at the same time and can be cross-fertilized to produce self-fertile offspring. What is the best reason for considering *N. sylvestris* and *N. tabacum* to be separate species?  
 (a) they cannot interbreed in nature  
 (b) they are reproductively distinct  
 (c) they are physiologically distinct  
 (d) they are morphologically distinct
151. Which one of the following is the correct statement regarding the particular psychotropic drug specified?  
 (a) morphine leads to delusions and disturbed emotions.  
 (b) barbiturates cause relaxation and temporary euphoria.  
 (c) hashish causes alteration of thoughts, perceptions and hallucinations.  
 (d) opium stimulates nervous system and causes hallucinations.
152. In succulent plants the stomata open in night and close in day. Which among the following would be best hypothesis to explain the mechanism of stomatal action in night only?  
 (a)  $CO_2$  accumulates, reduces pH, stimulate enzymes resulting in accumulation of sugars.  
 (b) increase in  $CO_2$  concentration, conversion of organic acids into starch resulting in the increased conversion into sugars resulting in  $K^+$  transport.  
 (c) low  $CO_2$  concentration accumulates organic acids resulting in the increased concentration of cell sap.  
 (d)  $CO_2$  used up, increase pH results in accumulation of sugars.
153. The cells of the quiescent centre are characterised by  
 (a) having dense cytoplasm and prominent nuclei  
 (b) having light cytoplasm and small nuclei

- (c) dividing regularly to add to the corpus  
(d) dividing regularly to add to tunica

154. *Thermococcus*, *Methanococcus* and *Methanobacterium* exemplify
- (a) bacteria whose DNA is relaxed or positively supercoiled but which have a cytoskeleton as well as mitochondria  
(b) bacteria that contain a cytoskeleton and ribosomes  
(c) archaeobacteria that contains protein homologous to eukaryotic core histones  
(d) archaeobacteria that lack any histones resembling those found in eukaryotes but whose DNA is negatively supercoiled.
155. Ectophloic siphonostele is found in
- (a) *Osmunda* and *Equisetum*  
(b) *Marsilea* and *Botrychium*  
(c) *Adiantum* and *Cucurbitaceae*  
(d) *Dicksonia* and *Maidenhair fern*.
156. Chlorenchyma is known to develop in the
- (a) cytoplasm of *Chlorella*  
(b) mycelium of a green mould such as *Aspergillus*  
(c) spore capsule of a moss  
(d) pollen tube of *Pinus*
157. The distance between two genes in a chromosome is measured in cross-over units which represent
- (a) ratio of crossing over between them  
(b) percentage of crossing over between them  
(c) number of crossing over between them  
(d) none of these.
158. In transgenics, expression of transgene in target tissue is determined by
- (a) enhancer (b) transgene  
(c) promoter (d) reporter.
159. How many genome types are present in a typical green plants cell?
- (a) more than five (b) more than ten  
(c) two (d) three.
160. The growth curve of bacterial population in lab is plotted against time. What will be the shape of graph?
- (a) sigmoid (b) hyperbolic  
(c) ascending straight line  
(d) descending straight line.

**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** : Protoplasmic continuity is maintained in perforated septum.

**Reason** : Usually a small pore remains in the centre of the septum.

162. **Assertion** : The primary protenema of moss by death and decay of cells may break into fragments.

**Reason** : Each fragment gives rise to leafy gametophyte.

163. **Assertion** : Cephalization is advantageous to an animal.

**Reason** : It improves the appearance of the animal.

164. **Assertion** : Koel does not build nest for egg laying.

**Reason** : Koel lays its eggs in the nest of tailor bird.

165. **Assertion** : Competitive inhibitor is also called as substrate analogue.

**Reason** : It resembles the enzymes in structure.

166. **Assertion** : Persons suffering from haemophilia fail to produce blood clotting factor VIII.

**Reason** : Prothrombin producing platelets in such persons are found in very low concentration.

167. **Assertion** : Hybridoma cells are shifted to a medium deficient in nutrient which cannot be synthesized by myeloma cells.

**Reason** : This medium allows selection of hybridoma cells.

168. **Assertion** : Maize is an albuminous seed.

- Reason** : Endosperm is completely absorbed by its growing embryo.
- 169. Assertion** : Ciliated epithelium is present in the inner lining of trachea and large bronchi.
- Reason** : Ciliary movement propel the mucus and foreign particle towards the larynx.
- 170. Assertion** : Light is one of the important factor in transpiration.
- Reason** : It induces stomatal opening and closing. Therefore, transpiration increases in light and decreases in dark.
- 171. Assertion** : The higher concentration of  $O_2$  in the atmosphere is inhibitory to photosynthesis.
- Reason** :  $CO_2$  is the main substrate of photosynthesis.
- 172. Assertion** :  $F_1$  particles are present in the inner mitochondrial membrane.
- Reason** : An electron gradient formed on the inner mitochondrial membrane, forms ATP.
- 173. Assertion** : Rhabdome is present in *Palaeomon*.
- Reason** : Rhabdome has an important role in digestion.
- 174. Assertion** : Pituitary is attached to hypothalamus by a vein.
- Reason** : This attachment is done through a hypophysial portal vein.
- 175. Assertion** : Rabies is acute infectious disease of warm blooded mammals characterised by involvement of central nervous system resulting in paralysis and finally death.
- Reason** : This is caused due to neurotropic filterable bacteria in saliva of rabid animals.
- 176. Assertion** : Many plants are propagated vegetatively even though they bear seeds.
- Reason** : Potatoes multiply by tubers and apple by cutting.
- 177. Assertion** : Nuclear endosperm is formed by subsequent nuclear division without wall formation.
- Reason** : Coconut is an example of such endosperm, where the endosperm remains nuclear throughout the development of the fruit.
- 178. Assertion** : In mammals the female secondary sexual characters are developed by gonadotropins.
- Reason** : Gonadotropins are secreted by graafian follicle.
- 179. Assertion** : The plant biomass which serves as the food of herbivores and decomposers is said to result from the gross primary productivity.
- Reason** : Gross primary productivity is the rate of net production of organic material (biomass).
- 180. Assertion** : Methyl mercury is a highly persistent pollutant that accumulates in food chains.
- Reason** : Mercury pollution is responsible for minamata.

### GENERAL KNOWLEDGE

- 181.** The first of the GAEL (Global Alliance for the elimination of Leprosy) was held in  
 (a) New Delhi (b) Bombay  
 (c) Calcutta (d) Paris.
- 182.** Megger is an instrument to measure  
 (a) very low resistance  
 (b) insulation resistance  
 (c) inductance of a coil  
 (d) all of the above.
- 183.** Terminator technology promotes sale of which of the following that is/are generated by it?  
 (a) transgenic fertile seed.  
 (b) gene modified plants.  
 (c) genetically engineered seeds fertilized in next generation.  
 (d) all of these.
- 184.** Which among the following has become the third

- tiger reserve of Assam?  
 (a) Manas Wildlife Sanctuary  
 (b) Kaziranga National Park  
 (c) Nameri National Park  
 (d) none of these.
185. To make the acidic soil suitable for agricultural, one of the following material is used.  
 (a) lime (b) gypsum  
 (c) calcium superphosphate  
 (d) vegetable compost.
186. The landform which is not associated with wind erosion is  
 (a) sand dune (b) inselberg  
 (c) drumlin (d) mushroom rock.
187. BCG vaccination is to be given to a new born child  
 (a) immediately after child birth  
 (b) within 48 hours  
 (c) within seven days  
 (d) within six months.
188. For reproducing sound, CD (compact disc) audioplayer uses a  
 (a) quartz crystal (b) titanium needle  
 (c) laser beam  
 (d) barium titanate ceramic
189. In a three pin electrical plug, longest pin should be connected to  
 (a) ground terminal (b) live terminal  
 (c) neutral terminal (d) any terminal.
190. The new addition to the commonwealth games 2010 is  
 (a) shooting (b) hockey  
 (c) wrestling (d) football.
191. The name of the player who established record in World Cup Cricket 2007 of making six sixes is  
 (a) Sanath Jaisurya (b) Virendra Sehwag  
 (c) Adam Gilchrist (d) Hershelle Gibbs.
192. The lateral meaning of the word Arya is  
 (a) superior (b) learned  
 (c) priest (d) warrior.
193. When T.V. is switched on  
 (a) audio and video both start simultaneously  
 (b) audio is heard immediately but video starts later because video needs some warm up time  
 (c) video starts immediately but audio is heard later because sound travels at a lesser speed than light  
 (d) it depends on the T.V. stand.
194. The instrument of music in which Ustad Amjad Ali Khan has distinguished himself is  
 (a) sarod (b) violin  
 (c) sitar (d) shehnai.
195. A deep and narrow river valley with steep bank is called  
 (a) geyser (b) bluff  
 (c) delta (d) canyon.
196. A 'breath test' used by traffic police to check drunken drivers uses -  
 (a) potassium dichormate-sulphuric acid  
 (b) potassium permanganate sulphuric acid  
 (c) turmeric on filter paper  
 (d) silica gel coated with silver nitrate
197. In which of the following books is 'Knowledge is Power' written?  
 (a) Essay on Man (b) Paradise Lost  
 (c) Leviathan (d) Das Capital.
198. Who said "where weather accumulates, men decay"?  
 (a) Abraham Lincoln (b) Mao Tsetung  
 (c) Karl Marx (d) Goldsmith.
199. Which of the following computer viruses is named after cherry and caffen soft drink popular with programmers?  
 (a) sircam (b) code pink  
 (c) cod3 red (d) malisa
200. The fourth Buddhist council was held during the reign of  
 (a) Ashoka  
 (b) Chandragupta  
 (c) Kanishka  
 (d) Chandragupta Vikramaditya

# SOLUTIONS

## PHYSICS

1. (d)

2. (c): Acceleration =  $\frac{d^2x}{dt^2}$

For part  $OP$ , the acceleration is positive as the velocity is increasing. Slope is increasing. For part  $PQ$ , the acceleration is zero. Horizontal straight line shows that the velocity is zero. For part  $QR$ , acceleration is negative. It is retarded motion. Velocity is decreasing as the slope decreases with time. Hence option (c) is correct.

3. (a): Centripetal force ( $F$ ) =  $\frac{mv^2}{r} \therefore v = \sqrt{\frac{Fr}{m}}$

4. (b): Momentum of rifle = Momentum of bullet  
 $m_1v_1 = m_2v_2$ , Also  $m_1 > m_2$

$$\frac{\text{K.E. of rifle}}{\text{K.E. of bullet}} = \frac{\frac{1}{2}m_1v_1^2}{\frac{1}{2}m_2v_2^2}$$

$$= \frac{m_1^2v_1^2}{m_2^2v_2^2} = \frac{m_2}{m_1}$$

K.E. of rifle is less than K.E. of bullet.

5. (a): Distance of corner mass from opposite side =  $r$

$$r^2 = l^2 - \left(\frac{l}{2}\right)^2 = \frac{3l^2}{4}$$

$$l = mr^2 = \frac{3}{4}ml^2$$

6. (c): Using Lami's theorem, we have

$$\frac{P}{\sin\theta_1} = \frac{R}{\sin 150^\circ} \Rightarrow \frac{P}{\sin\theta_1} = \frac{R}{\sin(180^\circ - 30^\circ)}$$

$$\Rightarrow \frac{1.9318 \text{ kgwt}}{0.9659} = \frac{R}{1/2}$$

$$\Rightarrow R = \frac{1.9318}{0.9659} \times \frac{1}{2} \text{ kgwt} = 1 \text{ kgwt.}$$

7. (a): Gravitational force,  $F \propto \frac{1}{r^n}$

$$F = \frac{k}{r^n} \quad \text{where } k \text{ is a constant.}$$

For a planet, moving in a circular orbit of

$$\text{radius } R, F = \frac{k}{R^n}$$

$$\text{But, } F = m\omega^2 R$$

$$\Rightarrow \frac{k}{R^n} = mR \cdot \left(\frac{2\pi}{T}\right)^2 \Rightarrow \frac{k}{R^{n+1}} = \frac{m(2\pi)^2}{T^2}$$

$$\Rightarrow T^2 \propto R^{n+1}$$

$$\therefore T \propto R^{\frac{n+1}{2}}$$

8. (a):  $n_h = 10^{21}$  atoms/m<sup>3</sup>

$$n_i = 10^{19}$$
 atoms/m<sup>3</sup>,  $n_e = ?$

$$n_e n_h = n_i^2$$

$$n_e = \frac{n_i^2}{n_h} = \frac{(10^{19})^2}{10^{21}} = \frac{10^{38}}{10^{21}} = 10^{17} \text{ atoms/m}^3.$$

9. (a): In series combination,  $\frac{l}{K_1} + \frac{l}{K_2} = \frac{2l}{K}$

$$\Rightarrow \frac{1}{K_1} + \frac{1}{K_2} = \frac{2}{K} \Rightarrow k = \frac{2K_1K_2}{K_1 + K_2}$$

10. (d): Fringe width,  $\beta = \frac{\lambda D}{d}$

From question,  $d' = 3d$

$$\therefore \text{New fringe width, } \beta' = \frac{\lambda D}{d'}$$

$$\therefore \beta' = \frac{\lambda D}{3d} = \frac{\beta}{3}$$

11. (a)

12. (d): Due to insertion of slab, the optical path increases by  $x/\mu$ , where  $x$  is thickness of slab.

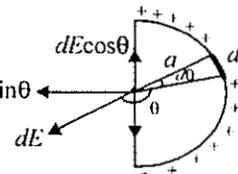
Therefore the converging point will shift away by

$$\left[x - \frac{x}{\mu}\right] = x\left(1 - \frac{1}{\mu}\right)$$

13. (a): Velocity of electromagnetic wave is

$$c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

14. (d):



Electric field intensity at  $O$  due to small elemental length  $dl$  of charged ring,

$$dE = \frac{1}{4\pi\epsilon_0} \cdot \frac{\lambda dl}{a^2} = \frac{1}{4\pi\epsilon_0} \cdot \frac{\lambda a d\theta}{a^2}$$

$$dE = \frac{1}{4\pi\epsilon_0} \cdot \frac{\lambda}{a} d\theta$$

$\therefore$  Net electric field at centre  $O$  is

$$E = \int dE \sin\theta = \int_0^\pi \frac{1}{4\pi\epsilon_0} \frac{\lambda}{a} \sin\theta d\theta$$

$$= \frac{\lambda}{4\pi\epsilon_0 a} [-\cos\theta]_0^\pi$$

$$\therefore E = \frac{\lambda}{2\pi\epsilon_0 a}$$

15. (a) : Impedance of  $RL$  circuit is

$$Z = \sqrt{R^2 + X_L^2}$$

where  $X_L = \omega L = 2\pi f L$

$$\therefore Z = \sqrt{R^2 + (2fL)^2}$$

16. (c) : Frequency of fundamental mode of vibrations of 1<sup>st</sup> closed organ pipe,

$$v_1 = \frac{v}{4l_1} = \frac{v}{4 \times 100} \quad \dots (i)$$

Frequency of fundamental mode of vibrations of 2<sup>nd</sup> closed organ pipe,

$$v_2 = \frac{v}{4l_2} = \frac{v}{4 \times 101} \quad \dots (ii)$$

From question,  $v_1 - v_2 = \frac{16}{20}$

$$\Rightarrow \frac{v}{4 \times 100} - \frac{v}{4 \times 101} = \frac{16}{20}$$

$$\Rightarrow \frac{v}{4} \left[ \frac{1}{100} - \frac{1}{101} \right] = \frac{16}{20}$$

$$\Rightarrow \frac{v}{4} \left[ \frac{101 - 100}{101} \right] = \frac{16}{20} \Rightarrow \frac{v}{4} \times \frac{1}{101} = \frac{16}{20}$$

$$\Rightarrow v = \frac{16 \times 101 \times 4}{20} = 323.2 \text{ m/s.}$$

17. (a) : Stages 1 and 2 are at the same temperature. Also stages 4 and 5 are at same temperature. As  $V_p$  is more at higher temperature and same at all stages at equal temperature.

$$\therefore V_{p3} > V_{p1} = V_{p2} > V_{p4} = V_{p5}$$

18. (b) :  $-\frac{dN}{dt} = \lambda N \Rightarrow N_2 = \lambda N_1$

19. (c) : Kinetic energy is +ve ( $A$ )  
|total energy| < |P.E.]

$\therefore C \rightarrow$  total energy,  $B$  the P.E.

20. (b) : Net charge on system = 0

$\therefore$  Net force on system = 0.

Now consider one charge :  $T = qvB$ .

21. (c) :  $Y = \frac{F/A}{l}$

$$\therefore F = \frac{YA}{l} \cdot \Delta l = k \cdot \Delta l$$

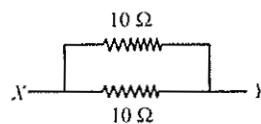
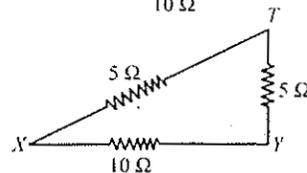
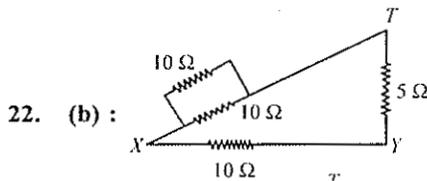
Force  $\propto$  extension

If the extension is  $x$ , work done in extending by  $dx$

$$dW = kx dx \quad \therefore W = \frac{1}{2} k \cdot x^2$$

$$\text{If } x \text{ is } l' - l, W = \frac{1}{2} k(l' - l)^2$$

$$\text{i.e. work done is } \frac{1}{2} \frac{YA}{l} (l' - l)^2.$$



$$R_{XY} = \frac{10 \times 10}{10 + 10} = 5 \Omega.$$

23. (a) : The magnetic intensity due to an isolated pole of strength  $m_p$  at a distance ( $r$ ) =  $\frac{m_p}{r^2}$

24. (a) : With increase in frequency, reactance of  $LC$  circuit will increase. As a result, voltage increases. So, brightness will increase.

25. (c) : When heater wires are connected in series then equivalent resistance,

$$R_s = R_1 + R_2 = 2R \quad (\because R_1 = R_2)$$

Rate of heat produced,  $H_s = \frac{V^2}{R_s}$

$$H_s = \frac{V^2}{2R} \quad \dots (i)$$

In second case,  $R_p = \frac{R_1 R_2}{R_1 + R_2} = \frac{R \cdot R}{2R}$

or  $R_p = \frac{R}{2}$

$\therefore$  Rate of heat produced,  $H_p = \frac{V^2}{R_p}$

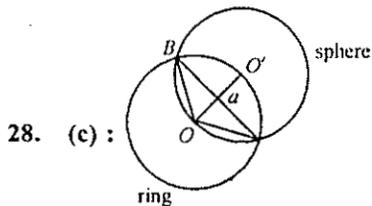
$$H_p = \frac{2V^2}{R} \quad \dots (ii)$$

Dividing (i) by (ii), we get

$$\frac{H_s}{H_p} = \frac{(V^2/2R)}{(2V^2/R)} = \frac{V^2}{2R} \times \frac{R}{2V^2} = \frac{1}{4}$$

26. (a)

27. (a) : Lumen is the S.I. unit of luminous flux.



Charge on ring  $q$ , centre of ring =  $O$

Centre of sphere =  $O'$

Linear charge density of ring,  $\lambda = \frac{q}{2\pi a}$

Charge on arc  $AB$  of ring,

$$q_{AB} = \lambda (\text{arc } AB) = \frac{1}{2\pi a} \cdot a \cdot \frac{2\pi}{3}$$

$$q_{AB} = q/3$$

i.e., charged enclosed by sphere =  $q/3$

$\therefore$  Flux coming out of sphere =  $q/3\epsilon_0$ .

29. (a) : For dc,  $V = IR$  ( $R$  is resistance of inductor)

$$100 = 1 \times R \Rightarrow R = 100 \Omega.$$

For ac,  $Z = \sqrt{R^2 + X_L^2}$

$$\therefore V = IZ$$

$$\Rightarrow 100 = 0.5 \sqrt{R^2 + X_L^2}$$

$$\Rightarrow 100 = 0.5 \sqrt{(100)^2 + X_L^2}$$

$$\Rightarrow 100 = \frac{5}{10} \sqrt{(100)^2 + X_L^2}$$

$$X_L^2 = (200)^2 - (100)^2 = 300 \times 100$$

$$\Rightarrow X_L = \sqrt{3 \times (100)^2} = 100\sqrt{3}$$

$$\Rightarrow \omega L = 100\sqrt{3} \Rightarrow 2\pi\nu L = 100\sqrt{3}$$

$$\Rightarrow 2 \times \pi \times 50 \times L = 100\sqrt{3}$$

$$\Rightarrow 100 \times \pi L = 100\sqrt{3}$$

$$\therefore L = \frac{\sqrt{3}}{\pi} = \frac{\sqrt{3}}{3.14} \Rightarrow L = 0.55 \text{ H.}$$

30. (c) : Resistance of 25 W, 200 V bulb

$$R_1 = \frac{(200)^2}{25} \Omega.$$

Resistance of 100 W, 200 V bulb

$$R_2 = \frac{(200)^2}{100} \Omega.$$

Clearly,  $R_1 > R_2$ .  $\therefore H_1 > H_2$ .

$\therefore$  25 W bulb will glow more brightly.

31. (d)

32. (b) : The forbidden gap in the energy band of Si = 1.1 eV.

33. (a) : Since the wavelength of violet light is the smallest, therefore maximum deviation will occur for violet light.

34. (d) : By truth table,  $Y = \overline{A+B}$ . Therefore it is a NOR gate operation.

35. (d) : Angle of first order diffraction ( $\theta_1$ ) =  $32^\circ$ . We know that the angle of diffraction for the  $n$ th order ( $\theta_n$ ) is given by  $d \sin \theta_n = n\lambda$ .

For first order diffraction we get

$$d \sin 32^\circ = 1 \times \lambda \text{ or, } \lambda = d \sin 32^\circ.$$

Now for second order diffraction,

$$d \sin \theta_2 = 2 \times \lambda \text{ or, } d \sin \theta_2 = 2 \times d \sin 32^\circ$$

$$\text{or } \sin \theta_2 = 2 \times \sin 32^\circ = 2 \times 0.529 = 1.06.$$

Since the sine of any angle cannot be greater than 1, therefore there is no second order diffraction.

36. (a)

37. (a) : We know that  $J = AT^2 e^{-b/T}$

$$\frac{J}{T^2} = A e^{-b/T}$$

Taking log both side, we get

$$\log_e \frac{J}{T^2} = \log_e (A \cdot e^{-b/T})$$

$$\log_e \frac{J}{T^2} = \log_e A - \frac{b}{T}$$

Comparing with  $y = mx + C$   
we get correct option (a).

38. (c) :  $h_o = 5 \text{ cm}$ ,  $h_i = ?$

$$u = -100 \text{ cm}, R = -20 \text{ cm}. \therefore f = -10 \text{ cm}$$

Using mirror formula,

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v} - \frac{1}{100} = -\frac{1}{10}$$

$$\frac{1}{v} = \frac{1}{100} - \frac{1}{10} = \frac{1-10}{100} = -\frac{9}{100}$$

$$\therefore v = -\frac{100}{9} \text{ cm.}$$

$$\frac{h_i}{h_o} = \frac{v}{u} \Rightarrow \frac{h_i}{5 \text{ cm}} = \frac{(100/9)}{100} = \frac{1}{9}$$

$$\therefore h_i = 5/9 = 0.55 \text{ cm.}$$

39. (b) : Magnifying power of compound microscope

$$M = -\frac{v_o}{u_o} \left( 1 + \frac{D}{f_e} \right) = -\frac{L}{f_o} \left( 1 + \frac{D}{f_e} \right)$$

40. (c)

41. (b) : From,  $f = \frac{1}{2l} \sqrt{\frac{T}{\mu}}$ ,  $f^2 = \frac{T}{4l^2 \mu}$

$$\text{or, } \mu = \frac{T}{4l^2 f^2} = \frac{[MLT^{-2}]}{L^2 T^{-2}} = \frac{M}{L}$$

$$= \frac{\text{Mass}}{\text{length}} = \text{linear mass density.}$$

42. (c) : As time of flight,

$$T = \frac{2u \sin \theta}{g} \therefore T' = \frac{2(nu) \sin \theta}{g} = nT$$

But range

$$R = \frac{u^2 \sin 2\theta}{g} \therefore R' = \frac{n^2 u^2 \sin 2\theta}{g} = n^2 R.$$

43. (c) : A needle placed carefully on the surface of water may float due to surface tension as upward force due to surface tension balances the weight of the needle. But these upward force due to surface tension are very small as compared to weight of ball. Also the weight of liquid displaced by the ball immersed in liquid is less than the weight of the ball, hence ball sinks into the liquid.
44. (a) : Green flower emit all colour except green and the emitted colours are dominated by red colour. So flower appear black.
45. (c) : Assertion is correct but reason is false because inductance reactance  $X_L = 2\pi fL$ . So, higher frequency greater inductance reactance.

46. (b)

47. (b) : Hardness penetrating power of X-ray depends upon accelerating voltage applied across X-ray tube. Characteristic X-ray relate to the material of target. X-ray can't pass through matter of heavier element like bones (which contain phosphorus and calcium) but can pass through matter of lighter element as flesh (which contain oxygen, hydrogen and carbon)

48. (d) : Emission transitions can take place between any higher energy level and any energy level below it while absorption transitions start from the lowest energy level only and may end at any higher energy level. Hence number of absorptions transitions between two given energy level. Hence number of absorptions transitions between two given energy levels is always less than the number of emission transitions between the same two levels.

$$49. (a) : \frac{1}{f} = (\mu_g - 1) \left[ \frac{1}{R_1} - \frac{1}{R_2} \right]$$

$$= \left( \frac{\mu_g}{\mu_w} - 1 \right) \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\frac{1}{f} = \left( \frac{\mu_g - \mu_w}{\mu_w} \right) \cdot \left[ \frac{1}{R_1} - \frac{1}{R_2} \right]$$

$$= \left( \frac{1.5 - 1.33}{1.33} \right) \cdot \left[ \frac{1}{20} + \frac{1}{20} \right]$$

$$\frac{1}{f} = \frac{0.13 \times 2}{20} \Rightarrow f = \frac{20}{0.26}$$

$$\therefore f = 76.92 \text{ cm.}$$

50. (b)

51. (d) : It is quite clear that magnetic poles always exists in pairs. Since, one can imagine magnetic field configuration with three poles. When north poles or south poles of two magnets are glued together. They provide a three pole field configuration. It is also know that a bar magnet does not exert a torque on itself due to own its field.

52. (b) : When the displacement of a particle executing SHM is  $y$ , then its

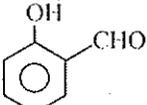
$$K.E. = \frac{1}{2} m \omega^2 (a^2 - y^2) \text{ and}$$

$$P.E. = \frac{1}{2} m \omega^2 y^2.$$

For  $K.E. = P.E.$  or  $2y^2 = a^2$  or,  $y = a/\sqrt{2}$ . Since total energy remains constant through out the motion, which is  $E = K.E. + P.E.$  So, when  $P.E.$  is maximum then  $K.E.$  is zero and vice versa.

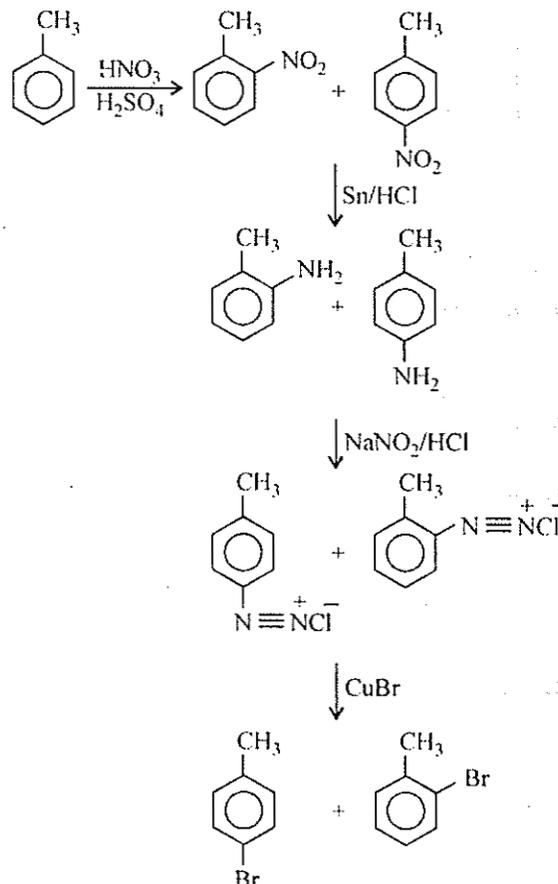
53. (c) : Electric shock is due to the electric current flowing through a living body. When the bird perches on a single high power line, no current passes through its body because its body is at equipotential surface i.e., there is no potential difference. While when man touches the same line, standing bare foot on ground the electrical circuit is completed through the ground. The hands of man are at high potential and his feet are at low potential. Hence large amount of current flows through the body of the man and person therefore gets a fatal shock.
54. (b) : Stopping potential is a measure of maximum kinetic energy of emitted photoelectron ( $eV_0 = K_{max}$ ) and  $K_{max}$  depends upon the frequency of incident light but is independent of intensity.
55. (a)
56. (a) : Magnetic moment,  $M = nIA$
57. (a) :  $V = E - I(R + r)$
58. (a)
59. (d) : The force on a charged particle moving in a uniform magnetic field always acts in direction perpendicular to the direction of motion of the charge. As work done by magnetic field on the charge is zero,  $[W = FS \cos\theta]$ , so the energy of the charged particle does not change.
60. (a)

### CHEMISTRY

61. (b) :  $X$  is  ; which undergoes Cannizzaro's reaction to give  $Z$ .
62. (b) : Slowest step of mechanism decides the rate expression. Thus rate =  $k [NO_2][F_2]$ .
63. (d) : I  $Na_2O + H_2O \rightarrow 2NaOH$   
 II  $Na_2S + H_2O \rightarrow 2NaOH + H_2S$   
 III  $Na_2Se + H_2O \rightarrow 2NaOH + H_2Se$   
 IV  $Na_2Te + H_2O \rightarrow 2NaOH + H_2Te$   
 I will have the highest pH. Among  $H_2S$ ,  $H_2Se$ ,

$H_2Te$  acidity goes on increasing on going down the group as bond length increases on increasing size of central atom. So,  $pH_4 < pH_3 < pH_2$   
 Overall order is  $pH_1 > pH_2 > pH_3 > pH_4$

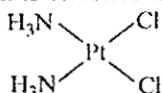
64. (b) :



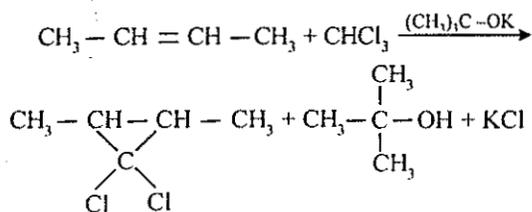
65. (d) :
- |             |            |                      |          |            |
|-------------|------------|----------------------|----------|------------|
|             | $2AB_2(g)$ | $\rightleftharpoons$ | $2AB(g)$ | $+ B_2(g)$ |
| Initial     | 2          |                      | 0        | 0          |
| Equilibrium | $2(1-x)$   |                      | $2x$     | $x$        |
- Moles at equilibrium =  $2(1-x) + 2x + x = 2 - 2x + 2x + x = x + 2$ .
- $$K_p = \frac{[P_{AB}]^2 [P_{B_2}]}{[P_{AB_2}]^2} = \frac{\left(\frac{2x}{x+2} \times p\right)^2 \left(\frac{x}{2+x} \times p\right)}{\left[\frac{2(1-x)}{x+2} \times p\right]^2}$$
- $$= \frac{4x^3}{x+2} \times p = \frac{4x^2 \times p}{2} \times \frac{1}{4}$$

$$x = \left( \frac{2K_p}{p} \right)^{1/3} \quad (\text{as } 1-x \approx 1, 2+x \approx 2)$$

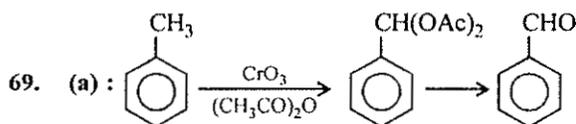
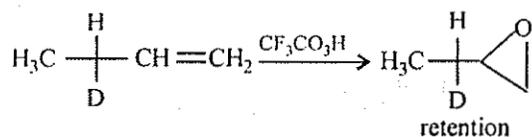
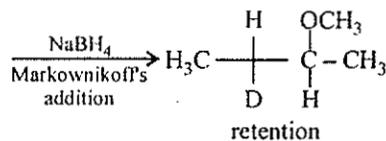
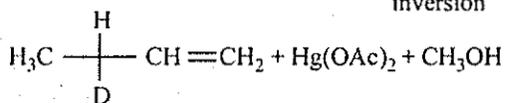
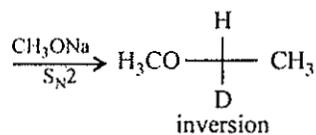
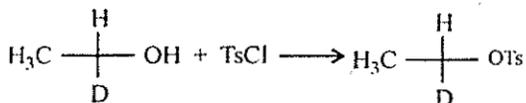
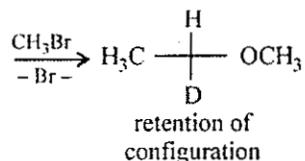
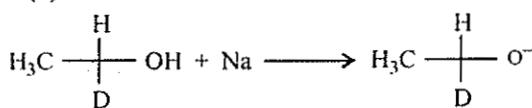
66. (a) : Cisplatin is effective in curing cancer



67. (b) : It is a method of preparation of cycloalkanes.



68. (b)



70. (b) : Weight of Ag required =  $V \times d$

$$= 80 \times 5 \times 10^{-3} \times 1.05 = 0.42$$

$$\therefore W = \frac{Eit}{96500}$$

$$\therefore 0.42 = \frac{108 \times 3 \times t}{96500} \Rightarrow t = 125 \text{ sec.}$$

71. (a) : The empirical relation,

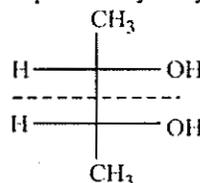
viz.,  $\frac{x}{m} = kc^{1/n}$ , put forward by Freundlich is known as Freundlich's adsorption isotherm. Taking log on both sides

$$\log \left( \frac{x}{m} \right) = \log k + \frac{1}{n} \log c$$

72. (a) :  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \begin{array}{c} \text{H} \\ | \\ \text{C} - \text{H} \\ | \\ \text{Cl} \end{array}$
- 1-chloropentane

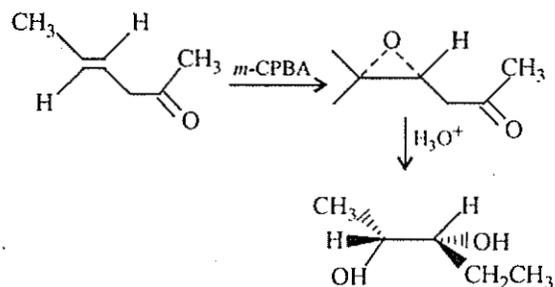
$\Rightarrow$  absence of asymmetric carbon atom.

73. (c) : As it has plane of symmetry



74. (d)

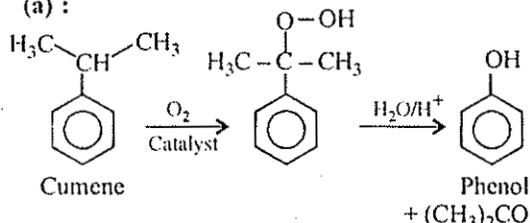
75. (b) :



76. (d) : This defect arises when a compound has excess metal ion. If a negative ion is absent from its lattice site leaving a hole occupied by electron. The holes occupied by electrons are called F-centres. Greater the number of F-centres greater is the intensity of colour.

77. (b) : Trinitrotoluene (TNT) with ammonium nitrate is extensively employed as blasting explosive.

78. (a) :



79. (c) : On long storage in contact with air and moisture, oils and fats develop unpleasant smell. This process is known as rancidification. It is due to

(a) Enzymatic hydrolysis - producing bad smelling lower fatty acids.

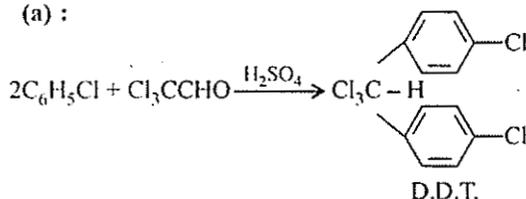
(b) Oxidation of unsaturated acids - producing aldehydes and ketones.

80. (a) : It is an example of pseudo unimolecular reaction where molecularity  $\geq 2$  but order of reaction is one.

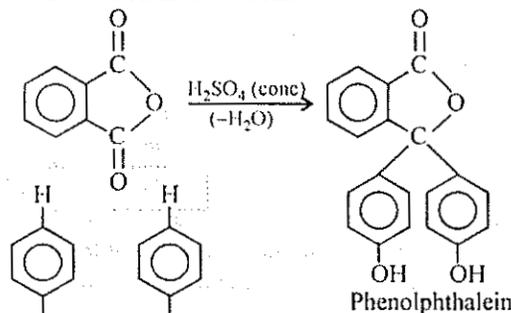
$$\text{Rate} = k[\text{Sugar}][\text{H}_2\text{O}]$$

In the reaction, water is present in excess and its concentration is taken to be constant, thus the reaction becomes independent of  $[\text{H}_2\text{O}]$  and is pseudo first order.

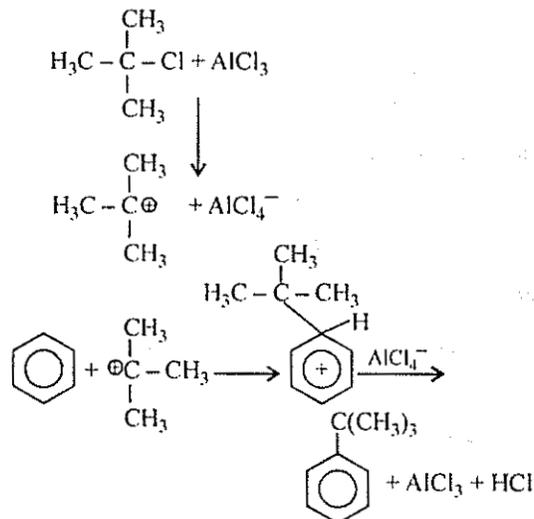
81. (a) :



82. (d) : Phenol couples with phthalic anhydride in presence of conc.  $\text{H}_2\text{SO}_4$  to form phenolphthalein which is used as an indicator :



83. (d) :



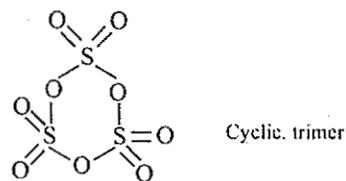
84. (c) :  $\text{H}_2\text{SO}_4$  is strong acid having  $\text{pH} < 7$ .  $\text{NaNO}_2$  on hydrolysis gives alkaline solution of  $\text{pH} > 7$ .  $\text{NaCl}$  is neutral and  $\text{H}_2\text{S}$  is weak acid.

85. (a) : The enzyme must contain at least one atom of Se.

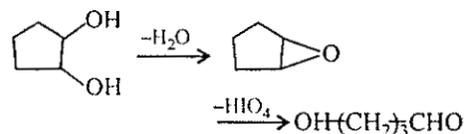
$$\therefore 0.5 \text{ g of Se is present in } 100 \text{ g of enzyme}$$

$$\therefore 78.4 \text{ g of Se will be present in } = \frac{100 \times 78.4}{0.5} = 1.576 \times 10^4 \text{ g of enzymes}$$

86. (d) :



87. (a) :

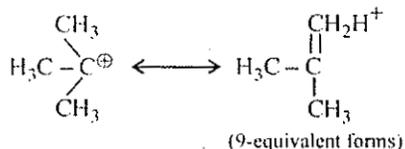


To cause oxidative cleavage of bonds carrying groups prone to undergo oxidation. One mole of reagent is required to cleave one bond.

88. (a) : In  $\text{H}_2\text{O}$ , electronegativity difference is highest. So, dipole moment is highest in this.  $\text{CH}_4$  is a symmetrical tetrahedral structure and its dipole moment is zero.

99. (c) :  $u = \sqrt{\frac{3RT}{M}}$



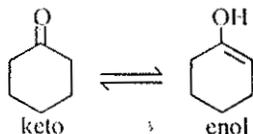


103. (d) :  $\text{H}_2$  and  $\text{Cl}_2$  react chemically. Hence Dalton's law is not applicable. Dalton's law states that "at a given temperature, the total pressure exerted by two or more non-reacting gases occupying a definite volume is equal to the sum of the partial pressures of the component gases."

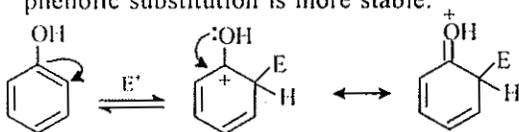
104. (a) :  $E = -\frac{2\pi^2 k^2 m_e^4}{n^2 h^2}$

where  $n$  = principal quantum number which has only integral value, it follows that total energy is quantized.

105. (a) : Solid + heat  $\rightleftharpoons$  liquid. So on heating forward reaction is favoured and amount of solid will decrease.
106. (a) : Cyclohexanone exists in two readily interconvertible different structures leading to dynamic equilibrium known as tautomerism.



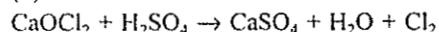
107. (c) : -OH group shows +M effect and is an activating group, moreover the arenium ion of phenolic substitution is more stable.



108. (b) : The factor  $T\Delta S$  increases with increase in temperature.

109. (a) :

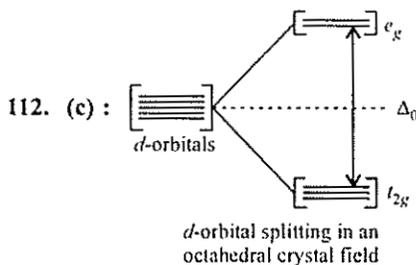
110. (b) : The reaction involved is



The available chlorine may be defined as the % of chlorine liberated when one mole of bleaching powder (127 g) is treated with excess of dilute  $\text{H}_2\text{SO}_4$ .

111. (b) : Due to presence of strong C-F bonds teflon has high thermal stability and chemical inertness. As, it softens on heating and can be remoulded. So,

it is a thermoplastic.



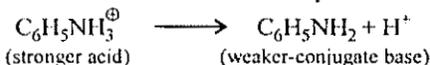
$\therefore$  In high spin situation,  $\Delta_0 < P$ , in  $d^6$  configuration, 4<sup>th</sup> and 5<sup>th</sup> electron are added to  $e_g$  rather than  $t_{2g}$ . So configuration of  $d^6$  ion will be  $t_{2g}^3 e_g^3$ .

113. (d) : Non-oxidising acids ( $\text{HCl}$  and dil.  $\text{H}_2\text{SO}_4$ ) do not have any effect on copper. However they dissolve the metal in presence of air. As it is a non-spontaneous process so,  $\Delta G$  can not be -ve.

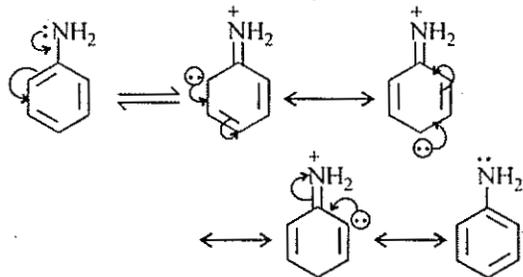
114. (d) : Molarity equation is written as  $M_1V_1 = M_2V_2$  thus if the  $V_2$  changes  $M_2$  also changes.

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{volume of solution in litre}}$$

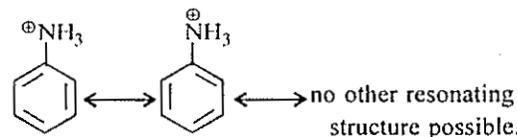
115. (c) : Aniline is weaker base than ammonium chloride. In  $\text{NH}_4\text{Cl}$  or aliphatic amines, then non-bonding electron pair of N is localised and is fully available for coordination with a proton.



On the other hand, in aniline and other aromatic amines, the non-bonding electron pair is delocalised into benzene ring by resonance.



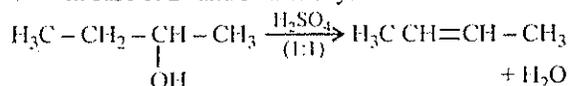
But anilinium ion is less resonance stabilised than aniline



116. (a)

117. (a) : Saytzeff's rule : The alkene formed in greatest amount is the one that corresponds to removal of the hydrogen from the  $\beta$ -carbon having the fewest hydrogen substituent.

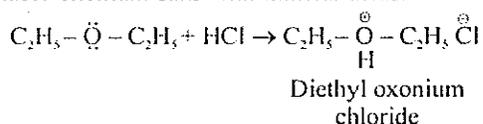
In case of 2° and 3° alc. Saytzeff's rule is followed



118. (c) :  $\text{SeCl}_4$  possesses see-saw geometry, which can be regarded as a distorted trigonal bipyramidal structure, having one lone pair of electrons in the basal position of the trigonal bipyramid. See-saw geometry of  $\text{SeCl}_4$  molecules arises due to the  $sp^3d$  hybridisation of the central atom. The distortion in shape is due to the presence of one lone pair of electrons.

119. (a) : Liq.  $\text{NH}_3$  has high heat of vaporisation (327 cal/g). So, it takes up lots of heat and helps in cooling. So, it is used in ice-plants.

120. (a) : Due to the presence of lone pair of electrons on oxygen atom, ethers behave as base and form stable oxonium salts with mineral acids.



## BIOLOGY

121. (b) : The environmental factors which can check the growth of population size constitute the environmental resistance. These include predators, food, water, nesting sites, similar competitors, etc. All living things tend to reproduce until the point at which their environment becomes a limiting factor. No population, human or otherwise, can grow indefinitely; eventually, some biotic or abiotic variable will begin to limit population growth.

122 (c) : The activated spermatozoan on reaching the egg plasma membrane, undergoes a number of changes in its acrosomal region. All these changes are collectively described under acrosome reaction. Acrosome reaction is calcium-dependent involving massive uptake of calcium and sodium with an efflux of hydrogen generating high pH and osmotic pressure, producing negative surface charge, and

partial or total release of the acrosomal enzymes. Calcium influx may activate phospholipase resulting in accumulation of unsaturated fatty acids and fusogenic lysophospholipids contributing to acrosome reaction.

123. (a) : Keystone species are those species which has significant and disproportionately large influence on the community structure and characteristics. It has often considerably low abundance and biomass as compared to dominant species. Removal of such species causes serious disruption in structure and function of community.

124. (b) : *Serratia marcescens* is considered a harmful human pathogen which has been known to cause urinary tract infections, wound infections, and pneumonia. *Serratia* bacteria also have many antibiotic resistance properties which may become important if the incidence of *Serratia* infections dramatically increases.

125. (c) : Clotting of collected blood can be prevented by -

- coating test tubes with silicon (which produce non wettable surface similar in its smoothness to endothelial lining of blood vessels).

- adding chelating agents (includes trisodium citrate, sodium oxalate and sodium EDTA) which remove calcium which is important for blood coagulation, and prevent blood clotting.

- adding Heparin, most powerful anticoagulant which acts indirectly by activating plasma antithrombin III. Heparin is effective both *in vivo* and *in vitro*. Whereas the option a, b and d are effective *in vitro*.

Heparinized blood is not suitable for blood counts (as it alters the shape of RBC's and WBC's which affects blood testing), Fragility testing and complement fixation tests. Hence (c) is the correct answer.

126. (c) : Cancer is caused by cells dividing repeatedly out of control. They cease to respond to the normal signals around them and form unspecialised masses of cells called tumours. Lung cancer usually starts in the epithelium of the bronchioles, so-called bronchial carcinoma. It then usually spreads throughout the lungs. It is caused almost exclusively by smoking. Tobacco smoke contains chemicals responsible for lung cancer. The most important of

these are polycyclic hydrocarbons which are converted in the body to carcinogens.

Besides, carbon monoxide combines with haemoglobin and reduces oxygen transport by about 15% in smokers and nicotine increases blood pressure, heart rate and constriction of blood vessels.

127. (d) : A major problem in the treatment of bacterial mediated diseases is that many bacteria have been found to show resistance to antibiotics. The emergence of antibiotic-resistant bacteria is closely linked to the extent that antibiotics are used in humans and items of human diet. Resistant strains may appear rapidly or slowly, according to the amount or type of antibiotic used. Bacteria occur in such large numbers that there is a high chance of a mutant individual eventually appearing in the population. As soon as it does, use of the antibiotic to which it is resistant will give it a selective advantage over non-resistant types and it will multiply and eventually become the dominant type. Antibiotics may also be destroyed by enzymes inside the cells being targeted. A well-known and important example is the group of enzymes known as penicillinases which hydrolyses and destroys penicillins and cephalosporins.
128. (d) : Diphtheria, leprosy and plague are the bacterial diseases of humans. Diphtheria is a serious air-borne contagious disease. It is caused by *Corynebacterium diphtheriae* which is a Gram-positive bacterium. It is inhaled through droplets and reaches to respiratory tract and infects it. Leprosy or Hansen's disease is a contact disease, caused by bacterium *Mycobacterium leprae*. It degenerates the tissues and deforms the body organs. Plague is a disease caused by bacterium *Yersinia pestis* or *Pasteurella pestis*.
129. (b) : Binding of antibodies to the antigens produces a large insoluble complex known as agglutination. It is a specific reaction, i.e., a particular antigen will only clump in the presence of its specific antibody. Each antibody has two antigen binding sites. It combines with two antigens, causing them to agglutinate.
130. (a) : The predator develops a preference to other diets and can give unforeseen negative results that could outweigh all benefits. For example, when the mongoose was introduced in Hawaii in order to control the rat population, it preyed on the endemic birds of Hawaii, especially their eggs, more often than it ate the rats. As most of the birds feed on insect and keep insect population low. The mongoose who destroy birds acts as secondary pest.
131. (c) : Dicumarol is an anticoagulant found in spoils sweet clover causes hemorrhage and other symptoms of bleeding disorder by disrupting vitamin K metabolism and preventing the activation of prothrombin and certain other clotting factors by the liver.
132. (b) : The propagation through vegetative multiplication is used to maintain the genetic traits of a given plant. It gives rise to genetically uniform population or clone. In case of plants propagated through seeds, variations creep in due to chance segregation of genes during meiosis and their chance combination during fertilization.
133. (d) : Bacteria attacking the dead animals represent the end of the food chain and are decomposers. These are the organisms that obtain energy from chemical breakdown of organisms. They secrete enzymes onto dead matter and then absorb the breakdown products. Bacteria are specialised to breakdown organic materials that are difficult for other organisms to digest. They also fulfil a vital role in the ecosystem, returning the constituents of organic matter to the environment in inorganic forms so that they can again be assimilated by producers.
134. (d) : Symbiosis means "living together". It is a beneficial coaction between two (or more) different species in which one or both the species are benefited and neither species is harmed. Symbiotic relationships are manifested through commensalism, proto cooperation and mutualism and are widespread in nature. Commensalism is an association or relationship between two different organisms in which one is always benefited while the other is neither benefited nor harmed. This relationship may be permanent or temporary and the benefit derived from the other organism may consist of protection, transportation,

living space and food. Protocooperation is a relationship between two species, which is favourable but not obligatory to both. Mutualism is a relationship between two or more individuals of different species in which all are benefited by one another.

135. (c) : At sexual maturity, the undifferentiated primordial germ cells divide several times by mitosis to produce a large number of spermatogonia. Each spermatogonium actively grows to a larger primary spermatocyte. Each primary spermatocyte undergoes two successive divisions, called maturation divisions. The first maturation division is reductional or meiotic. Hence, the primary spermatocyte divides into two haploid daughter cells called secondary spermatocytes. Both secondary spermatocytes now undergo second maturation division which is an ordinary mitotic division to form, four haploid spermatids. Thus each secondary spermatocyte gives rise to two spermatids that undergo transformation to form two sperms. Overall, both secondary spermatocytes give rise to four sperms.
136. (b) : Growth regulators are organic substances, other than nutrients, which in low concentration regulate growth, differentiation and development by promoting or inhibiting the same. Phytohormones are growth regulators produced naturally in plants and translocated to another region for regulating one or more physiological reactions when present in low concentration. Phytohormone can have a promoting or inhibiting effect on a process.
137. (b) : Grey crescent is the area just opposite to the site of entry of sperm into ovum. It marks the future dorsal side of the embryo.
138. (d) : During the post-pollination development, germination of pollen grain takes place. The pollen grain absorbs water and nutrients on the stigma from the stigmatic secretion through its germ pores. The tube or vegetative cell enlarges and comes out of the pollen grain through one of the germ pores or germinal furrows to form a pollen tube. Generative cell does not produce pollen tube instead it passes into the pollen tube and divides into 2 male gametes. Thus even after killing the generative cell with a laser beam, the pollen grain produces normal pollen tube because the vegetative cell has not been damaged.
139. (d) : Simple or unconditional reflexes are present in an individual right from birth. They are specific, predictable, purposeful and have survival value, e.g. breast feeding and swallowing in newly born babies and blinking of eyes are examples of unconditioned reflexes. (a), (b) and (c) are the examples of conditional reflexes and are not present at birth but develop later in life through learning habit.
140. (d) : Unlike *Cycas* and *Pinus*, *Gnetum* shows the occurrence of vessel elements and the absence of archegonia. Archegonia are altogether absent in the female gametophyte and vessels occur in the xylem along with the tracheids in the secondary wood. Thus *Gnetum* shows affinities with angiosperms. Besides it resembles angiosperms in several other aspects like presence of tetrasporic embryo sac, free nuclear divisions in the embryo sac, two cotyledonous embryo etc.
141. (a) : Vagus nerve arises from the side of medulla oblongata. It innervates the larynx, trachea, oesophagus, stomach, lungs, heart and intestines. It is a mixed nerve. It controls the visceral sensations and visceral movements, i.e., heart beat, respiratory movements, peristalsis, sound production, etc. Movement of the tongue is controlled by hypoglossal nerve as it innervates the muscles of the tongue.
142. (a) : Lubb (first sound, systolic sound) is the first heart sound which is low pitched, not very loud, of long duration (about 0.15 seconds) and is produced partly due to closure of atrio-ventricular valves (tricuspid and bicuspid) and partly by the contraction of the muscles in the ventricles.
143. (a) : Part of fertilizers added to crop fields are passed down to water bodies during rains through surface run-off. Presence of extra nutrients brings about dense growth of plant and animal life. The phenomenon is called eutrophication. Eutrophication leads to organic loading, depletion of oxygen, death of animals and fouling of water.

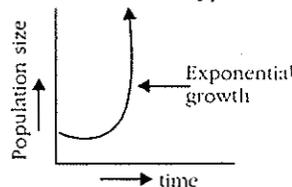
144. (d) : The egg cell is one of the haploid cell of egg apparatus present in the micropylar end of embryo sac in seeded plants. It is also called oosphere and represents the single female gamete of the embryo sac. Antipodal cells are the haploid cells, usually three in number, present in embryo sac at the opposite end of micropyle. Their function is unknown and at fertilization, they may disintegrate or multiply and enlarge.
145. (b) : Affinity of carbon monoxide for haemoglobin is 200 times more than oxygen. At 0.5 partial pressure, CO combines with 50% of haemoglobin. It produces a relatively stable compound called carboxy-haemoglobin. This causes low supply of oxygen to the body which is characterised by headache, dizziness, nausea, etc.
146. (a) : A patient of diabetes mellitus is unable to produce or fail to utilize insulin hormone. Thus, he is unable to store glucose in the form of glycogen. Hence, he started to excrete glucose in the urine. A patient is kept in carbohydrate free diet yet he excretes glucose in urine because high level of glucose not only depends on dietary carbohydrates but also on glycogenolysis (degradation of glycogen in liver) and gluconeogenesis (breakdown of fats into glucose in adipose tissues and conversion of muscle lactate into glucose *via* cori cycle).
147. (d) : Life cycle of *F. hepatica* is complete and completed in two hosts. Primary host, in which the adult fluke lives, is sheep. While the intermediate host, in which numerous larval stages are passed, is a snail (*Lymnaea*, *Planorbis*, etc.). This type of life cycle, involving two different kinds of hosts, is termed digenetic. Miracidium larva is the larval stage involved in life cycle. When suitable conditions become available, the encapsulated embryo, in 4-15 days, differentiates into a miracidium larva. It hatches out and swims in water. Metacercaria develops into adult fluke only inside its definitive host or sheep. The latter gets infection by grazing on leaves and grass blades to which the cysts are attached. Metacercaria survives action of host's gastric juice as its cyst is insoluble in it. Cyst wall finally dissolves in proximal part of intestine and liberates the larva.
148. (d) : Enzymes are protein that, in small amounts, speed up the rate of a biological reactions and help in regulating metabolism. Hormones are also metabolic regulator and help in stimulation or inhibition of one or more physiological processes. Vitamins are accessory food factors which are required in small quantity for controlling metabolism and body functioning.
149. (b)
150. (a) : The process by which  $N_2$  is reduced to  $NH_4^+$  is called nitrogen fixation. Nitrogenase enzyme catalyzes this reduction. It is only carried out by prokaryotic microorganisms. Principal  $N_2$ -fixers include certain free living cyanobacteria in symbiotic associations with fungi in lichens or with ferns, mosses, and liverworts, and by bacteria or other microbes associated symbiotically with roots, especially those of legumes. About 15 percent of the nearly 20,000 species in the fabaceae (Leguminosae) family have been examined for  $N_2$  fixation, and approximately 90 percent of these have root nodules in which fixation occurs. So without active nitrogenase enzyme there will be no  $N_2$  fixation in legumes.
151. (c) : Hallucination means apparent perception of external objects or sounds not actually present. It is caused by psychedelic drugs or hallucinogens. The hallucinogens act mainly on CNS (central nervous system) and greatly alter one's thoughts, feelings and perceptions. Hashish is the example of hallucinogen.
152. (b) : In CAM plants stomata open at night. In these plants night acidification occurs. *i.e.*, malic acid is synthesised during night due to incomplete oxidation of carbohydrates.
- $$\text{In night, } 2C_6H_{12}O_6 + 3O_2 \rightarrow 3C_4H_6O_5 + 3H_2O$$
- (malic acid)
- ↓
- leads to opening of stomata
- At night malic acid formed in guard cells dissociates into  $H^+$  and malate ions.  $K^+$  ion exchange from subsidiary cells with  $H^+$  ions. Thus due to accumulation of  $K^+$  ions osmotic pressure of guard cells increases, endosmosis occurs and

guard cells become turgid due to which stomata opens. The malic acid at day time breaks into  $\text{CO}_2$  and pyruvic acid thus increasing the concentration of  $\text{CO}_2$  in mesophyll cells. This is utilised in Calvin cycle to form sugar which is finally converted into starch.

153. (b) : In the apices of some roots, (e.g., *Zea mays*, maize), there is a central region of cells which normally does not divide. This central inactive region was called quiescent centre by F.A.L. Clowes (1959, 1961). The cells of this region have lesser amounts of RNA and DNA so they have small nuclei. These cells also have a lower rate of protein synthesis. Mitochondria and endoplasmic reticulum are less developed. The cells of the quiescent centre are usually inactive. However, if already existing meristematic cells are injured or become inactive due to any other reason, the cells of quiescent centre become active.
154. (d) : *Thermococcus*, *Methanococcus* and *Methanobacterium* exemplify archaeobacteria that lack any histones resembling those found in eukaryotes but whose DNA is negatively supercoiled. Archaeobacteria do not have a nucleus, the genetic material floats freely in the cytoplasm. They consist of ribosomal RNA. DNA contains a single, circular molecule, which is compact and tightly wound. No protein is associated with DNA. The archaeobacterial cell may contain plasmids, which are small, circular pieces of DNA and have a highly negatively supercoiled DNA.
155. (a) : Stele is a column containing vascular tissues which is surrounded by pericycle and separated from ground tissue by endodermis. Siphonostele is medullated protostele or protostele with a central non-vascular pith. Leaf gaps are absent. Siphonostele is of two types :  
In Ectophloic siphonostele, central pith is surrounded successively by xylem, phloem, pericycle and endodermis. In amphiphloic siphonostele there is a central pith and xylem is surrounded on either side by phloem, pericycle and endodermis. It is found in *Osmunda* and *Equisetum*.
156. (c) : Chlorenchyma or assimilatory parenchyma are parenchymatous cells that possess abundant

chloroplasts in them. They are capable of photosynthesis. A spore capsule of moss can perform photosynthesis because of the presence of chlorenchyma cells in them.

157. (b) : The physical distance between two genes determines both the strength of the linkage and the frequency of the crossing over between two genes. The strength of the linkage increases with the closeness of the two genes. On the other hand the frequency of crossing over increases with the increase in the physical distance between the two genes.
158. (d) : The plants, in which a functional foreign gene has been incorporated by any biotechnological methods that generally is not present in plant, are called transgenic plants. When plant cell are transformed by any of the transformation methods it is necessary to isolate the transformed cells/tissue. There are certain selectable marker genes present in vectors that facilitate the selection process. In transformed cells the selectable marker genes are introduced through vector. There is a number of marker genes which are commonly described as reporter genes screenable genes. Some of the reporter genes which are most commonly used in plant transformation are : cat, gus, lux, nptII., etc.
159. (c) : Since a typical green plant is diploid, therefore it has two sets of chromosomes. So the number of genome will be two, because genome is the entire set of gene carried by a gamete or present in the haploid cell of a particular organism.
160. (b) : Under continuous supply of food and space in the laboratory conditions the bacterial population grows exponentially and shows a J-shaped curve, thus the curve would be hyperbolic.



Such populations ultimately crash when the population size grows beyond carrying capacity.

161. (a) : In all the septate fungi except basidiomycetes (dolipore septum), the septa are seldom complete. They are perforated and contain plasmodesmata

or small central pores. Septal pores allow protoplasmic continuity between adjacent cells. This is useful for quick translocation of nutrients to all part of the body, mobilisation of reserve materials from older parts to younger parts and from vegetative hyphae to reproductive hyphae.

162. (a) : The haploid spores on germination gives rise to alga-like filamentous branched portion called primary protonema. This protonema develops buds, from which leafy gametophyte arises. Sometimes this primary protonema breaks up into small fragments accidentally and these fragments give rise to leafy gametophores.
163. (c) : Cephalization is the concentration of nervous tissues and sense organs in or towards the anterior end forming a distinct head. It provides greater prominence and domination of the head over the rest of the body. It does not improve the appearance of the animal.
164. (c) : Koel is a nest parasite and does not build a nest of its own. It simply lays its eggs in a crow's nest so that the eggs and young ones, are looked after by the foster parents.
165. (c) : Competitive inhibition is the inhibition of enzyme activity by the presence of a chemical that competes with the substrate for binding to the active site of the enzyme. The inhibitor chemical is called substrate analogue or competitive inhibitor. It resembles the substrate in structure and gets bound up to the active site of the enzyme without getting transformed by the latter.
166. (c) : Haemophilia, also called bleeder's disease is a X-linked recessive disorder. The person which contains the recessive gene for haemophilia lacks a normal clotting substance (thromboplastin) in blood. So minor injuries cause continuous bleeding and ultimate death of the person due to hemorrhages. Haemophilia is of two types ; type A characterized by lack of anti-haemophilic globulin (factor VIII) and type B characterized by a defect in plasma thromboplastic component (factor IX).  
Prothrombin is an inactive plasma protein and is produced by liver. It helps in blood clotting. It is not produced by platelets.
167. (a) : The hybridoma cells are shifted to a medium deficient in nutrient which cannot be synthesized by myeloma cells so that myeloma cells could be removed or hybridoma cells could be purified. The unfused myeloma cells *die* while hybridoma cells survive. The hybridoma cells are allowed to multiply separately.
168. (c) : Any seed which contains endosperm or perisperm at maturity is called albuminous or endospermic seed *i.e.*, food reserve of the seed is stored in endosperm or perisperm, *e.g.* rubber, coconut, castor bean, maize and other cereals. Seed that does not have endosperm at maturity and in which cotyledons absorb food reserve from endosperm during development and act as storage organs is called exalbuminous or non-endospermic seed, *e.g.*, mustard, groundnut, bean, pea etc.
169. (b) : Trachea and large bronchi are lined by pseudostratified ciliated columnar epithelium bearing glandular cells (mucous gland). The secretion of mucous glands keeps the walls of trachea and large bronchi moist and traps dust particles which enter with the air. The vibratile cilia of the epithelium then carry the mucous containing dust particles upto the larynx where they can be spitted out.
170. (a) : Light has got no direct effect on the rate of transpiration but indirectly it affects the rate in two ways firstly by controlling the stomatal opening and secondly by affecting the temperature. With the increase in the light intensity the rate of transpiration increases because the stomata get opened and the temperature increases. The rate of transpiration increases markedly in light and decreases in dark. There is a close relationship between the opening of stomata and presence of light.
171. (b) : Oxygen accumulation causes substantial inhibition of photosynthesis. Both oxygen evolution and CO<sub>2</sub> assimilation were reduced in the presence of atmospheric oxygen. Oxygen causes a direct and indeed competitive inhibition of Ribulose diphosphate carboxylase. As a result glycolate synthesis is enhanced and leads to begin photorespiration. Carbon dioxide being one of the raw materials for photosynthesis, its

- concentration affects the rate of photosynthesis markedly. Because of its very low concentration in atmosphere (0.03 per cent only) it acts as a limiting factor in natural photosynthesis.
172. (c) : Oxysomes or  $F_0 - F_1$  particles are present on the inner mitochondrial membrane. The  $F_1$  head-piece of oxysome functions as ATP-synthetase which synthesises ATP from ADP and ip (inorganic phosphate) using energy from proton gradient or ATP synthetase becomes active in ATP formation only when there is a proton gradient having high concentration of protons on  $F_0$  side (base) as compared to  $F_1$  side (head piece) of  $F_0 - F_1$  particles or oxysomes.
173. (c) : Inner ends of cone cells lie upon an elongated, spindle shaped rod, the rhabdome. Rhabdome is secreted and surrounded by a group of seven elongated retinal cells. Rhabdome and retinal cells together form the receptor region of eye.
174. (d) : Pituitary gland or hypophysis is situated in a depression, the sella turcica of sphenoid bone of the skull. It is directly attached to the hypothalamus by a stalk, the infundibulum. Hypophysial portal veins carry blood containing neurohormones (releasing factors) from the hypothalamus to the anterior pituitary.
175. (c) : Rabies (hydrophobia) is an acute viral disease of the central nervous system that affects all warm-blooded animals and is usually transmitted to humans by a bite from an infected dog. Symptoms appear after an incubation period ranging from 10 days to over a year and include malaise, fever, difficulty in breathing, salivation, periods of intense excitement, and painful muscle spasms of the throat induced by swallowing. In the later stages of the disease the mere sight of water induces convulsions and paralysis, death occurs within 4-5 days.
176. (a) : The most common form of asexual reproduction in plants is called vegetative propagation. It is the formation of new plants from vegetative units (propagules) such as buds, tubers, rhizomes, roots, stem, leaf etc. Besides the natural methods of vegetative propagation, there are a number of techniques for artificial vegetative propagation of economically and aesthetically important plants. Potatoes are produced by tubers and not by seeds. Stem tubers are found in potato and artichoke. They have buds in the region of nodes or eyes for vegetative multiplication. Root cuttings are used in propagation of lemon, apple, orange, blackberry etc.
177. (c) : In nuclear endosperm, first and further divisions of primary endosperm nucleus are not followed by cytokinesis or wall formation and thus these free nuclear divisions lead to formation of a large number of free nuclei in embryo sac. At maturity, centripetal wall formation may occur to make the tissue partly cellular. Endosperm of coconut is unique in sense that it is both nuclear and cellular. Here the primary endosperm nucleus undergoes a number of free nuclear divisions. When the fruit is about 50 mm long the embryo sac remains filled with a watery fluid or milk containing free nuclei and fine cytoplasmic particles. At a later stage when the fruit becomes about 100 mm in length the liquid shows in addition to free nuclei, several cells each enclosing variable number of nuclei. Thus coconut has multicellular endosperm (called coconut meat) in the outer part and free nuclear as well as vacuolate endosperm (called coconut milk) in the centre.
178. (d) : The female secondary sexual characters are developed by estrogens. Estrogens are steroid hormones secreted by growing ovarian follicles. It includes estradiol, estriol and estrone. This hormone is responsible for the development of female secondary sexual and accessory characters. In humans it is also formed in the adrenal cortex, testis and foetoplacental unit. Gonadotrophic hormones (LH and FSH) are secreted by the anterior lobe of pituitary gland. LH is responsible for ovulation and transforms graafian follicle into corpus luteum and FSH stimulates spermatogenesis and maturation of graafian follicle and secretion of estrogen in ovaries.
179. (d) : Net primary productivity is the available biomass for the consumption to heterotrophs (herbivores and decomposers). The rate of biomass

production is called productivity. It has two aspects, gross primary productivity and net primary productivity. The rate of total production of organic matter during photosynthesis is known as gross primary productivity. Its considerable amount is utilised by plants in respiration. The organic matter synthesised by plants (GPP) minus the rate of respiration and other loss represents the net primary productivity.

180. (b) : Mercury is an important toxic pollutant. It is changed to water soluble dimethyl mercury which undergoes biomagnification, *i.e.*,

accumulates in the body of organisms inhabiting in the water. Eating poisoned animals causes deformity known as minamata disease which is characterized by diarrhoea, impairment of various senses, numbness of lips, blurring of vision, mental dearrangement and death.

#### GENERAL KNOWLEDGE

- |          |          |          |          |          |
|----------|----------|----------|----------|----------|
| 181. (a) | 182. (b) | 183. (c) | 184. (b) | 185. (c) |
| 186. (c) | 187. (d) | 188. (c) | 189. (a) | 190. (c) |
| 191. (d) | 192. (a) | 193. (b) | 194. (a) | 195. (d) |
| 196. (a) | 197. (a) | 198. (d) | 199. (c) | 200. (c) |



# Chapterwise Index - '09

Physics • Chemistry • Biology

Use the index for topicwise analysis of this year's  
AIIMS paper and refer to these  
questions when you are practising MCQs chapterwise.

PHYSICS		
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Motion in Two Dimensions	16, 56	2
Laws of Motion and Friction	17, 59	2
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Gravitation	38, 57	2
Properties of Matter	21, 41	2
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Heat and Thermodynamics	20, 54, 55	3
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Thermal and chemical effects of current	24, 25	2
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Electromagnetic Induction and Alternating Current	6, 28, 29, 46	4
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Principles of Communication		0

CHEMISTRY		
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Atomic Structure		0
Periodic Properties		0
Chemical Bonding	83	1
Nuclear Chemistry		0
Gaseous and Liquid States	82, 109	2
Solid State	85	1
Mole Concept & Solutions	62, 69, 81	3
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Equilibrium	65, 68, 92, 114	4
Kinetics	66, 67, 106	3
Energetics	98, 103, 108	3
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Redox Reactions		0
Metallurgy		0
Hydrogen and its Compounds		0
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Purification and Analysis of Compound		0
General Organic Chemistry	74, 86, 88, 91, 93, 101	6
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Aromatic Hydrocarbons	75, 76, 77	3
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Alcohols, Phenols and Ethers	96, 105	2
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Carboxylic acids & their derivatives	112, 117	2
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BIOLOGY		
Chapter's Name	Question No.	Total
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Biological Classification		0
Kingdom Monera	142, 156	2
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Plant Kingdom	143	1
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Cell Reproduction		0
Cell Respiration	150, 168	2
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Anatomy of Flowering Plants	140, 149	2
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Reproduction and Embryonic Development	131, 132, 171, 179	4
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Human Population & Growth		0