**NEET (UG) 2024**

**SAMPLE PAPER - 9**

**Time Allowed: 3 hours and 20 minutes** **Maximum Marks: 720**

**General Instructions:**

- The test is of 3 hours and 20 minutes and it contains 200 questions. Internal choice is given within the sections.
- For each correct response, the candidate will get 4 marks.
- For each incorrect response, one mark will be deducted from the total scores.
- The maximum marks are 720.

**PHYSICS (Section-A)**

1. The dimension of mutual inductance is: **[4]**

   a) $[ML^2 T^{-3} A^{-2}]$ b) $[ML^2 T^{-2} A^{-2}]$

   c) $[ML^2 T^{-3} A^{-1}]$ d) $[ML^2 T^{-2} A^{-1}]$

2. Consider the following equation of Bernoulli's theorem: **[4]**
   $P + \frac{1}{2}\rho v^2 + \rho gh$ = K(constant)
   The dimensions of KIP are same as which of the following?

   a) Pressure b) Thrust

   c) Angle d) Viscostiy

3. For motion on a straight-line path with constant acceleration (magnitude of displacement/distance covered) is: **[4]**

   a) $< 1$ b) $\leq 1$

   c) $= 1$ d) $> 1$

4. An artillery piece which consistently shoots its shells with the same muzzle speed has a maximum range R. To hit a target which is $\frac{R}{2}$ from the gun and on the same level, the elevation angle of the gun should be: **[4]**

   a) 60° b) 45°

   c) 30° d) 15°

5. Two forces of 5 N and 12 N simultaneously act on a particle. The net force on the particle is: **[4]**

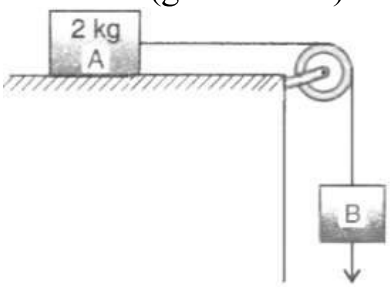
a) 13 N

b) Between 7 N and 17 N

c) 12 N

d) 17 N

6. The coefficient of static friction, $\mu_S$ between block A of mass 2 kg and the table as shown in the figure is 0.2. What would be the maximum mass value of block B so that the two blocks do not move? The string and the pulley are assumed to be smooth and massless: ($g = 10\ m/s^2$) **[4]**




a) 0.4 kg

b) 2.0 kg

c) 4.0 kg

d) 0.2 kg

7. A bullet weighing 50 gm leaves the gun with a velocity of 30 m/s. If the recoil speed imparted to the gun is 1 m/s, the mass of the gun is: **[4]**

a) 20 kg

b) 15 kg

c) 30 kg

d) 1.5 kg

8. A ball dropped from a height of 2m rebounds to a height of 1.5 m after hitting the ground. Then the percentage of energy lost is: **[4]**

a) 50

b) 100

c) 25

d) 30

9. Particles of masses m, 2m, 3m,... ,nm grams are placed on the same line at distances l, 2l, 3l, ..., nl cm from a fixed point. The distance of the centre of mass of the particles from the fixed point (in centimetres) is: **[4]**

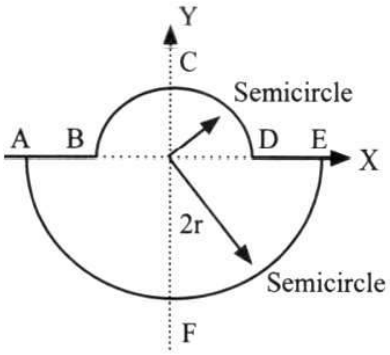
a) $\frac{2l}{n(n^2+1)}$

b) $\frac{l}{n+1}$

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

d) $\frac{(2n+1)l}{3}$

10. A uniform thin rod is bent in the form of closed-loop ABCDEFA as shown in the figure. The ratio of moment of inertia of the loop about the x-axis to that about the y-axis is: **[4]**




a) $= \frac{1}{2}$ b) $< 1$

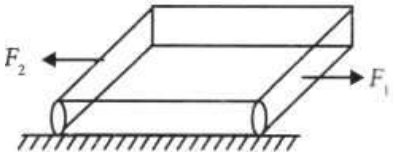
c) $> 1$ d) $= 1$

11. In planetary motion, the angular momentum conservation leads to the law of **[4]**

a) orbits b) periods

c) conservation of kinetic energy d) areas

12. Two opposite forces $F_1 = 120$ N and $F_2 = 80$ N act on an elastic plank of modulus of elasticity $Y = 2 \times 10^{11}$ $Nm^{-2}$ and length $l = 1$ m placed over a smooth horizontal surface. The cross-sectional area of the plank is $S = 0.5$ $m^2$. The change in length of the plank is $x \times 10^{-9}$ m. The value of x is: **[4]**




a) 0.1 b) 1.3

c) 1.1 d) 1

13. The coefficient of volume expansion of a liquid is $49 \times 10^{-5}$/K. Calculate the fractional change in its density when the temperature is raised by $30^{o}$C. **[4]**

a) $3.0 \times 10^{-3}$ b) $1.5 \times 10^{-2}$

c) $1.1 \times 10^{-3}$ d) $7.5 \times 10^{-3}$

14. Paraffin wax contracts on solidification. The melting point of wax will: **[4]**

i. increase with pressure

ii. decrease with pressure

iii. not change with pressure

iv. decrease linearly with pressure

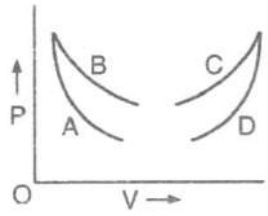
a) iii and iv

b) ii and iii

c) only i

d) iv and i

15. Four curves A, B, C, and D are drawn in figure for a given amount of gas. The curves which represent adiabatic and isothermal changes are: **[4]**



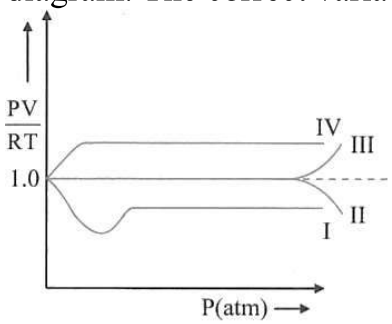

a) B and A respectively

b) D and C respectively

c) C and D respectively

d) A and B respectively

16. An experiment is carried on a fixed amount of gas at different temperatures initially at low pressure and then at high pressure such that it deviates from the ideal gas behaviour at higher values of pressure. The variation of $\frac{PV}{RT}$ with P is shown in the adjoining diagram. The correct variation is represented by **[4]**




a) curve III

b) curve I

c) curve IV

d) curve II

17. The displacement of a particle varies according to the relation: **[4]**
$x = 4(\cos \pi t + \sin \pi t)$
The amplitude of the particle is:

a) 8

b) -4

c) 4

d) $4\sqrt{2}$

18. A string of linear density of 0.2 kg per metre is stretched with a force of 500 newtons. A transverse wave of length 4.0 metre and amplitude $(1/\pi)$ metre is travelling along it. Then, the total energy per unit length of the string is: **[4]**

a) 2500 J

b) 12.5 J

c) 50 J

d) 62.5 J

19. If the resultant amplitude due to the superposition of two waves changes periodically with time as well as in position, then it is a case of: **[4]**

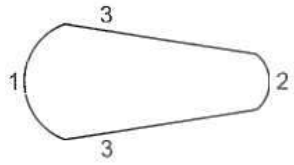
a) Lissajous' figures

b) beats

c) stationary waves

d) interference

20. Consider a non-spherical conductor shown in the figure which is given a certain amount of positive charge. The charge distributes itself on the surface such that the charge densities are $\sigma_1$, $\sigma_2$, and $\sigma_3$ at the regions 1, 2 and 3 respectively. Then: **[4]**



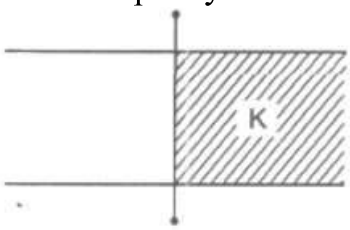

a) $\sigma_2 > \sigma_3 > \sigma_1$

b) $\sigma_2 > \sigma_1 > \sigma_3$

c) $\sigma_3 > \sigma_1 > \sigma_2$

d) $\sigma_1 > \sigma_2 > \sigma_3$

21. A dielectric is placed in between the two parallel plates of a capacitor as shown in figure, the dielectric constant of the dielectric being K. If the initial capacity is C, then the new capacity will be: **[4]**




a) (K + 1)C

b) KC

c) C(K + 1)/2

d) (K - 1)C

22. A voltmeter of range 2V and resistance 300 Ω cannot be converted into ammeter of range: **[4]**

a) 100 mA

b) 1 mA

c) 1 A

d) 10 mA

23. A proton and an $\alpha$ - particle, having kinetic energies $k_P$ and $K\alpha$ respectively, enter into a magnetic field at right angles. The ratio of the radii of trajectory of proton to that of $\alpha$ - particle is 2 : 1. The ratio of $K_P$ : $K\alpha$ is: **[4]**

a) 8 : 1 b) 1 : 8

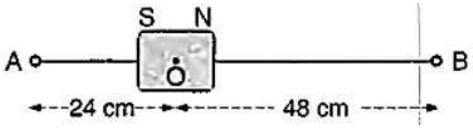
c) 1 : 4 d) 4 : 1

24. A hydrogen atom is paramagnetic. A hydrogen molecule is: **[4]**

a) paramagnetic b) anti-ferromagnetic

c) ferromagnetic d) diamagnetic

25. A bar magnet of length 3 cm has points A and B along its axis at distances of 24 cm and 48 cm on the opposite sides. Ratio of magnetic fields at these points will be: **[4]**




a) 8 b) 4

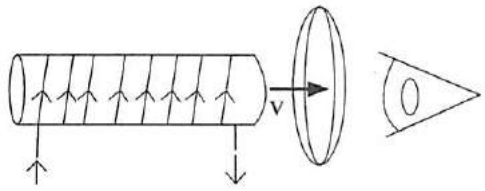
c) 3 d) $\frac{1}{2\sqrt{2}}$

26. A coil has 1000 turns and 500 $cm^2$ as its area. The plane of the coil is placed at a right angle to a magnetic induction field of $2 \times 10^{-5}$ $wb/m^2$. The coil is rotated through 180° in 0.2 seconds. The average emf (in millivolt) induced in the coil is: **[4]**

a) 5 b) 15

c) 10 d) 20

27. A current-carrying solenoid is approaching a conducting loop as shown in the figure. The direction of induced current as observed by an observer on the other side of the loop will be: **[4]**




a) anti-clockwise b) east

c) west d) clockwise

28. When a voltage measuring device is connected to AC mains, the meter shows the steady input voltage of 220 V. This means **[4]**

a) Input voltage cannot be AC voltage, but a DC voltage

b) the meter reads not v but $<v^2>$ and is calibrated to read $\sqrt{\langle v^2 \rangle}$

c) the pointer of the meter is stuck by some mechanical defect

d) maximum input voltage is 220 V

29. If the magnetic field in a plane electromagnetic wave is given by $\vec{B} = 3 \times 10^{-8} \sin (1.6 \times 10^3 x + 48 \times 10^{10} t)\ \hat{j}$ T, then what will be expression for electric field? **[4]**

a) $\vec{E} = (3 \times 10^{-8} \sin (1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{k}$ v/m)

b) $\vec{E} = (9 \sin (1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{k}$ v/m)

c) $\vec{E} = (3 \times 10^{-8} \sin (1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{k}$ v/m)

d) $\vec{E} = (60 \sin (1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{k}$ v/m)

30. A metal plate is lying at the bottom of a tank full of a transparent liquid. Height of the tank is 100 cm but the plate appears to be at 45 cm above the bottom. The refractive index of the liquid is: **[4]**

a) 1.32

b) 1.00

c) 1.53

d) 1.81

31. A single slit diffraction pattern is obtained using a beam of red light. If the red light is replaced by the blue light, then the diffraction pattern: **[4]**

a) will disappear

b) becomes narrower

c) remains unchanged

d) becomes broader

32. A nucleus of mass M at rest splits into two parts having masses $\frac{M'}{3}$ and $\frac{2M'}{3} (M' < M)$. The ratio of de Broglie wavelength of two parts will be: **[4]**

a) 2 : 1

b) 1 : 2

c) 2 : 3

d) 1 : 1

33. The collector plate in an experiment on photoelectric effect is kept vertically above the emitter plate. Light source is put on and a saturation photoelectric current is recorded. An electric field is switched on which has a vertically downward direction, then: **[4]**

a) the photoelectric current will increase

b) the kinetic energy of the electrons will increase

c) the stopping potential will decrease

d) the threshold wavelength will increase

34. In an atom the ratio of the radius of orbit of an electron to the radius of a nucleus is: **[4]**

a) $10^6$

b) $10^4$

c) $10^3$

d) $10^5$

35. A piece of wood from a recently cut tree shows 20 decays per minute. A wooden piece of the same size placed in a museum (obtained from a tree cut many years back) shows 2 decays per minute. If the half-life of $C^{14}$ is 5730 years, then the age of the wooden piece placed in the museum is approximate: **[4]**

a) 13094 years

b) 10439 years

c) 19039 years

d) 39049 years

## PHYSICS (Section-B)

### Attempt any 10 questions

36. Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional force are 10% of energy. How much power is generated by the turbine? ($g = 10\ m/s^{-2}$) **[4]**

a) 10.2 kW

b) 7.0 kW

c) 8.1 kW

d) 12.3 kW

37. A uniform disc of mass M and radius R is mounted on an axle supported in frictionless bearings. A light cord is wrapped around the rim of the disc and a steady downward pull T is exerted on the cord. The tangential acceleration of a point on the rim is: **[4]**

a) $\frac{2T}{M}$

b) $\frac{MR^2}{2T}$

c) $\frac{MR^2}{T}$

d) $\frac{T}{M}$

38. In the following four periods **[4]**

i. Time of revolution of a satellite just above the earth's surface ($T_{st}$).

ii. Period of oscillation of mass inside the tunnel bored along the diameter of the earth ($T_{ma}$).

iii. Period of simple pendulum having a length equal to the earth's radius in a uniform field of 9.8 N/kg ($T_{sp}$).

iv. Period of an infinite length simple pendulum in the earth's real gravitational field ($T_{is}$).

a) $T_{st} > T_{ma}$

b) $T_{sp} > T_{is}$

c) $T_{ma} >$ st

d) $T_{st} = T_{ma} = T_{sp} = T_{is}$

39. The apparent coefficient of expansion of a liquid when heated in a copper vessel is C and when heated in a silver vessel is S. If A is the linear coefficient of expansion of copper, then the linear coefficient of expansion of silver is: **[4]**

a) $\frac{C+3A-S}{3}$

b) $\frac{S+3A-C}{3}$

c) $\frac{C+S+3A}{3}$

d) $\frac{C+S-3A}{3}$

40. **Stationary waves** are so-called because in them: **[4]**

i. there occurs no flow of energy along with the wave

ii. the particles of the medium do not execute SHM

iii. the particles of the medium are not disturbed at all

iv. the interference effect cannot be observed

a) ii and iii

b) only i

c) iv and i

d) iii and iv

41. If the intensities of two interfering waves be $I_1$ and $I_2$, the contrast between maximum and minimum intensity is maximum, when: **[4]**

a) $I_1 << I_2$

b) $I_1 = I_2$

c) either $I_1$ or $I_2$ is zero

d) $I_1 >> I_2$

42. A microammeter has a resistance of 100 Ω and a full scale range of 50 $\mu$A. It can be used as a voltmeter or as a higher range ammeter provided resistance is added to it. Pick the correct range and resistance combinations: **[4]**

a) 10 V range and 200 kΩ resistance in series

b) 5 mA range and 100 Ω resistance in parallel

c) 10 mA range and 10 Ω resistance in parallel

d) 50 V range and 10 k £2 resistance in series

43. A magnet of magnetic moment 50i A-$m^2$ is placed along the x-axis in a magnetic field $\vec{B} = (0.5i + 3.0\hat{j})$ tesla. The torque acting on the magnet is: **[4]**

a) $75\hat{i}$ Nm

b) $175\hat{k}$ Nm

c) $25\sqrt{37}\hat{k}$ Nm

d) $150\hat{k}$ Nm

44. A 100 turns coil of area of cross-section 200 $cm^2$ having 2 Ω resistance is held perpendicular to a magnetic field of 0.1 T. If it is removed from the magnetic field in one second, the induced charge produced in it is: **[4]**

a) 2 C

b) 1 C

c) 0.2 C

d) 0.1 C

45. The average power lost per cycle of AC is given by: **[4]**

a) $\frac{1}{2}E_0I_0 \sin\theta$

b) $\frac{1}{2}E_0I_0 \times\theta$

c) $\frac{1}{2}E_0I_0 \tan\theta$

d) $\frac{1}{2}E_0I_0 \cos\theta$

46. A lens having focal length f and aperture of diameter d forms an image of intensity I. Aperture of diameter $\frac{d}{2}$ in central region of lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively **[4]**

a) f and $(\frac{3I}{4})$

b) f and $(\frac{f}{4})$

c) $(\frac{3f}{4})$ and $(\frac{I}{2})$

d) $(\frac{f}{2})$ and $(\frac{I}{2})$

47. An achromatic combination of lenses is formed by joining: **[4]**

a) 2 concave lenses

b) convex and plane mirror

c) 2 convex lenses

d) 1 concave, 1 convex

48. Maximum velocity of the photoelectrons emitted by a metal surface is $1.2 \times 10^6$ $ms^{-1}$. Assuming the specific charge of the electron to be $1.8 \times 10^{11}$ C $kg^{-1}$, the value of the stopping potential (in volt) will be: **[4]**

a) 4

b) 3

c) 2

d) 6

49. If m is the mass of electron, v its velocity, r is the radius of stationary circular orbit around a nucleus with charge Ze, then from Bohr's second postulate, the radius of the **[4]**

quantised orbit in CGS system is given by:

a) $\frac{n^2h^2}{4\pi^2me^2Z}$

b) $\frac{4\pi^2m}{n^2h^2Ze^2}$

c) $\frac{4\pi^2mZe^2}{n^2h^2}$

d) $\frac{n^2h^2Ze^2}{4\pi^2m}$

50. The activity of 1 mg sample of $_{37}Sr^{90}$ whose half-life is 28 years is: (Given that Avogadro's number is $6.02 \times 10^{23}$) **[4]**

a) $5.24 \times 10^{10}$ dps

b) $5.24 \times 10^{11}$ dps

c) $5.24 \times 10^{9}$ dps

d) $5.24 \times 10^{8}$ dps

## CHEMISTRY (Section-A)

51. Two solutions of a substance (non-electrolyte) are mixed in the following manner. 480 mL of 1.5 M of I solution with 520 mL of 1.2 M of II solution. The molarity of final solution is: **[4]**

a) 1.344 M

b) 2.70 M

c) 1.50 M

d) 1.20 M

52. Suppose a completely filled or half-filled set of p or d-orbitals is spherically symmetrical. Point out the species which is spherical symmetrical: **[4]**

a) O

b) $Cl^-$

c) C

d) Fe

53. The elements which exhibit both vertical and horizontal similarities are: **[4]**

a) transition elements

b) rare earth elements

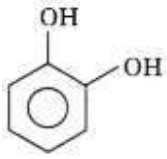
c) representative elements

d) inert gas elements

54. Select compound having maximum solubility in water: **[4]**

a) 


b) 

c) 

d) 

55. The correct order of increasing intermolecular hydrogen bond strength is **[4]**

a) $HCN < CH_4 < NH_3$

b) $CH_4 < HCN < NH_3$

c) $CH_4 < NH_3 < HCN$

d) $HCN < H_2O < NH_3$

56. In which of the molecule on hydrolysis, proton donor oxyacid is not formed from their central atom? **[4]**

a) $SF_4$

b) $P_4O_{10}$

c) $NCl_3$

d) $PCl_3$

57. The ($S^o$) of the following substances are: **[4]**

$CH_4$ (g) 186.2 JK-$^{1}$ mol$^{-1}$; $O_2$ (g) 205.2 JK$^{-1}$ mol$^{-1}$

$CO_2$ (g) 213.6 JK$^{-1}$ mol$^{-1}$; H2O (l) 69.9.JK$^{-1}$ mol$^{-1}$

The entropy change ($\Delta S^o$) for the reaction

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + {}_2H_2O$ (l) is:

a) -108.1 J K$^{-1}$ mol$^{-1}$

b) -242.8 J K$^{-1}$mol$^{-1}$

c) -37.6 J K$^{-1}$ mol$^{-1}$

d) -312.5 J K$^{-1}$ mol$^{-1}$

58. Identify the CORRECT equilibrium expression for the following reaction. **[4]**

$MgO_{(s)} + CO_{2(g)} \rightleftharpoons MgCO_{3(S)}$

a) $K = \frac{[MgO][CO_2]}{[MgCO_3]}$

b) $K = \frac{[MgCO_3]}{[MgO][CO_2]}$

c) $K = [CO_2]$

d) $K = \frac{1}{[CO_2]}$

59. In $K_2Cr_2O_7$ titration, using the indicator diphenylamine, an intense blue color is obtained just after the equivalence point. In this process, $Cr_2O_7^{2-}$ oxidizes the indicator and itself undergoes reduction. How many electrons are needed when the following half-reaction is balanced? **[4]**

$Cr_2O_7^{2-} + H^+ + ?e^- \longrightarrow Cr^{3+} + H_2O$

a) 4

b) 2

c) 6 d) 3

60. In the balanced redox reaction for the disproportionation of bromine in the presence of a strong base, $OH^-$ producing bromide ion and bromate ion, the coefficient of bromide ion is _____. **[4]**

a) 6 b) 3

c) 5 d) 12

61. Willemite is a type of _____. **[4]**

a) cyclic silicate b) chain silicate

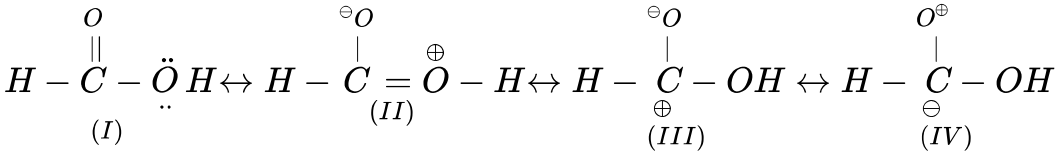
c) orthosilicate d) pyrosilicate

62. The states of hybridisation of boron and oxygen atoms in boric acid ($H_3BO_3$) are respectively: **[4]**

a) $sp^3$, $sp^3$ b) $sp^3$, $sp^2$

c) $sp^2$, $sp^3$ d) $sp^2$, $sp^2$

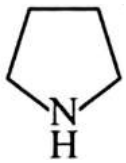
63. Examine the following resonating structures of formic acid and arrange them in decreasing order of stability: **[4]**

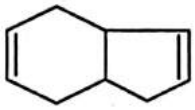


a) III > II > IV > I b) I > II > III > IV

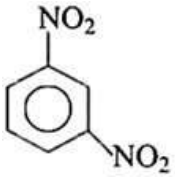
c) IV > III > I > II d) II > I > III > IV

64. Amongst the following, which species is a (4n+2) $\pi$ system? **[4]**

a)  b) 

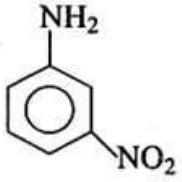

c)  d) 

65.  $\xrightarrow{(CH_3CO)_2O} A \xrightarrow[H_2SO_4]{HNO_3} B \xrightarrow{H^{\oplus}/H_2O} C$; Identify C: **[4]**

a) 

b) 

c) 

d) 

66. An ideal solution if formed when its components: **[4]**

a) have no enthalpy change on mixing

b) have both the above characteristics

c) have high solubility

d) have no volume change on mixing

67. For a dilute solution containing 2.5 g of a non-volatile non-electrolyte solute in 100 g of water, the elevation in boiling point at 1 atm pressure is 2°C. Assuming concentration of solute is much lower than the concentration of solvent, the vapour pressure (mm of Hg) of the solution is (take $K_b$ = 0.76 K kg $mol^{-1}$): **[4]**

a) 718

b) 740

c) 724

d) 736

68. $E_{RP_{Mn}7+/Mn^{2+}}$ for the given reaction is: **[4]**

$5Fe^{2+} + MnO_4^- + 8H^+ \rightleftharpoons 5Fe^{3+} + Mn^{2+} + 4H_2O$

a) $E_{Mn^{7+}/Mn^{2+}} = E^o_{RP} + \frac{0.059}{7}\log\frac{[MnO_4^-]}{[Mn^{2+}]}$

b) $E_{Mn^{7+}/Mn^{2+}} = E^o_{RP} - \frac{0.059}{5}\log\frac{[MnO_4^-][H^+]^8}{[Mn^{2+}]}$

c) $E_{Mn^{7+}/Mn^{2+}} = E^o_{RP} + \frac{0.059}{5}\log\frac{[MnO_4^-][H^+]^8}{[Mn^{2+}]}$

d) $E_{Mn^{7+}/Mn^{2+}} = E^{\circ}_{RPMn^{7+}/Mn^{2+}} + \frac{0.059}{5}\log\frac{[MnO_4^-]}{[Mn^{2+}]}$

69. In a reaction, the threshold energy is equal to: **[4]**

a) activation energy

b) activation energy + normal energy of reactants

c) normal energy of reactants

d) activation energy - normal energy of reactants

70. The decomposition of a substance **P** takes place according to first-order kinetics. Its initial concentration is reduced to one fourth in 24 s. The rate constant of the reaction is _____. **[4]**

a) $\frac{1}{24}s^{-1}$

b) $\frac{0.693}{12}s^{-1}$

c) $\frac{0.693}{16}s^{-1}$

d) $\frac{0.693}{4}s^{-1}$

71. $CuSO_4$ solution reacts with excess KCN to give: **[4]**

a) $K_3[Cu(CN)_4]$

b) CuCN

c) $Cu(CN)_2$

d) $K_2[Cu(CN)_2]$

72. The catalyst used in the oxidation of hydrogen chloride gas into chlorine gas is _____. **[4]**

a) iron

b) cupric oxide

c) cupric chloride

d) tungsten

73. $Nd^{2+}$ = _____ **[4]**

a) $4f^4 6s^2$

b) $4f^2 6s^2$

c) $4f^3$

d) $4f^4$

74. The number of sigma bonds in Zeise's salt is: **[4]**

a) 12

b) 8

c) 6

d) 4

75. Give the order of chelating effect of following ligands : **[4]**

I. $C_2O_4^{2-}$

II. $EDTA^{4-}$

III. dien

a) I > III > II

b) II > III > I

c) III > II > I

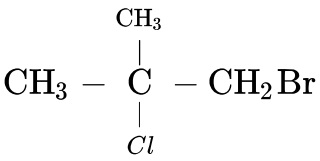
d) I > II > III

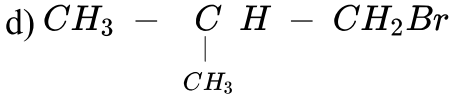
76. In a $S_N2$ substitution reaction of the type, **[4]**

$R\text{-}Br + Cl^- \xrightarrow{DMF} R\text{-}Cl + Br^-$ Which one of the following has the highest relative rate?

a) $CH_3CH_2CH_2Br$

b) $CH_3CH_2Br$

c) 

d) 

77. When enthanol is heated with cone. $H_2SO_4$, a gas is produced. The compound formed, when this gas is treated with cold dilute aqueous solution of Baeyer's reagent, is: **[4]**

a) Formaldehyde

b) Ethanoic acid

c) Glycol

d) Formic acid

78. The correct decreasing order of the acidic strength of carboxylic acids is _____. **[4]**

i. $C_6H_5$ - COOH

ii. $CH_3$ - $CH_2$ - COOH

iii. HCOOH

iv. $CH_3COOH$

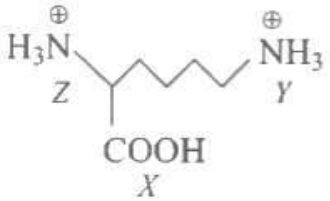
a) iii > i > iv > ii

b) i > iii > iv > ii

c) i > ii > iii > iv

d) iii > iv > ii > i

79. The correct order of acidic strengths **[4]**



is:

a) X > Z > Y

b) Y > Z > X

c) X > Y > Z

d) Z > Y > X

80. Glycosidic linkage is **[4]**

a) an amine linkage

b) an ether linkage

c) an ester linkage

d) an amide linkage

81. Carbohydrates which differ in configuration at the glycosidic carbon (i.e., $C_1$ in aldose and $C_2$ in ketoses) are called: **[4]**

a) enantiomers

b) anomers

c) diastereomers

d) epimers

82. The best reagent for the conversion of 3-methylbutanoic acid to 2-methylpropanamine is _____. **[4]**

a) $LiAlH_4$/dry ether

b) $Br_2$/aq. NaOH

c) $NaN_3$ + conc. $H_2SO_4$

d) $H_2$/Ni

83. Select the cell which represents the measurement of the standard reduction potential of the silver electrode. **[4]**

a) $Pt(s) \mid H_2$ (g, 1 bar) $\mid H^+$ (aq, 1 M) $\| Ag^+$ (aq, 2 M) $\mid$ Ag

b) $Pt(s) \mid H_2$ (g, 0.1 bar) $\mid H^+$ (aq, 1 M) $\| Ag^+$ (aq, 1 M) $\mid$ Ag

c) $Pt(s) \mid H_2$ (g, 1 bar) $\mid H^+$ (aq, 0.1 M) $\| Ag^+$ (aq, 1 M) $\mid$ Ag

d) $Pt(s) \mid H_2$ (g, 1 bar) $\mid H^+$ (aq, 1 M) $\| Ag^+$ (aq, 1 M) $\mid$ Ag

84. For detection of which element Lassaigne test is used? **[4]**

a) All of these

b) Chlorine

c) Nitrogen

d) Sulphur

85. Calculate the strength of HCl when 24.5 mL of x molar HCl neutralizes 30 mL of 0.15 M $Na_2CO_3$. **[4]**

a) 13.4 g/L

b) 5.7 g/L

c) 7.2 g/L

d) 10.6 g/L

## CHEMISTRY (Section-B)

### Attempt any 10 questions

86. Which is **not correct** for the covalent character? **[4]**

a) $UF_6 > UF_4$

b) $SnCl_4 > SnCl_2$

c) $CaCl_2 > ZnCl_2$

d) $SbCl_5 > SbCl_3$

87. What volume of $O_2$ measured at standard conditions will be formed by the action of 100 mL of 0.5 N $KMnO_4$ on hydrogen peroxide in an acid solution? The skeleton equaion for the reaction is, $KMnO_4 + H_2SO_4 + H_2O_2 \rightarrow KHSO_4 + MnSO_4 + H_2O + O_2$ **[4]**

a) 1.12 litre

b) 0.28 litre

c) 0.56 litre

d) 0.12 litre

88. $AlF_3$ is soluble in HF only in presence of KF. It is due to the formation of: **[4]**

a) $K[AlF_3H]$

b) $AlH_3$

c) $k_3[AlF_3H_3]$

d) $k_3[AlF_6]$

89. In the periodic table from left to right in a period, the atomic volume: **[4]**

a) remains same

b) first decreases then increases

c) increases

d) decreases

90. The wavelengths of the radiations emitted when in a H atom, electron falls from infinity to stationary state 1, is: **[4]**

a) 91 nm

b) 192 nm

c) $9.1 \times 10^{-8}$ nm

d) 406 nm

91. In the following reaction sequence, identify **X**, **Y** and **Z**. **[4]**

$H_3BO_3 \xrightarrow{373K} X \xrightarrow{433K} Y \xrightarrow{Red\ hot} Z$

a) X = boric anhydride, Y = metaboric acid, Z = tetraboric acid

b) X = metaboric acid, Y = tetraboric acid, Z = boric anhydride

c) X = tetraboric acid, Y = boric anhydride, Z = metaboric acid

d) X = metaboric acid, Y = boric anhydride, Z = tetraboric acid

92. Effective collisions are those in which molecules must: **[4]**

a) all of these

b) have energy equal to or greater than the threshold energy

c) have proper orientation

d) acquire the energy of activation

93. The standard potentials of $Cu/Cu^{2+}$ and $Cu/Cu^{+}$ are -0.337 and -0.530 V respectively. What is equilibrium constant at $30^{o}C$ for the reaction $2Cu^{+} \rightleftharpoons Cu^{2+} + Cu^{+}$? **[4]**

a) $3.4 \times 10^{6}$

b) $2.8 \times 10^{+7}$

c) $3.4 \times 10^{-6}$

d) $2.8 \times 10^{-7}$

94. 965-ampere current is passed for 10 minute in 0.1 M$CuSO_4$(aq.) solution using copper electrodes. The concentration of $CuSO_4$ solution becomes: **[4]**

a) 0.07 M

b) 0.007 M

c) 0.004 M

d) Remains 0.1 M

95. Decomposition of X exhibits a rate constant of 0.05 $\mu$g/year. How many years are required for the decomposition of 5 $\mu$g of X into 2.5 $\mu$g? **[4]**

a) 20

b) 25

c) 50

d) 40

96. Hydrolysis of one mole of per oxo disulphuric acid produces **[4]**

a) two moles of peroxomono sulphuric acid

b) one mole of sulphuric acid, one mole of peroxomono sulphric acid and one mole of hydrogen peroxide

c) one mole of sulphuric acid and one mole of peroxonomo sulphuric acid

d) two moles of sulphuric acid

97. Complete the following statement with the appropriate option. **[4]**
In phosphorus(III) oxide, each P-atom forms _____ structure and is covalently bonded to _____.

a) tetrahedral; three O-atoms

b) tetrahedral; four O-atoms

c) octahedral; two P-atoms

d) octahedral; three O-atoms

98. Which of the following statements is **not** correct? **[4]**

A. $La(OH)_3$ is less basic than $Lu(OH)_3$.

B. In lanthanide series, ionic radius of $Ln^{3+}$ ions decreases.

C. La is actually an element of transition series rather than lanthanide series.

D. Atomic radii of Zr and Hf are same because of lanthanide contraction.

a) B

b) C

c) D

d) A

99. Which of the following ligands is expected to be bidentate? **[4]**

a) $C_2O_4^{2-}$

b) Br

c) $CH_3CN$

d) $CH_3NH_2$

100. 1°, 2° and 3° nitroalkane can be identified by action of: **[4]**

a) $CHCl_3$ + KOH (alc)

b) $CHCl_3$ + NaOH (aq.)

c) $HNO_2$ + NaOH (aq.)

d) $HNO_3$ + NaOH (aq.)

## BOTANY (Section-A)

101. Phylogenetic system of classification is based on **[4]**

a) floral characters.

b) chemical constituents.

c) morphological features.

d) evolutionary relationships.

102. If a botanist has to nomenclate a similar species, he will use : **[4]**

a) Neotype

b) Mesotype

c) Isotype

d) Syntype

103. In plants, the symptoms like mosaic formation, leaf rolling and curling, yellowing and vein clearing, dwarfing and stunted growth produced by: **[4]**

a) Fungus

b) Bacteria

c) Viruses

d) Lichens

104. Mycorrhiza is correctly described as **[4]**

a) symbiotic relationship between fungi and roots of some higher plants.

b) parasitic association between roots and some fungi.

c) relation of ants with the stem of some trees.

d) symbiosis of algae and fungi.

105. A close relation between flower and the pollinating agent is best exhibited by: **[4]**

a) Yucca
b) Amorphophallus
c) Wheat
d) Both Amorphophallus and Yucca

106. Division Tracheophyta includes: **[4]**

a) All non-vascular and vascular plants
b) All vascular plants
c) Bryophyta
d) All non-vascular plants

107. Which of the following shows the aquatic ancestry of bryophytes? **[4]**

a) Non-ciliated sperms
b) Biflagellate spores
c) Ciliated sperms
d) Gametophytic plant body

108. The plant whose seeds are known to have the longest viability period is: **[4]**

a) Triticum Vulgare (wheat)
b) Carica papaya (papaya)
c) Lupinus (Lupine arcticus)
d) Phoenix dactylifera (date palm)

109. In angiosperm, archesporium gives rise to: **[4]**

a) Wall of anther
b) Wall of sporangium
c) Both wall of sporangium and sporogenous cells
d) Tapetum and sporogenous cells

110. In potato and colocasia stem is called: **[4]**

a) All of these
b) Offset
c) Stolon
d) Sucker

111. Axis of Inflorescence is: **[4]**

a) All of these
b) Petiole
c) Peduncle
d) Pedicel

112. The transverse section of a plant shows the following anatomical features: **[4]**

i. A large number of scattered vascular bundles surrounded by bundle sheath.
ii. Large conspicuous parenchymatous ground tissue.
iii. Vascular bundles are conjoint and closed.

iv. Phloem parenchyma absent.

Identify the category of plant and its part:

a) Dicotyledonous stem
b) Monocotyledonous root
c) Dicotyledonous root
d) Monocotyledonous stem

113. Which one of the Mendel traits of pea was recessive? **[4]**

a) Green seed colour
b) Round seed
c) Axial flower
d) Green pod

114. Which one of the following is a genetic trait? **[4]**

a) Grave's disease
b) Thalassemia
c) Cushing's syndrome
d) Parkinson's disease

115. During infection of E. coli cells by bacteriophage $T_2$, **[4]**

a) only nucleic acids enter the cell.
b) both proteins and nucleic acids enter the cell.
c) proteins are the only phage components that actually enter the infected cell.
d) only proteins from the infecting phage can also be detected in progeny phage

116. If the sequence of bases in DNA is ATTCGATG, the sequence of bases in its transcript will be: **[4]**

a) AUUCGAUG
b) GUAGCUUA
c) CAUCGAAU
d) UAAGCUAC

117. 9 + 2 organisation of microtubules found in: **[4]**

a) More than one is correct
b) Cilia
c) Centriole
d) Flagella

118. Which one of the following is wrong statement? **[4]**

a. Anabaena and Nostoc are capable of fixing nitrogen in free-living state also.
b. Root nodule forming nitrogen fixers live as aerobes under free-living conditions.
c. Phosphorus is a constituent of cell membranes, certain nucleic acids and all proteins.
d. Nitrosomonas and Nitrobacter are chemoautotrophs.

a) Statement (b) is wrong.
b) Statement (a) is wrong.
c) Statement (d) is wrong.
d) Statement (c) is wrong.

119. Salmonella is related with: **[4]**

a) TB
b) Typhoid
c) Tetanus
d) Polio

120. Leprosy is caused by: **[4]**

a) Mycobacterium
b) Salmonella
c) TMV
d) Monocystis

121. In which of the following stages chiasmata disappear? **[4]**

a) Diakinesis
b) Leptotene
c) Zygotene
d) Pachytene

122. The measure of maximum rate of reproduction under optimal conditions is known as: **[4]**

a) Biotic potential
b) Population growth
c) Carrying capacity
d) Population formation

123. Identify the possible link **A** in the following food chain: **[4]**
Plant $\rightarrow$ insect $\rightarrow$ frog $\rightarrow$ A $\rightarrow$ Eagle

a) Wolf
b) Cobra
c) Parrot
d) Rabbit

124. Match the following columns and select the correct option. **[4]**

| **Column-I** | **Column-II** |
|---|---|
| (a) Clostridium butylicum | (i) Cyclosporin-A |
| (b) Trichoderma polysporum | (ii) Butyric Acid |
| (c) Monascus purpureus | (iii) Citric Acid |
| (d) Aspergillus niger | (iv) Blood cholesterol-lowering agent |

a) (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)
b) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
c) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
d) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

125. The species which may become the endangered category are known as? **[4]**

a) Vulnerable
b) Living fossils
c) Threatened
d) Rare

126. From origin of life to its diversification on earth, there have occurred following number of episodes of mass extinction. **[4]**

a) Three
b) Four
c) Two
d) Five

127. Modem ex-situ conservation includes **[4]**

i. cryopreservation techniques
ii. in vitro-fertilization
iii. propagation of plants by using tissue culture methods

a) (ii) and (iii)
b) All of these
c) Only (iii)
d) Only (i)

128. The sites at which crossing over occurs between non-sister chromatids of the homologous chromosomes is known as: **[4]**

a) Recombination nodules
b) Chiasmata
c) Hot spot
d) Crossover nodules

129. Nuclear membrane disappears at: **[4]**

a) Anaphase
b) Late prophase
c) Early prophase
d) Metaphase

130. Select the correct statement about chlorophyll. **[4]**

a. Two types of chlorophyll molecules are found in the leaves of green plants
b. Chlorophyll molecules are found in the stroma of chloroplast
c. Chlorophyll molecules appear green because they reflect light in the red and blue ranges
d. Chlorophyll molecules are present in the thylakoid membrane

a) Statement (d) is correct.
b) Statement (b) is correct.
c) Statement (a) is correct.
d) Statement (c) is correct.

131. Which type of phosphorylation takes place in photosynthesis? **[4]**

a) Non-cyclic
b) Cyclic
c) Both Cyclic and Non-cyclic
d) Terminal

132. The light reaction in photosynthesis is also called: **[4]**

a) Hill's reaction
b) All of these
c) Calvin cycle
d) Blackmann's reaction

133. Moll's half leaf experiment is to prove that: **[4]**

a) $CO_2$ is necessary for photosynthesis
b) $O_2$ is released during photosynthesis
c) Chlorophyll is necessary
d) Organic substance is produced

134. R.Q. is represented by: **[4]**

a) $\frac{C}{N}$
b) $\frac{O_2}{CO_2}$
c) $\frac{N}{C}$
d) $\frac{CO_2}{O_2}$

135. Pineapple can be made to flower in off season by the application of: **[4]**

a) Short days
b) Temperature
c) Zeatin
d) Ethylene/NAA

## BOTANY (Section-B)

**Attempt any 10 questions**

136. Biological names are generally written in which language? **[4]**

a) English
b) Latin
c) None of these
d) Italics

137. Yeast is good source of: **[4]**

a) Proteins
b) Vitamin C
c) Sugars
d) Riboflavin

138. Phycoerythrin is the major pigment in **[4]**

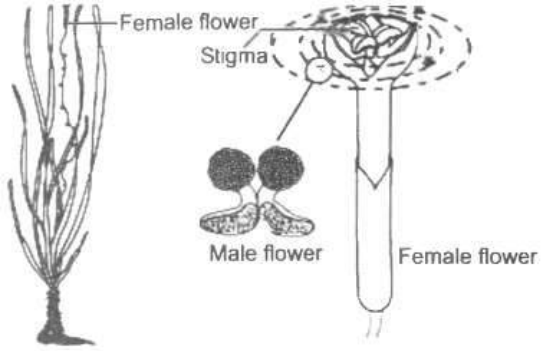
a) green algae

b) blue green algae

c) brown algae

d) red algae

139. The figure is given below showing hydrophily in: **[4]**




a) Lotus

b) Zostera

c) Vallisneria

d) All of these

140. How many statements are correct for monocotyledonous seed? **[4]**

i. Generally, monocotyledonous seeds are non-endospermic but some as in orchids are endospermic.

ii. In the seeds of cereals such as maize the seed coat is membranous and generally fused with the fruit wall.

iii. The outer covering of endosperm separates ihe embryo by a proteinous layer called aleurone layer.

iv. Seed consists of one large and shield shaped cotyledon known as scutellum and a short axis with a plumule and a radicle.

v. The plumule and radical are enclosed in sheaths which are called coleoptile and coleorhizae respectively.

a) Five

b) Four

c) One

d) Three

141. In a certain taxon of insects, some have 17 chromosomes and the others have 18 chromosomes. The 17 and 18 chromosome bearing organisms are: **[4]**

a) All males

b) Males and females, respectively

c) Females and males, respectively

d) All females

142. hn-RNA undergoes two additional process. Out of them in one process an unusual nucleotide (methyl GPT) is added to the 5' end of molecule. What would you called this? **[4]**

a) Capping

b) Termination

c) Tailing

d) Splicing

143. Gluconeogenesis (GNG) is a metabolic pathway that results in the generation of glucose from certain noncarbohydrate carbon substrates. Site of gluconeogenesis is: **[4]**

a) mitochondria

b) Goigi bodies

c) glyoxysomes

d) Lysosomes

144. Which is wrongly matched? **[4]**

| Option | | |
|---|---|---|
| (A) | Clostridium butylicum | Lactic acid |
| (B) | Aspergillus niger | Citric acid |
| (C) | Yeast | Statins |
| (D) | Acetobacter acetii | Acetic acid |

a) Option (C)

b) Option (A)

c) Option (B)

d) Option (D)

145. Which of the following is formed during respiration? **[4]**

a) $NO_2$

b) $SO_2$

c) $CO_2$

d) $O_2$

146. Trichoderma species, free-living fungi, are present in root ecosystems are potentially useful as **[4]**

a) biofertilisers

b) vectors for genetic engineering

c) methanogens

d) biopesticides

147. The trophic level of lion in a forest ecosystem is: **[4]**

a) $T_2$

b) $T_3$

c) $T_4$

d) $T_1$

148. Decapitation of plant leads to the activation of axillary buds due to **[4]**

a) All of these

b) Increase in cytokinins

c) More light availability

d) Auxin translocation

149. Induction of cell division activity and delay in senescence is caused by **[4]**

a) ethylene

b) cytokinin

c) ABA

d) NAA

150. Use product of photosynthesis: **[4]**

a) Energy

b) Starch

c) Glucose

d) $O_2$

## ZOOLOGY (Section-A)

151. Refer the following statement and answer the question. **[4]**
Stinging capsule is the characteristic feature of phylum **X**. It exhibits metagenesis containing two body forms in which sessile and cylindrical form is called **Y** and umbrella shaped, and free swimming is called **Z**. Identify **X** : **Y** and **Z**.

a) X - Coelenterate, Y - Poly, Z - Medusa

b) X - Echinodermata, Y - Medusa, Z - Polyp

c) X - Ctenophora, Y - Radula, Z - Hypostome

d) X - Mollusca, Y - Osculum, Z - Radula

152. Which of the following is a connecting link between invertebrates and non-invertebrates? **[4]**

a) Balanoglossus

b) Crocodile

c) Sycon

d) Sphenodon

153. Choose the correct statement: **[4]**

a) All pisces have gills covered by an operculum

b) All mammals are viviparous

c) All reptiles have a three-chambered heart

d) All cyclostomes do not possess jaws and paired fins

154. Frogs help human as they: **[4]**

a) Maintain ecological balance

b) Eat insect and protect the crop

c) In some countries the muscular legs of frog are used as food by man

d) All of these

155. Which of the following types of tissue is being described by the given statements? **[4]**

i. They are named because of their special function of linking and supporting other tissues/organs of the body.

ii. They include cartilage, bone, adipose, and blood.

iii. They provide strength, elasticity, and flexibility to the tissue.

iv. They also secrete modified polysaccharides, which accumulate between cells and fibres and act as matrix.

a) Epithelial tissue

b) Muscle tissue

c) Connective tissue

d) Neural tissue

156. Which of the following activity is more difficult during bronchial asthma? **[4]**

a) Expiration

b) Transportation of oxygen

c) Forced inspiration

d) Inspiration

157. Methenoglobin refers to: **[4]**

a) Deoxygenated haemoglobin

b) A colourless respiratory pigment

c) Oxygenated haemoglobin

d) Oxidized haemoglobin

158. Which of the following statements about the mechanism of ventilation/breathing is/are correct? **[4]**

i. As the diaphragm relaxes, air is expelled from the respiratory system.

ii. During inspiration the lungs act as suction pump.

iii. Inspiration is a passive and expiration is an active process.

iv. For quiet breathing, external intercostal muscles and diaphragm do not play an important role.

a) (i), (ii), and (iv)

b) Only (ii)

c) Only (i)

d) Both (i) and (ii)

159. If the oxyhaemoglobin dissociation curves of maternal and foetal haemoglobin are compared, the foetal curve will be on: **[4]**

a) Right hand side and sigmoid

b) Left hand side and sigmoid

c) Left hand side and parabola

d) Right hand side and parabola

160. Carbon dioxide entering erythrocytes reacts with water to form carbonic acid. The enzyme is: **[4]**

a) Carbonic anhydrase

b) Hydrolas

c) Carboxypeptidase

d) Oxidoreductase

161. The solid mass of 8-16 cells formed from zygote after successive mitotic divisions is called **[4]**

a) morula

b) blastula

c) gastrula

d) inner cell mass

162. Which of the following cells during gametogenesis is normally diploid? **[4]**

a) Primary polar body

b) Secondary polar body

c) Spermatogonia

d) Spermatid

163. After ovulation, Graafian follicles turns into **[4]**

a) corpus atresia

b) corpus albicans

c) corpus callosum

d) corpus luteum

164. Ectopic pregnancies are referred to as **[4]**

a) pregnancies terminated due to the hormonal imbalance.

b) implantation of defective embryo in the uterus.

c) pregnancies with genetic abnormality.

d) implantation of embryo at site other than uterus.

165. Select the option including all sexually transmitted diseases. **[4]**

a) AIDS, Malaria, Filaria

b) Gonorrhoea, Syphilis, Genital herpes

c) Cancer, AIDS, Syphilis

d) Gonorrhoea, Malaria, Genital herpes

166. Choose the correct sequential order of the evolution of higher plants group. **[4]**

a) Seed fem → Lycopods → Progymnosperm →

b) Silophyton → Progymnosperm → Seed fem → Angiosperms

Zosterophyllum → Dicotes

c) Seed fem → Progymnosperm → Zosterophyllum → Lycopods → Ferns.

d) Zosterophyllum → Progymnosperm → Seed fem → Monocotes

167. The presence of gill slits, in the embryos of all vertebrates, supports the theory of **[4]**

a) organic evolution

b) metamorphosis

c) biogenesis

d) recapitulation

168. In the kidney, glucose is mainly reabsorbed in: **[4]**

a) Distal convoluted tubules

b) Proximal convoluted tubules

c) Loop of Henle

d) Bowman's capsule

169. The most abundant, harmful, and universal waste product of metabolism is: **[4]**

a) $H_2O$

b) $C_2H_5OH$

c) $CO_2$

d) Uric acid

170. Excretory organ of crustaceans are: **[4]**

a) Nephridia

b) Protonephridia

c) Green gland

d) Malpighian tubules

171. Which of the following statements are correct regarding muscle proteins? **[4]**

i. Actin is a thin filament and is made up of two F-actins.

ii. The complex protein, tropomyosin is distributed at regular intervals on the troponin.

iii. Myosin is a thick filament which is also a polymerised protein.

iv. The globular head of meromyosin consists of light meromyosin (LMM).

a) (i) and (iii)

b) (i), (ii) and (iii)

c) (i), (ii), and (iv)

d) (ii) and (iv)

172. Cadmium: **[4]**

A. Is a cumulative poison.

B. Resembles Zn chemically and may replace it in enzymes destroying their catalytic activity.

C. Replaces bone calcium.

a) only B and C are correct.
b) only A and B are correct.
c) all are correct.
d) only B is correct.

173. A U-shaped bone present at the base of buccal cavity is **[4]**

a) femur
b) hyoid bone
c) lacrimal bone
d) ethmoid bone

174. Which nerve originates from the medulla? **[4]**

a) third cranial nerve
b) Optic
c) Oculomotor
d) Vagus

175. The functional joint between two nerve fibres is: **[4]**

a) Synapsis
b) Taxis
c) Synapse
d) Reflex

176. Cerebellum is concerned with the **[4]**

a) coordinating and regulation muscles tone.
b) All of these
c) contraction of voluntary muscles.
d) maintaining posture, orientation and equilibrium of body.

177. The hormone which controls the rate of body metabolism is: **[4]**

a) Thyroxine
b) HGH
c) ACH
d) Insulin

178. The releasing and inhibitory hormones are produced by: **[4]**

a) Testis
b) Pituitary
c) Hypothalamus
d) Pancreas

179. In amphibia, the heart has: **[4]**

a) Two auricles and one ventricle
b) One auricle and two ventricles
c) One auricle and one ventricle
d) Two auricles and two ventricle

180. Which granulocytes secrets histamine, serotonin, and heparin? **[4]**

a) Basophils
b) Monocyte
c) Eosinophils
d) Neutrophilis

181. Which structures are directly involved in the pulmonary circulation? **[4]**

a) Right ventricle, pulmonary arteries and left atrium
b) Superior vena cava, right atrium and left ventricle
c) Right atrium, aorta and left ventricle
d) Left ventricle, aorta and inferior vena cava

182. In India, the first time an international meeting on biotechnology was held in: **[4]**

a) 1989
b) 1988
c) 1986
d) 1987

183. Consider the following statements. **[4]**

i. A soil inhabiting plant bacterium, Agrobacterium tumefaciens, is a pathogen of several dicot plants and is able to transfer a piece of DNA known as T-DNA.
ii. The T-DNAcauses tumours.
iii. Tumour formation induced by Ti plasmid.

Which of the statements given above are correct?

a) (i) and (ii)
b) (i) and (iii)
c) (ii) and (iii)
d) (i), (ii), and (iii)

184. Choose the correct option regarding retrovirus: **[4]**

a) A dsRNA virus
b) A DNA virus that can synthesise RNA during infection
c) An RNA virus that can synthesise DNA during infection
d) A ssDNA virus

185. A new variety of rice was patented by a foreign company through such varieties have been present in India for a long time. This is related to : **[4]**

a) Lerma ROJO
b) Sharbati Sonora
c) Co-667
d) Basmati

**ZOOLOGY (Section-B)**

**Attempt any 10 questions**

186. Which of the following characteristic distinguish arthropoda from annelids and molluscs? **[4]**

a) An external skeleton made of chitin (a polysaccharide) and protein rather than a shell made chiefly of mineral salts.

b) Subdivision of the legs into movable segments.

c) All of these

d) Distinct group of muscles, derived from many body segments, that move the separate parts of the exoskeleton.

187. The only type of cell seen in a tendon is **[4]**

a) fibroblasts

b) collagenous cells

c) muscle fibres

d) reticular cells

188. Identify the motile, phagocytic corpuscle of mammalian blood : **[4]**

a) Neutrophils

b) Monocytes

c) Thrombocytes

d) Basophils

189. In the place, where low $P_{o_2}$ high $P_{co_2}$ high $H^+$ concentration and higher temperature exist, the conditions are favourable for: **[4]**

a) $CO_2$ gets bound to haemoglobin in the lung surface

b) Dissociation of oxygen from the oxyhemoglobin

c) Formation of oxyhaemoglobin

d) Dissociation of haemoglobin

190. Menstrual cycle is controlled by: **[4]**

a) Estrogen and progesterone

b) LH only

c) Estrogen only

d) FSH only

191. Diseases or infections which are transmitted through sexual intercourse are collectively called Sexually Transmitted Diseases (STDs), which is not correct for it? **[4]**

a) Genital herpes, genital warts are STD

b) Hepatitis-B can also be transmitted by transfusion of blood, or from an infected mother to the foetus too

c) It is also called Venereal Diseases (VD) or Reproductive Tract Infections (RTI)

d) All STD are completely curable

192. Which of the following frequency was described by Hardy-Weinberg for an entire population? **[4]**

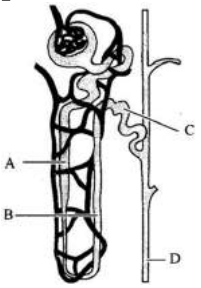
a) Phenotype

b) Genotype

c) Genes

d) Allele

193. Refer the given figure of nephron and identify the structure which is responsible to perform the following function. **[4]**




i. Actively reabsorbs sodium and chloride.

ii. Secretes ammonium ions and hydrogen ions.

iii. Forms part of juxtaglomerular apparatus.

iv. Relatively permeable to water, but in the presence of ADH its permeability to water increases making urine concentrated.

a) B

b) A

c) C

d) D

194. The collar bone is known as: **[4]**

a) Clavicle

b) Patella

c) Scapula

d) Cricoid

195. The gelatinous, elastic membrane covering the sensory hair cells of the human ear is known as **[4]**

a) basilar membrane

b) neuro-sensory membrane

c) tectorial membrane

d) Reissner's membrane

196. Blood calcium level is a resultant of how much dietary calcium is absorbed, how much calcium is lost in the urine, how much bone dissolves releasing calcium into the blood, and how much calcium from the blood enters tissues. A number of factors play an important role in these processes. Mark the one which has no role. **[4]**

a) Thymosin

b) Thyrocalcitonin

c) Parathyroid hormone

d) Vitamin-D

197. A scientist was studying the production of a protein that was released by an animal cell into a culture medium. She found that the protein only appeared in the culture medium after she added a few drops of a hormone to the cell. Before adding the hormone, she labelled the protein inside the cell with a fluorescent dye and looked at the cell under the light microscope. The dye was seen in flattened sheets and tube-like structures throughout the cell, and in stacks of flattened sac-like structures. After adding the hormone, the dye was also seen as small dots clustered against the cell membrane. Which statement most likely explains these observations? **[4]**

a) The protein is made in the Golgi apparatus, is passed to the endoplasmic reticulum and is secreted through hormone-stimulated pinocytosis.

b) The protein is made in the endoplasmic reticulum, is passed to the Golgi apparatus and is secreted through hormone-stimulated exocytosis.

c) The hormone triggers the synthesis of the protein in the endoplasmic reticulum and it is then secreted outside of the cell via channel proteins in the cell membrane.

d) The hormone stimulates protein synthesis in the cell vacuole; the protein is then passed to the Golgi apparatus, and eventually passes through the cell membrane by passive diffusion.

198. Monocyte serves as : **[4]**

a) Shock troops

b) Mopping up

c) Macrophages

d) Plasma cell

199. Which of the following steps are catalysed by Taq polymerase in a PCR reaction? **[4]**

a) All of these

b) Denaturation of template DNA

c) Annealing of primers to template DNA

d) Extension of primer end on the template DNA

200. Which one of the following is commonly used in transfer of foreign DNA into crop plants? **[4]**

a) Agrobacterium tumefaciens

b) Trichoderma harzianum

c) Meloidogyne incognita

d) Peniciilium expansum

# Solution

## SAMPLE PAPER - 9

## PHYSICS (Section-A)

1.

**(b)** $[ML^2 T^{-2} A^{-2}]$

**Explanation:** Mutual Inductance, $M = -\dfrac{e_2}{\dfrac{di_1}{dt}}$

$$[M] = \frac{\left[e_2\right]}{\left[\dfrac{di_1}{dt}\right]} = \frac{\left[\dfrac{W}{q}\right]}{\left[\dfrac{q}{t^2}\right]} = \frac{ML^2T^{-2}}{\dfrac{A^2T^2}{T^2}} = ML^2A^{-2}T^{-2}$$

2.

**(c)** Angle

**Explanation:** $P + \frac{1}{2}\rho v^2 + \rho gh = K$

K has the same dimensions as each one of the factors on the LHS i.e., $\frac{1}{2}\rho v^2$ and $\rho$gh.

$\therefore \quad \dfrac{[K]}{[P]} = 0$

Angle has no dimensions, i.e., $[\theta] = 0$

Hence, $\dfrac{[K]}{[P]} = [\theta]$

3.

**(c)** = 1

**Explanation:** As it is on straight line the distance would be same as displacement, hence their ratio will be =1

4.

**(d)** 15°

**Explanation:** $R_{max.} = R = \dfrac{u^2}{g}$ or $u^2 = Rg$

Now, as range = $\dfrac{u^2 \sin 2\theta}{g}$

Then $\dfrac{R}{2} = \dfrac{Rg\sin 2\theta}{g}$

or $\sin 2\theta = \frac{1}{2} = \sin 30^o$

or $\theta = 15^o$

5.

**(b)** Between 7 N and 17 N

**Explanation:** Between 7 N and 17 N

6. **(a)** 0.4 kg

**Explanation:** The mass of block A is 2 kg, the coefficient of friction is 0.2.

As the blocks do not move, therefore, the tension in the string must be equal to the force of friction on block A. Applying Newton's second law for block A, $T = \mu_S m_A g$

$= 0.2 \times 2 \times 10$

$= 4$ N

Applying Newton's second law for block B, $T = m_A g$

$4 = m_B \times 10$

$m_B = 0.4$ kg

Thus, the maximum mass of block B is 0.4 kg.

7.

**(d)** 1.5 kg

**Explanation:** Given,

$m_b = 50gm = 50 \times 10^{-3}$

$v_b = 30\ ms^{-1}$

$v_g = 1\ ms^{-1}$

According to the law of conservation of momentum

$m_g v_g = m_b v_b$

$$m_g = \frac{m_b v_b}{v_g}$$

$$m_g = \frac{\left(50 \times 10^{-3}\right)(30)}{1g} = 150 \times 10^{-3} = 1.5 \text{ kg}$$

8.

**(c)** 25

**Explanation:** $U_1 = mgh_1$ and $U_2 = mgh_2$

$$\% \text{ energy lost} = \frac{U_1 - U_2}{U_1} \times 100$$

$$= \frac{mgh_1 - mgh_2}{mgh_1} \times 100 = \left(\frac{h_1 - h_2}{h_1}\right) \times 100$$

$$= \frac{2 - 1.5}{2} \times 100 = 25\ \%$$

9.

**(d)** $\frac{(2n+1)\,l}{3}$

**Explanation:** $X_{CM} = \frac{m_1 x_1 + m_2 x_2 + \ldots}{m_1 + m_2 + \ldots}$

$$= \frac{ml + 2m \cdot 2l + 3m \cdot 3l + \ldots}{m + 2m + 3m + \ldots}$$

$$= \frac{ml\,(1 + 4 + 9 + \ldots)}{m\,(1 + 2 + 3 + \ldots)}$$

$$= \frac{l\frac{n(n+1)\,(2n+1)}{6}}{\frac{n(n+1)}{2}} = \frac{l(2n+1)}{3}$$

10.

**(b)** < 1

**Explanation:** The moment of inertia of semi-circular portions about x and y axes are the same. But the moment of inertia of the straight portion about the x-axis is zero.

11.

**(d)** areas

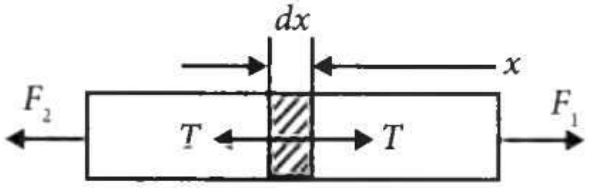
**Explanation:** In planetary motion, the angular momentum conservation leads to the law of areas.

12.

**(d)** 1

**Explanation:**

Consider an element of thickness dx,




Change in length of the element is dl = $\frac{T}{S}\frac{dx}{Y}$ and

T = $F_1$ - ($F_1$ - $F_2$)$\frac{x}{l}$

$$\int_0^{\Delta l} dl = \int_0^{l=1} \frac{120 - \frac{(120-80)x}{l}}{0.5 \times 2 \times 10^{11}} dx$$

$$\Delta l = \int_0^1 \frac{120 - \frac{40}{l}x}{10^{11}} dx$$

$$\Delta l = \frac{100l}{10^{11}} = 10^{-9} \text{ ...}(\because\ l = 1)$$

Hence x = 1

13.

**(b)** $1.5 \times 10^{-2}$

**Explanation:** When the temperature of a liquid is increased by $\Delta T^{o}C$, the mass will remain unchanged while due to thermal expansion volume will increase and becomes V' = V(1 + $\gamma\Delta$T) where $\gamma$ is coefficient of volume expansion of liquid.

$$\therefore \quad \rho' = \frac{m}{V'} = \frac{m}{V[1 + \gamma\Delta T]} = \frac{\rho}{1 + \gamma\Delta T}$$

$$\therefore \text{ Fractional change in density} = \left[1 - \frac{\rho'}{\rho}\right] = \frac{\gamma\Delta T}{1 + \gamma\Delta T}$$

$$= \frac{49 \times 10^{-5} \times 30}{1 + 49 \times 10^{-5} \times 30}$$

$= 1.5 \times 10^{-2}$

14.

**(c)** only i

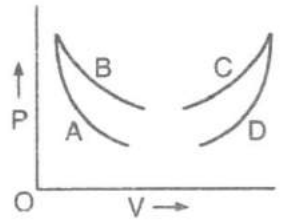
**Explanation:** The substance which contracts in volume on solidifying have their melting point raised by pressure.

15.

**(d)** A and B respectively

**Explanation:**

We have given the graphs →




As, $\frac{\text{Slope of Adiabatic}}{\text{Slope of Isothermal}} = Y$

$\Rightarrow$ Where Y = $\frac{C_P}{C_V}$

So, A $\rightarrow$ Adiabatic process.

B $\rightarrow$ Isothermal process.

Hence, A and B respectively.

16. **(a)** curve III

**Explanation:** The experiment is carried out at high pressure. Hence, the gas does not obey ideal gas equation but follows Van der Waal's gas equation.

For n moles,

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = RT$$

At extremely high pressure, term $\frac{an^2}{V^2}$ can be neglected.

$\therefore$ P(V - nb) = RT

$\therefore$ PV - Pnb = RT

$\therefore$ PV = RT + Pnb i.e., PV > RT

This implies the curve of graph $\frac{PV}{RT}$ vs P rises up after a certain point.

17.

**(d)** $4\sqrt{2}$

**Explanation:** $x = 4(\cos\pi t + \sin\pi t)$

$$= 4\sqrt{2}\left[\frac{1}{\sqrt{2}}\cos\pi t + \frac{1}{\sqrt{2}}\sin\pi t\right]$$

$$= 4\sqrt{2}\left[\sin\frac{\pi}{4}\cos\pi t + \cos\frac{\pi}{4}\sin\pi t\right]$$

$$= 4\sqrt{2}\sin\left(\pi t + \frac{\pi}{4}\right)$$

Standard equation of displacement is,

$x = a \sin(\omega t + \phi)$

Comparing the given equation with the standard equation.

$a = 4\sqrt{2}$

18.

**(d)** 62.5 J

**Explanation:** The energy E of the vibrating string is given by:

$E = 2\pi^2 n^2 a^2 m$

Here, n = 12.5 Hz, a = $(1/\pi)$ m
and m = 0.2 kg/m

$\therefore$ E = $2(\pi)^2 \times (12.5)^2 \times \left(\frac{1}{\pi}\right)^2 \times 0.2 = 62.5$ J

19.

**(c)** stationary waves
**Explanation:** stationary waves

20.

**(b)** $\sigma_2 > \sigma_1 > \sigma_3$
**Explanation:** Consider any paint P inside
Inside conductor net electric field = 0

$\sigma = \frac{Q}{A}$

$\sigma \propto \frac{1}{A}$

$A_2 < A_1 < A_3$

$\sigma_2 > \sigma_1 > \sigma_3$

21.

**(c)** C(K + 1)/2
**Explanation:** $C = \frac{\varepsilon_0 A}{d}$, $C_1 = \frac{\varepsilon_0 A}{2d}$ and $C_2 = \frac{K\varepsilon_0 A}{2d}$

$C_{\text{eff.}} = \frac{\varepsilon_0 A}{2d} + \frac{K\varepsilon_0 A}{2d} = \frac{\varepsilon_0 A}{2d}(K+1) = \frac{C}{2}(K+1)$

22.

**(b)** 1 mA
**Explanation:** $I_g = \frac{2}{300}$ A = $\frac{2}{300} \times 1000$ mA

$= \frac{20}{3}$ mA = 6.67 mA

As range of ammeter cannot be decreased but can be increased only. Therefore, the Instrument cannot be converted to measure the range 1 mA.

23.

**(d)** 4 : 1
**Explanation:** F = $\frac{mV^2}{r}$ and F = qVB

$\therefore \frac{mV^2}{r} = qVB \Rightarrow r = \frac{mV}{qb}$

or, $r = \frac{\sqrt{2mk}}{qB}$ ( $\because$ $p = mV = \sqrt{2mk}$)

$\Rightarrow \frac{r^2q^2B^2}{2m} = K$

$K_p = \frac{r_p^2q_p^2B^2}{2m_p}$ and $K_\alpha = \frac{r_\alpha^2q_\alpha^2B^2}{2m_\alpha}$

$\therefore \frac{K_p}{K_\alpha} = \frac{r_p^2q_p^2m_\alpha}{r_\alpha^2q_\alpha^2m_p} = \left(\frac{2}{1}\right)^2\left(\frac{1}{2}\right)^2\frac{4}{1}$ or, $\frac{K_p}{K_\alpha} = 4 : 1$

24.

**(d)** diamagnetic

**Explanation:** Hydrogen molecule behaves as diamagnetic as no net magnetic moment is associated with it.

25. **(a)** 8

**Explanation:** For a short magnet at a point along its axial line,

$B = \frac{\mu_0}{4\pi} \cdot \frac{2M}{r^3}$

or $\frac{B_1}{B_2} = \left(\frac{r_2}{r_1}\right)^3 = \left(\frac{48}{24}\right)^3 = \frac{8}{1} = 8$

26. **(a)** 5

**Explanation:** 5

27. **(a)** anti-clockwise

**Explanation:** The direction of current in the solenoid is clockwise. On displacing it towards the loop a current in the loop will be induced in an opposite sense so as to oppose its approach. Therefore the direction of induced current as observed by the observer will be anticlockwise.

28.

**(b)** the meter reads not v but $<v^2>$ and is calibrated to read $\sqrt{\langle v^2\rangle}$

**Explanation:** The voltmeter connected to AC mains calibrated to read rms value $\sqrt{\langle v^2\rangle}$.

29.

**(b)** $\vec{E}$ = (9 sin (1.6 $\times$ $10^3$x + 48 $\times$ $10^{10}$t)$\hat{k}$ v/m)

**Explanation:** Given, $\vec{B} = 3 \times 10^{-8}$ sin (1.6 $\times$ $10^3$x + 48 $\times$ $10^{10}$t)

Using, $E_0 = B_0 \times C = 3 \times 10^{-8} \times 3 \times 10^8 = 9$ V/m

∴ Electric field:

$\vec{E}$ = (9 sin (1.6 × $10^3$x + 48 × $10^{10}$t)$\hat{k}$ v/m

30.

**(d)** 1.81

**Explanation:** Real depth of plate, H = 100 cm

Apparent depth of plate, h = 100 - 45 = 55 cm

∴ Refractive index of fluid = $\frac{H}{h} = \frac{100}{55}$ = 1.81

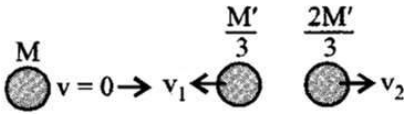
31.

**(b)** becomes narrower

**Explanation:** As $\lambda_{blue} < \lambda_{red}$, and width of diffraction bands is directly proportional to $\lambda$, therefore diffraction bands become narrower and crowded.

32.

**(d)** 1 : 1

**Explanation:** 


$\left|\vec{P}_1\right| = \left|\vec{P}_2\right|$ (from the conservation of momentum)

Here $\vec{P}$ is momentum.

So, $\lambda = \frac{h}{P}$ Here wavelength will be same.

33.

**(b)** the kinetic energy of the electrons will increase

**Explanation:** When an electric field is acting vertically downwards, the photoelectron being negatively charged will experience a force due to the electric field acting vertically upwards which is the initial direction of motion of emitted photoelectrons. Due to which the electron gets accelerated and hence its kinetic energy increases.

34.

**(d)** $10^5$

**Explanation:** The radius of orbit of electrons = $10^{-10}$ m

radius of nucleus =$10^{-15}$ m

Ratio = $\frac{10^{-10}}{10^{-15}} = 10^5$

Hence the radius of electron orbit is $10^5$ times larger than the radius of nucleus.

35.

**(c)** 19039 years

**Explanation:** Given: $\frac{dN_0}{dt}$ = 20 decays/min

$\frac{dN_0}{dt}$ = 2 decays/min

$T_{1/2}$ = 5730 years

As we know,

$N = N_0 e^{-\lambda t}$

$\therefore\ t = \frac{1}{\lambda}\log\frac{N_0}{N} = \frac{2.303 \times T_{1/2}}{0.693} \times \log_{10}\frac{N_0}{N}$

But $\frac{\frac{dN_0}{dt}}{\frac{dN}{dt}} = \frac{N_0}{N} = \frac{20}{2} = 10$

$\therefore\ t = \frac{2.303 \times 5730}{0.693} \times 1$ = 19039 years

**PHYSICS (Section-B)**

36.

**(c)** 8.1 kW

**Explanation:** Given that,

h = 60 cm

g = 10 $ms^{-2}$

Rate of flow of water = 15 kg/s

Power of the falling water = $\frac{\text{Work done}}{\text{Time}}$ 15 kg $s^{-1}$ × 10 m $s^{-2}$ × 60 m = 9000 watt

Loss in energy due to friction = $9000 \times \frac{10}{100}$

= 900 watt

Power generated by the turbine = (9000 - 900) watt = 8100 watt = 8.1 kW

37. **(a)** $\frac{2T}{M}$

**Explanation:** Tangential acceleration,

$a = r\alpha = R \cdot \left(\frac{2T}{MR}\right) = \frac{2T}{M}$

38.

**(c)** $T_{ma}$ > st

**Explanation:**

i. $T_{st} = 2\pi\sqrt{\frac{(R+h)^3}{GM}} = 2\pi\sqrt{\frac{R}{g}}$ ...(As, h << R and GM = $gR^2$)

ii. $T_{ma} = 2\pi\sqrt{\frac{R}{g}}$

iii. $T_{sp} = 2\pi\sqrt{\frac{1}{g\left(\frac{1}{l}+\frac{1}{R}\right)}}$

$= 2\pi\sqrt{\frac{R}{2g}}$ ...(As, l = R)

iv. $T_{is} = 2\pi\sqrt{\frac{R}{g}}$ ...(As, $l = \infty$)

39.

**(d)** $\frac{C + S - 3A}{3}$

**Explanation:** $C = \gamma_{abs} - 3\alpha = \gamma_{abc} - 3A$

$S = \gamma_{abc} - 3\alpha$ ...(i)

$\therefore$ C - S = 3α - 3A

or $\alpha = \frac{C - S + 3A}{3}$

40.

**(b)** only i

**Explanation:** only i

41.

**(b)** $I_1 = I_2$

**Explanation:** The contrast will be maximum, when $I_1 = l_2$, i.e., a = b. In that case, $I_{min} = (a - b)^2 = 0$

where a and b are the amplitudes of interfering waves.

42. **(a)** 10 V range and 200 kΩ resistance in series

**Explanation:** 10 V range and 200 kΩ resistance in series

43.

**(d)** $150\hat{k}$ Nm

**Explanation:** $150\hat{k}$ Nm

44.

**(d)** 0.1 C

**Explanation:** Here, area of cross section

$A = 200cm^2 = 200 \times 10^{-4} m^2$

Number of turns = N =100

Resistance, R = 2 Ω

Initial magnetic flux linked with the coil is

$\phi = BA \cos\theta = 0.1 \times 200 \times 10^{-4} \times \cos 0^{o}$

$= 2 \times 10^{-3}$ Weber

Final magnetic flux linked with the coil is

$\phi_f = 0$ ( $\because$ B = 0)

$\therefore$ Induced emf in the coil is $e = -\frac{N\Delta\phi}{\Delta t} = -\frac{N\left(\phi_f - \phi_i\right)}{\Delta t}$

$= \frac{-100\left(0 - 2 \times 10^{-3}\right)}{1} = 2 \times 10^{-1} V$

= 0.2 volt

Induced current in the coil is $I = \frac{e}{R} = \frac{0.2V}{2\Omega} = 0.1$ amp

Induced charge in the coil

q = It = 0.1 $\times$ 1 = 0.1 coulomb

45.

**(d)** $\frac{1}{2} E_0 I_0 \cos\theta$

**Explanation:** Average power lost/cycle

$= E_v I_v \cos\theta$

$= \frac{E_0}{\sqrt{2}} \frac{I_0}{\sqrt{2}} \cos\theta$

$= \frac{1}{2} E_0 I_0 \cos\theta$

46. **(a)** f and $(\frac{3I}{4})$

**Explanation:** The focal length of the lens remains the same. The intensity of the image formed by the lens is proportional to the area exposed to incident light from the object.

i.e., Intensity $\propto$ area

or $\frac{I_2}{I_1} = \frac{A_2}{A_1}$

Initial area, $A_1 = \pi\left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4}$

After blocking, exposed area,

$A_2 = \frac{\pi d^2}{4} - \frac{\pi (d/2)^2}{4}$

$= \frac{\pi d^2}{4} - \frac{\pi d^2}{16} = \frac{3\pi d^2}{16}$

$\therefore \frac{I_2}{I_1} = \frac{A_2}{A_1} = \frac{\frac{3\pi d^2}{16}}{\frac{\pi d^2}{4}} = \frac{3}{4}$

or $I_2 = \frac{3}{4} I_1 = \frac{3}{4} I$

47.

**(d)** 1 concave, 1 convex

**Explanation:** For an achromatic combination $\frac{\omega_1}{f_1} + \frac{\omega_2}{f_2} = 0$

i.e. 1 convex lens and 1 concave lens.

48. **(a)** 4

**Explanation:** Specific charge of electron, $\frac{e}{m} = 1.8 \times 10^{11}$ C kg$^{-1}$

Maximum kinetic energy of photoelectrons = $\frac{1}{2}$ mv$^2_{max.}$ = eV$_S$ (where V$_S$ is the stopping potential.)

$\therefore \frac{1}{2}$ mv$^2_{max.}$ = eV$_S$

$\therefore$ V$_S = \frac{mv^2_{max}}{2e} = \frac{\left(1.2 \times 10^6\right)^2}{2 \times 1.8 \times 10^{11}} = 4$V.

49. **(a)** $\frac{n^2h^2}{4\pi^2me^2Z}$

**Explanation:** $\frac{n^2h^2}{4\pi^2me^2Z}$

50.

**(c)** 5.24 $\times$ 10$^9$ dps

**Explanation:** Activity, R = $\frac{0.6931}{T} \times N$

$= \frac{0.6931 \times 6.02 \times 10^{23} \times 10^{-3}}{28 \times 365 \times 24 \times 3600 \times 90}$

= 5.24 $\times$ 10$^9$ dps

51. **(a)** 1.344 M

**Explanation:** milli mole, in of I = 480 × 1.5 = 720

milli mole, in of II = 520 × 1.2 = 624

∴ Total mm = 720 + 624 = 1344

Total V = 480 + 520

= 1000 mL

∴ M × 1000 = 1344

or M = 1.344

52.

**(b)** $Cl^-$

**Explanation:** $Cl^-$ has $ns^2np^6$ configuration

53. **(a)** transition elements

**Explanation:** Rare earth elements are 17 in number: La, Ce-Lu, Sc, Y.

54.

**(d)**


**Explanation:**


has strong H-bonding with $H_2O$.

55.

**(b)** $CH_4 < HCN < NH_3$

**Explanation:** The strength of H-bonding depends upon two factors:

i. Electronegativity difference between the hydrogen and Halogen element.

ii. Number of H-bonding interaction.

So the order of H-bonding is $CH_4 < HCN < NH_3$.

56.

**(c)** $NCl_3$

**Explanation:** $NCl_3 \xrightarrow{H_2O} NH_3 + HOCl$

57.

**(b)** -242.8 J $K^{-1}mol^{-1}$

**Explanation:** $\Delta S^\circ = S^\circ CO_2 + 2 \times S^\circ H_2O - \left(S^\circ CH_4 + 2 \times S^\circ_{O_2}\right)$

= (213.6 + 2 × 69.9) - (186.2 + × 205.2)

= -242.8 J $K^{-1}$ $mol^{-1}$

58.

**(d)** $K = \frac{1}{[CO_2]}$

**Explanation:** In heterogeneous equilibria, the concentration of pure solids and pure liquids are not included in the equilibrium expression.

59.

**(c)** 6

**Explanation:** The balanced reaction is:

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

60.

**(c)** 5

**Explanation:** $3Br_{2(aq)} + 6OH^-_{(aq)} \rightarrow 5Br^-_{(aq)} + BrO_3^-{}_{(aq)} + 3H_2O_{(l)}$

61.

**(c)** orthosilicate

**Explanation:** orthosilicate

62.

**(d)** $sp^2$, $sp^2$

**Explanation:** $sp^2$, $sp^2$

63.

**(b)** I > II > III > IV

**Explanation:** (I) is most stabilise as it is neutral, (II) structure is more stabilise than (III) and (IV) because of complete octet. (IV) is destabilise as electronegative oxygen contain positive charge.

64.

**(d)**


**Explanation:**

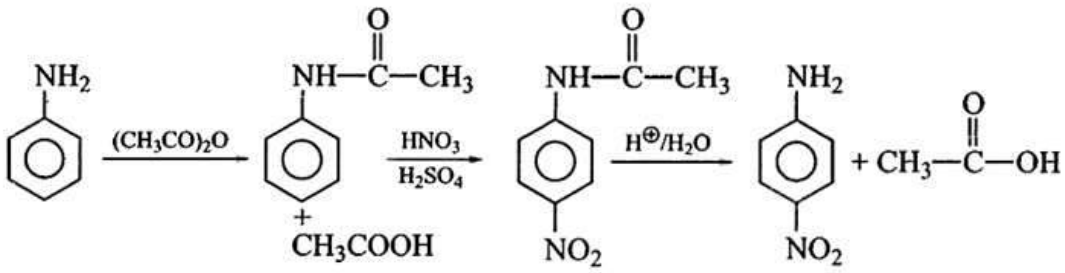

Thiophene

The lone pair of electrons on 'S' in thiophene is involved in delocalization and hence, there are 6$\pi$-electrons. Therefore, it is a $(4n + 2)\pi$ system.

65.

**(b)**

**Explanation:**



66.

**(b)** have both the above characteristics

**Explanation:** For ideal solution,

$\Delta V_{mix} = 0$, $\Delta H_{mix} = 0$ and $\Delta T_{mix} = 0$

67.

**(c)** 724

**Explanation:** $w_{solute} = 2.5$ g, $W_{solvent} = 100$ g, $\Delta Tb = 2°$

$$\therefore \Delta T_b = \frac{1000 \times K_b \times w}{W \times m}$$

$$\text{or } = \frac{1000 \times 0.76 \times 2.5}{100 \times m}$$

$\therefore$ m = 9.5

$$\text{Now, } \frac{P^{\circ} - P_s}{P^{\circ}} = \frac{w \times M}{m \times W} \text{ (Given dilute solution)}$$

$$\frac{760 - P_s}{760} = \frac{2.5 \times 18}{9.5 \times 100} = 0.047$$

$\therefore$ $P_S = 724$ mm

68.

**(c)** $E_{Mn^{7+}/Mn^{2+}} = E^{o}_{RP} + \frac{0.059}{5} \log \frac{\left[MnO_4^-\right]\left[H^+\right]^8}{\left[Mn^{2+}\right]}$

**Explanation:** $MnO_4^- \longrightarrow Mn^{2+}$

$Mn^{7+} + 5e \longrightarrow Mn^{2+}$

complete oxidant is $MnO_4^-$ and $H^+$

69.

**(b)** activation energy + normal energy of reactants

**Explanation:** Activation energy = (Threshold energy) - (Average energy of the reactants). Activation energy is the minimum increase in potential energy of a system required for molecules to react and threshold energy is the minimum kinetic energy required to convert kinetic energy into activation energy during the formation of the activated complex.

70.

**(b)** $\frac{0.693}{12} s^{-1}$

**Explanation:** Order of reaction = 1

Amount of the substance left after n half-lives is given as $[A]_t = \frac{[A]_0}{2^n}$

$\therefore \frac{1}{4} = \frac{1}{2^n}$

$\therefore$ n = 2

$2 \times t\frac{1}{2} = 24s$ (given)

$\therefore t\frac{1}{2} = 12s$

$k = \frac{0.693}{t\frac{1}{2}} = \frac{0.693}{12} s^{-1}$

71. **(a)** $K_3[Cu(CN)_4]$

**Explanation:** $K_3[Cu(CN)_4]$

72.

**(c)** cupric chloride

**Explanation:** $4HCl + O_2 \xrightarrow{CuCl_2} 2H_2O + 2Cl_2$

73.

**(d)** $4f^4$

**Explanation:** Nd(60) = [Xe] $4f^4\ 5d^0\ 6s^2$

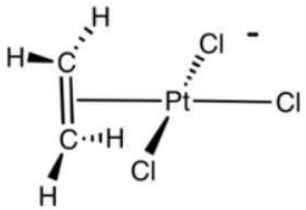
$Nd^{2+}$ = [Xe] $4f^4\ 5d^0\ 6s^0$

74.

**(b)** 8

**Explanation:** There are 8 sigma bonds in Zeise's salt i.e. three sigma bonds between Pt and Cl atoms, four between hydrogen, and one bond between ethene molecule.

The structure of **Zeise's salt** / potassium trichloro(ethylene)platinate(II) / $K[PtCl_3(C_2H_4)]\cdot H_2O$ is as follows:



75.

**(b)** II > III > I

**Explanation:** II > III > I

76.

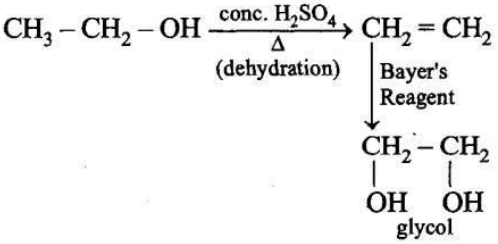
**(b)** $CH_3CH_2Br$

**Explanation:** $S_N2$ reaction is most favorable for 1° substrate in the presence of polar aprotic solvents like DMF.

77.

**(c)** Glycol

**Explanation:**




78. **(a)** iii > i > iv > ii

**Explanation:** The lower the $pK_a$ value, the higher is the acid strength. Benzoic acid ($pK_a$ = 4.19) is stronger than acetic acid ($pK_a$ = 4.76) but weaker than formic acid ($pK_a$ = 3.75).

The more the number of alkyl groups, the more is the electron density on the O - H bond (+I effect) and less will be the less able to release H+ ions.

∴ The correct decreasing order of acid strength is,

Formic acid > Benzoic acid > Acetic acid > Propionic acid

(iii) (i) (iv) (ii)

79. **(a)** X > Z > Y

**Explanation:** — COOH is most acidic, Z is more acidic due to - I power of X.

80.

**(b)** an ether linkage

**Explanation:** The linkage between two monosaccharide units through oxygen atoms is called glycosidic linkage.

The ether bond is when more than two hydrocarbons linked by a single bond to an oxygen. Hence, the glycosidic bond is an ether bond.

81.

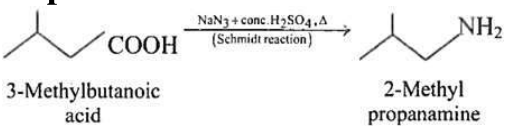
**(b)** anomers

**Explanation:** anomers

82.

**(c)** $NaN_3$ + conc. $H_2SO_4$

**Explanation:**




3-Methylbutanoic acid — 2-Methyl propanamine

83.

**(d)** Pt(s) | $H_2$ (g, 1 bar) | $H^+$ (aq, 1 M) || $Ag^+$ (aq, 1 M) | Ag

**Explanation:** Measurement of the standard reduction potential of an electrode is done by coupling it with SHE and maintaining the concentration of its oxidized and reduced species at unity. Here, SHE acts as the anode and silver electrode acts as the cathod.

84. **(a)** All of these

**Explanation:** All of these

85. **(a)** 13.4 g/L

**Explanation:** $Na_2CO_3$ = HCl

$a_1M_1V_1 = a_2M_2V_2$

$2 \times 0.15 \times 30 = 1 \times M_2 \times 24.5$

$\therefore M_2 = \dfrac{2 \times 0.15 \times 30}{24.5}$

$\therefore M_2 = 0.367$ M

Strength = Molarity × molar mass

$= 0.367 \times 36.5$

$= 13.3955$ g/L $\approx$ 13.4 g/L

## CHEMISTRY (Section-B)

86.

**(c)** $CaCl_2 > ZnCl_2$

**Explanation:** $ZnCl_2 > CaCl_2$ (covalent character)

87.

**(b)** 0.28 litre

**Explanation:** meq. of $O_2$ = meq. of $KMnO_4 = 100 \times 0.5$

$\dfrac{w}{8} \times 1000 = 50$

$\therefore w_{O_2} = 0.4$ g

$\therefore V_{O_2} = \dfrac{22.4 \times 0.4}{32} = 0.28$ litre

88.

**(d)** $k_3[AIF_6]$

**Explanation:** $AlF_3$ is insoluble in anhydrous HF because the $F^-$ ions are not available in hydrogen bonded HF but, it becomes soluble in presence of little amount of KF due to formation of complex, $K_3[AlF_6]$.

$AIF_3 + 3KF \rightarrow k_3[AIF_6]$.

89.

**(b)** first decreases then increases

**Explanation:** Atomic volume is the volume occupied by one gram of an element. Across a period, the atomic volume first decreases and then increases.

90. **(a)** 91 nm

**Explanation:** $\frac{1}{\lambda} = R_H\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right]$

91.

**(b)** X = metaboric acid, Y = tetraboric acid, Z = boric anhydride

**Explanation:** $H_3BO_3 \xrightarrow{373K} \underset{(X)}{HBO_2} \xrightarrow{433K}$

*Orthoboric acid* — *Meta boric acid*

$H_2B_4O_7 \xrightarrow{\text{Re } d \text{ hot}} B_2O_3$

$(Y)$ — $(Z)$

*Tetra Boric acid* — *Boric anhydride*

92. **(a)** all of these

**Explanation:** all of these

93. **(a)** $3.4 \times 10^6$

**Explanation:** $3.4 \times 10^6$

94.

**(d)** Remains 0.1 M

**Explanation:** In pressure of copper electrode (i.e., attacked electrodes for electrolysis of $CuSO_4$)

**Anode:** $Cu \longrightarrow Cu^{2+} + 2e$

**Cathode:** $Cu^{2+} + 2e \longrightarrow Cu$

Thus no change in concentration of $CuSO_4$ (aq.)

95.

**(c)** 50

**Explanation:** Given, rate constant (k) = 0.05 $\mu$g/year

Thus, from the unit of k, it is clear that the reaction is zero order.

Now, we know that

half-life ($t_{1/2}$) for zero order reaction = $\frac{a_0}{2k}$

where, $a_0$ = initial concentration,

k = rate constant

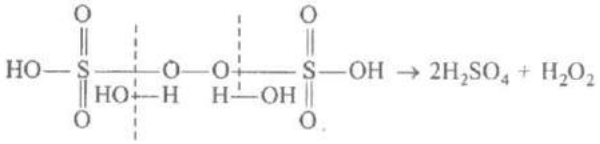
$t_{1/2} = \frac{5\mu g}{2 \times 0.05\mu g/year} = 50$ years

Thus, 50 years are required for the decomposition of 5 $\mu$g of X into 2.5 $\mu$g.

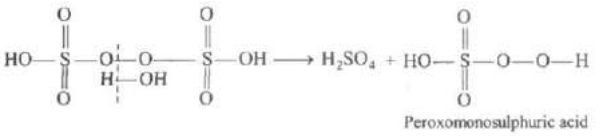
96.

**(c)** one mole of sulphuric acid and one mole of peroxonomo sulphuric acid

**Explanation:** Peroxodisulphuric acid ($H_2S_2O_8$) on complete hydrolysis gives two moles of $H_2SO_4$ and one mole of $H_2O_2$ as




On partial hydrolysis, it gives one mole of $H_2SO_4$ and one mole of peroxomonosulphuric acid as




Peroxomonosulphuric acid

97. **(a)** tetrahedral; three O-atoms

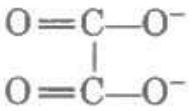
**Explanation:** tetrahedral; three O-atoms

98.

**(d)** A

**Explanation:** $La(OH)_3$ is strongest base among lanthanides.

99. **(a)** $C_2O_4^{2-}$

**Explanation:** When a ligand has two groups that are capable of bonding to the central atom, it is said to be bidentate. Thus the only ligand, which is expected to be bidentate is $C_2O_4^{2-}$ as  .

100.

**(c)** $HNO_2$ + NaOH (aq.)

**Explanation:** $HNO_2$ + NaOH (aq.)

## BOTANY (Section-A)

101.

**(d)** evolutionary relationships.

**Explanation:** Phylogenetic system or cladistics is based on evolutionary sequence as well as the genetic relationship amongst the living beings.

102.

**(c)** Isotype

**Explanation:** If a botanist has to nomenclature a similar species, he will use isotype because it is a duplicate of holotype which is a original specimen from which we create description of new species.

103.

**(c)** Viruses

**Explanation:** In plants, the symptoms of mosaic formation, leaf rolling and curling, yellowing and vein clearing, dwarfing and stunted growth are due to viruses.

104. **(a)** symbiotic relationship between fungi and roots of some higher plants.
**Explanation:** Association between roots of higher plants and fungal hyphae is called mycorrhiza. Both the organisms are benefitted in this relationship. The fungal hyphae take nutrition from the plant and in return increase surface area for absorption of water and minerals for the plant Mycorrhizas are found in the roots of Pinus and between roots of higher plants.

105. **(d)** Both Amorphophallus and Yucca
**Explanation:** Both Amorphophallus and Yucca

106. **(b)** All vascular plants
**Explanation:** Tracheophytes are land plants that have vascular tissue for conduction. They have dignified tissue(the xylem) for conducting water and minerals throughout the plant. They also have a specialized non-lignified tissue (the phloem) to conduct products of photosynthesis.

107. **(c)** Ciliated sperms
**Explanation:** Bryophytes are also called amphibians of the plant kingdom because these plants can live in soil but are dependent on water for sexual reproduction. This amphibian nature of bryophytes and the production of biflagellated(ciliated male gametes) male gametes shows that they have evolved from aquatic ancestors. Also, they need a moist environment to grow which favors their aquatic ancestry.

108. **(c)** Lupinus (Lupine arcticus)
**Explanation:** Lupinus (Lupine arcticus)

109. **(c)** Both wall of sporangium and sporogenous cells
**Explanation:** Both wall of sporangium and sporogenous cells

110. **(c)** Stolon
**Explanation:**
These grow aerially for some time and then bend downwards to touch the ground. Here, the terminal bud gives rise to a new stem and adventitious roots. Stolon arises from the base of the main stem. Eg., Jasmine
In horticulture, branches are lowered down to meet the soil where they strike the root. Such natural stolons are found in Mentha sp.

111. **(c)** Peduncle
**Explanation:** The peduncle is the main axis of an inflorescence or the axis bearing a flower or fruit. A peduncle is a stem supporting an inflorescence.

112. **(d)** Monocotyledonous stem

**Explanation:** Closed vascular bundles are scattered and surrounded by bundle sheath embedded in large parenchymatous ground tissue is characteristic of monocot stem. The vascular bundles are open, conjoint, and arranged in a ring with inconspicuous pith in the dicot stem. In roots, the vascular tissues are arranged radially.

113. **(a)** Green seed colour
**Explanation:** Green seed colour

114. **(b)** Thalassemia
**Explanation:** Thalassemia

115. **(a)** only nucleic acids enter the cell.
**Explanation:** The experiment conducted by Hershey and Chase proved that DNA is the genetic material and that during infection of E. coli cells by bacteriophage $T_2$, only nucleic acids enter the cell. Nucleic acids from the head pass through the hollow tail and enter the bacterial cell. The remainder of the phage remains on the outside of the bacterium as ghost.

116. **(d)** UAAGCUAC
**Explanation:** UAAGCUAC

117. **(a)** More than one is correct
**Explanation:** Both cilia and flagella possess basal body, rootlets, basal plate and shaft. The shaft shows 9+2 arrangement. Each peripheral fibril consists of 2 microtubules or sub-fibers B and A.

118. **(d)** Statement (c) is wrong.
**Explanation:** Phosphorus is present in the form of phospholipid bilayer in plasma membrane. It is an essential component of all nucleic acids (DNA and RNA) but never found in proteins.

119. **(b)** Typhoid
**Explanation:** Typhoid

120. **(a)** Mycobacterium
**Explanation:** Recombinant DNA technology has allowed the production of antigenic polypeptides of pathogens in bacteria or yeast. Vaccines produced using this approach allow large-scale production and hence greater availability for immunization, e.g., hepatitis B vaccine produced from yeast.

121. **(a)** Diakinesis
**Explanation:** Prophase 1 of Meiosis is the first stage of meiosis and is defined by five different phases; Leptotene, Zygotene, Pachytene, Diplotene, and Diakinesis. In diakinesis terminalisation of chiasmata occurs.

122. **(a)** Biotic potential
**Explanation:** Biotic potential

123. **(b)** Cobra
**Explanation:** Plant → insect → frog → Cobra → Eagle

124.

**(d)** (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

**Explanation:** Clostridium butylicum - is used in the production of Butyric acid.
Trichoderma polysporum - is used in the production of Cyclosporin-A and C, an antifungal antibiotic.
Monascus purpureus - is used in the production of statin which helps in lowering blood cholesterol.
Aspergillus niger - helps in the production of Citric acid.

125. **(a)** Vulnerable

**Explanation:** Vulnerable

126.

**(d)** Five

**Explanation:** From origin of life to its diversification on earth, there have occurred five number of episodes of mass extinction.

127.

**(b)** All of these

**Explanation:** Ex situ conservation means off-site conservation. It protects an endangered species of plant or animal outside its natural habitat. While ex situ conservation comprises some of the oldest and best known conservation methods, it also involves newer methods also like cryopreservation etc.

128. **(a)** Recombination nodules

**Explanation:** During the pachytene stage, bivalent chromosomes now clearly appear as tetrads. Appearance of recombination nodules (are protein complexes which are associated with synaptonemal complexes) the sites at which crossing over occurs between non-sister chromatids of the homologous chromosomes. Crossing over is also an enzyme-mediated process and the enzyme involved is called recombinase.

129.

**(b)** Late prophase

**Explanation:** During the Late prophase, the chromosomes condense, the nucleolus disappears, and the nuclear envelope breaks down.

130. **(a)** Statement (d) is correct.

**Explanation:** Five types of chlorophyll molecules are found in the leaves of green plants. Chlorophyll molecules appear green because they reflect light in the green ranges. Chlorophyll molecules are present in the thylakoid membrane.

131.

**(c)** Both Cyclic and Non-cyclic

**Explanation:** Both Cyclic and Non-cyclic

132. **(a)** Hill's reaction

**Explanation:** Hill's reaction

133. **(a)** $CO_2$ is necessary for photosynthesis

**Explanation:** $CO_2$ is necessary for photosynthesis

134.

**(d)** $\frac{CO_2}{O_2}$

**Explanation:** $\frac{CO_2}{O_2}$

135.

**(d)** Ethylene/NAA

**Explanation:** Ethylene is used to initiate flowering and for synchronising fruit-set in pineapples. It also induces flowering in mango.

**BOTANY (Section-B)**

136.

**(d)** Italics

**Explanation:** Certain conventions are followed while writing the scientific names:

i. The name of the genus begins with a capital letter.
ii. The name of the species begins with a small letter.
iii. When printed, the scientific name is given in italics.
iv. When written by hand, the genus name and the species name have to be underlined separately.

137.

**(d)** Riboflavin

**Explanation:** Investigations have shown that yeasts require one or more members of the vitamin B complex in order to grow well in chemically defined media. It appears, however, that riboflavin (vitamin $B_2$) is not needed as a constituent of the culture media supporting yeast growth. Since riboflavin is known to play an important role as a respiratory enzyme generally throughout the plant and animal kingdoms, it seems probable that yeasts are able to synthesize this vitamin in amounts sufficient at least for their own requirements. In a preliminary survey of the production of vitamin $B_2$ by some 200 kinds of yeasts, one species has been found to produce extraordinary amounts of riboflavin in synthetic culture media.

138.

**(d)** red algae

**Explanation:** Phycoerythrin (PE) is a red protein pigment complex from the light-harvesting phycobiliprotein family, present in red algae.

139.

**(c)** Vallisneria

**Explanation:** Vallisneria

140.

**(b)** Four

**Explanation:** Four statements are correct about monocotyledonous seed as statement (I) and (iv) are wrong.

The corrected wrong statements are given below-

i. Generally, monocotyledonous seeds are endospermic but some as orchids are non-endospermic.

ii. Embryo consists of one large and shield-shaped cotyledon known as scutellum and a short axis with a plumule and a radicle.

141.

**(b)** Males and females, respectively

**Explanation:** In certain insects, 17 and 18 chromosome-bearing organisms are males and females, respectively based on their XX-XO type of sex determination. In this method, females have autosomes and one pair of sex chromosomes (A + XX), while males have autosomes and one sex chromosome (A + X).

142. **(a)** Capping

**Explanation:** Capping is the process of addition of methyl GPT at the 5′ end of hnRNA which is catalyzed by the enzyme guanlyl transferase.

143.

**(c)** glyoxysomes

**Explanation:** Gluconeogenesis is the phenomenon in which glucose is synthesised from non-carbohydrate sources like lipid or protein. It takes place in gIyoxysomes. Glyoxysomes are the organelles having fine granular stroma enclosed by single layered membrane. Several enzymes like isocitrate lyase and malate synthetase (involved in glyoxylate cycle) are present in these particles.

144.

**(b)** Option (A)

**Explanation:** Clostridium butylicum is used to produce butyric acid.

145.

**(c)** $CO_2$

**Explanation:** $CO_2$

146.

**(d)** biopesticides

**Explanation:** Trichoderma species, free-living fungi, are present in root ecosystems are potentially useful as biopesticides.

147.

**(c)** $T_4$

**Explanation:** $T_4$

148.

**(b)** Increase in cytokinins

**Explanation:** Cytokinins are the phytohormones that are responsible for promoting cell division by cytokinesis process in roots and shoots thus having a role in plant growth. They release the capitation of plants by affecting cell growth, cell differentiation, apical dominance, and axillary bud growth.

149.

**(b)** cytokinin

**Explanation:** The most important function of cytokinins is the promotion of cell division.

The varying amounts of cytokinins, along with sufficient auxins is required for the growth of callus in tissue culture experiments. Cytokinins delay the senescence of leaves and other organs by mobilisation of nutrients. It is known as Richmond-Lang effect.

150.

**(c)** Glucose

**Explanation:** Glucose

## ZOOLOGY (Section-A)

151. **(a)** X - Coelenterate, Y - Poly, Z - Medusa

**Explanation:** Stinging capsule is the characteristic feature of coelenterate. One body form of coelenterate is sessile and cylindrical and called as polyp and the other body form is umbrella shaped and free swimming called as medusa.

152. **(a)** Balanoglossus

**Explanation:** Balanoglossus is a connecting link between invertebrates and non-invertebrates. Balanoglossus belongs to phylum hemichordate which was earlier considered as a sub-phylum under phylum chordata. But, now it is placed as a separate phylum under non-chordata because notochord and post anal tail are absent in it.

153.

**(d)** All cyclostomes do not possess jaws and paired fins

**Explanation:** Cyclostomes have a sucking and circular mouth without jaws. Their body is devoid of scales and paired fins.

154.

**(d)** All of these

**Explanation:** Frogs are beneficial for mankind because they eat insects and protect the crop. Frogs maintain ecological balance because these serve as an important link of the food chain and food web in the ecosystem. In some countries, the muscular legs of the frog are used as food by man.

155.

**(c)** Connective tissue

**Explanation:** The features given describes the connective tissue. Connective tissue connects, supports, binds, or separates other tissues or organs, typically having relatively few cells embedded in an amorphous matrix, often with collagen or other fibres, and including cartilaginous, fatty, and elastic tissue.

156. **(a)** Expiration

**Explanation:** Expiration

157.

**(d)** Oxidized haemoglobin

**Explanation:** Oxidized haemoglobin

158.

**(d)** Both (i) and (ii)

**Explanation:** Statements (i) and (ii) are correct.

i. Inspiration is an active and expiration is a passive process.

ii. For quiet breathing, external intercostal muscles and diaphragm play an important role.

159.

**(b)** Left hand side and sigmoid

**Explanation:** Left hand side and sigmoid

160. **(a)** Carbonic anhydrase
**Explanation:** RBCs contain a very high concentration of the enzyme, carbonic anhydrase and minute quantities of the same is present in the plasma too. This enzyme facilitates the reaction between carbon dioxide and water to form carbonic acid and its dissociation into bicarbonate ions and protons.

161. **(a)** morula
**Explanation:** The embryo with 8-16 blastomeres is called morula.

162. **(c)** Spermatogonia
**Explanation:** Spermatogonia

163. **(d)** corpus luteum
**Explanation:** The ovulation is followed by the luteal phase during which the remaining parts of the Graafian follicles transform as the corpus luteum.

164. **(d)** implantation of embryo at site other than uterus.
**Explanation:** Ectopic pregnancy is a complication of pregnancy in which the embryo attaches outside the uterus.

165. **(b)** Gonorrhoea, Syphilis, Genital herpes
**Explanation:** The sexually transmitted disease (STD) is used to refer to a condition that's passed from one person to another through sexual contact. Among the options, only Gonorrhoea, Syphilis, and Genital herpes are the diseases that are sexually transmitted diseases.

166. **(b)** Silophyton → Progymnosperm → Seed fem → Angiosperms
**Explanation:** Silophyton → Progymnosperm → Seed fem → Angiosperms

167. **(d)** recapitulation
**Explanation:** According to recapitulation theory, the development of an embryo (ontogeny) repeats the evolutionary changes its species took over the millennia to appear in its modern form (phylogeny).

168. **(b)** Proximal convoluted tubules
**Explanation:** Most of the solutes are reabsorbed from the ultrafiltrate in the Proximal convoluted tubule. This includes ions, certain water-soluble vitamins, glucose, etc. Glucose is reabsorbed with the help of Sodium/Glucose cotransporter called as SGLT 1 in PCT and SGLT2 in PST.
So, the correct answer is 'Proximal convoluted tubules'.

169. **(c)** $CO_2$
**Explanation:** The end products of aerobic metabolism of carbohydrates are carbon dioxide and water. Carbon dioxide remains dissolved in the blood and is carried by the veins to the

lungs for oxygenation. If carbon dioxide is not removed from the metabolizing tissues, it will be toxic for that tissue and stop metabolism.
So, the correct option is 'Carbon dioxide'.

170. **(c)** Green gland
**Explanation:** Green gland are the excretory organ of crustaceans.

171. **(a)** (i) and (iii)
**Explanation:** Each actin (thin) filament is made of two 'F' (filamentous) actins helically wound to each other. Each F actin is a polymer of monomeric 'G' (globular) actins. Myosin (thick) filament is a polymerised protein. Many monomeric proteins called meromyosins constitute one thick filament. Tropomyosin is a fibrous molecule that attaches to F actin in the groove between its filament. The globular head of meromyosin consists of heavy meromyosin.

172. **(c)** all are correct.
**Explanation:** Cadmium shows the danger of cumulative effects in the environment due to its acute and chronic toxicity.
Chemically cadmium is very similar to zinc, and the two metals can replace each other in many geochemical and biochemical processes. Both metals are found in (+2) oxidation state in water. This means that cadmium can replace zinc in some enzymes of our body, thereby altering the stereo-structure of the enzyme and impairing its catalytic activity. The acute cadmium poisoning in humans expresses as high blood pressure, kidney damage, destruction of testicular tissue, and red blood cells.

173. **(a)** femur
**Explanation:** The hyoid bone (lingual bone or tongue-bone) is a horseshoe-shaped bone situated in the anterior midline of the neck between the chin and the thyroid cartilage. At rest, it lies at the level of the base of the mandible in the front and the third cervical vertebra ($C_3$) behind.

174. **(d)** Vagus
**Explanation:** Vagus

175. **(c)** Synapse
**Explanation:** A microscopic gap or a functional joint between a pair of adjacent neurons over which nerve impulses pass when going from one neuron to the next is called a synapse.

176. **(b)** All of these
**Explanation:** Cerebellum, also called as little brain is very large and well developed, as man performs a wide range of movements. It maintains posture, equilibrium and muscle tone. It coordinates the voluntary movements initiated by the cerebrum.

177. **(a)** Thyroxine
**Explanation:** Thyroxine

178.

**(c)** Hypothalamus

**Explanation:** Releasing hormones and the inhibiting hormones of hypothalamus reach the pituitary gland through a portal circulatory system and regulate the functions of the anterior pituitary. The posterior pituitary is under the direct neural regulation of the hypothalamus.

179. **(a)** Two auricles and one ventricle

**Explanation:** In amphibians, the heart is a 3-chambered heart with two atria and a single ventricle.

180. **(a)** Basophils

**Explanation:** Basophils

181. **(a)** Right ventricle, pulmonary arteries and left atrium

**Explanation:** Pulmonary circulation involves circulation between lungs and heart. The deoxygenated blood pumped into the pulmonary artery is passed on to lungs from where oxygenated blood is carried by pulmonary veins into the left atrium.

182.

**(b)** 1988

**Explanation:** 1988

183.

**(d)** (i), (ii), and (iii)

**Explanation:** Agrobacterium tumifaciens, a pathogen of several dicot plants is able to deliver a piece of DNA known as 'T-DNA' to transform normal plant cells into a tumour and direct these tumour cells to produce the chemicals required by the pathogen.

184.

**(c)** An RNA virus that can synthesise DNA during infection

**Explanation:** A retrovirus is RNA virus which is capable to synthesize DNA during infection.

185.

**(d)** Basmati

**Explanation:** Basmati

## ZOOLOGY (Section-B)

186.

**(c)** All of these

**Explanation:** An arthropod has a segmented body covered by an exoskeleton made from chitin and other chemicals. This exoskeleton serves as protection and provides places for muscle attachment. Arthropods must moult because their exoskeletons don't grow with them. The body feature from which the phylum takes its name is the jointed appendages, which include antennae and mouthparts as well as walking leges.

187. **(a)** fibroblasts

**Explanation:** A tendon is a fibrous connective tissue which attaches skeletal muscle to bone. Tendons may also attach muscles to structures such as eyeball. A tendon helps in the movement of bone or structure.

188.

**(b)** Monocytes

**Explanation:** Monocytes

189.

**(b)** Dissociation of oxygen from the oxyhemoglobin

**Explanation:** In the tissues, where low $PO_2$, high $PCO_2$, high $H^+$ concentration and higher temperature exist, the conditions are favourable for dissociation of oxygen from the oxyhaemoglobin.

190. **(a)** Estrogen and progesterone

**Explanation:** The cycle of events starting from one menstruation till the next one is called the menstrual cycle. The menstrual cycle is complex controlled by the sex hormones - oestrogen and progesterone produced by ovaries.

191.

**(d)** All STD are completely curable

**Explanation:** All STD are completely curable

192.

**(d)** Allele

**Explanation:** According to Hardy-Weinberg principle, allele frequencies in a population are stable and is constant from generation to generation.

193.

**(c)** C

**Explanation:** In the given figure of nephron, structure marked as A, B, C, and D are respectively descending limb of loop of Henle, ascending limb of loop of Henle, distal convoluted tubule and collecting duct.

Distal tubule controls the blood flow through the glomerular capillaries and glomerular filtration of the nephron to which it belongs and reabsorbs sodium, potassium and chloride.

194. **(a)** Clavicle

**Explanation:** Clavicle

195.

**(c)** tectorial membrane

**Explanation:** The tectorial membrane is one of two acellular membranes in the cochlea of the inner ear, the other being the basilar membrane. The tectorial membrane is an acellular gelatinous structure that covers the spiral limbus (as a thin fibrillar layer) and the spiral organ of Corti and extends along the longitudinal length of the cochlea parallel to the basement membrane.

196. **(a)** Thymosin

**Explanation:** Thymosin

197.

**(d)** The hormone stimulates protein synthesis in the cell vacuole; the protein is then passed to the Golgi apparatus, and eventually passes through the cell membrane by passive diffusion.

**Explanation:** Beta cells of pancreas produce insulin. It promotes protein synthesis in tissue from amino acids and reduces catabolism of proteins. It increases the synthesis of fat in the adipose tissue from fatty acids and reduces the breakdown and oxidation of fat. Insulin decreases the level of glucose in the blood. It acts by increasing the rate at which glucose is transported out of the blood and into cells and by stimulating muscle cells to take up sugar from the blood and convert it to glycogen.

198.

**(d)** Plasma cell

**Explanation:** Plasma cell

199.

**(d)** Extension of primer end on the template DNA

**Explanation:** Extension of primer end on the template DNA

200. **(a)** Agrobacterium tumefaciens

**Explanation:** Agrobacterium tumefaciens is the causative agent of crown gall, an important disease of many commercial crops. This disease has come to be recognised in recent years as being caused by a DNA plasmid (Ti plasmid) carried by bacterium and transferred to the plant cells. Following the discovery of the relationship between crown gall and the Ti plasmid, this plasmid has come to be widely used in plant genetic engineering as a vector in order to inject a novel gene in host plant to form a transgenic plant.