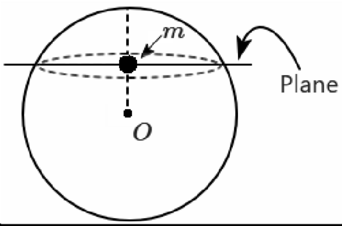
Physics - Section A

1 A particle of mass m is placed at the mid-point of the radius of a thin uniform spherical shell of mass M, as shown in the figure. Consider the plane that slices the shell into two parts: the plane is perpendicular to the radius and passes through m. The upper part of the shell has a mass $\frac{M}{4}$ and the lower part $\frac{3M}{4}$. Let the gravitational force exerted by the upper part of the shell on the particle be F. The force exerted by the lower part of the shell on the particle is:



1.	$3F$	2.	$2F$
3.	$4F$	4.	F

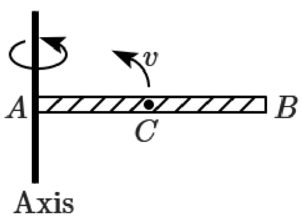
2 The escape velocity of a particle, projected tangentially from the surface of a planet of radius R, is: (g is the gravitational acceleration on the planet's surface)

1.	$\sqrt{5gR}$	2.	$\sqrt{3gR}$
3.	$\sqrt{2gR}$	4.	infinite

3 The centre-of-mass (C.M.) of four identical particles kept at the four vertices of a square with a diagonal d, is at its geometric centre. If one of the particles is removed, the C.M. of the remaining particles is located at a distance, from the centre, of:

1.	$\frac{d}{4}$	2.	$\frac{d}{3}$
3.	$\frac{d}{6}$	4.	$\frac{3d}{4}$

4 A uniform rod AB of mass M and length L, rotates about an axis passing through the end-point A; the axis of rotation being perpendicular to the rod AB. Let, the velocity of the centre-of-mass C be v. The kinetic energy of the rod is:



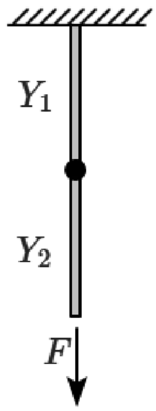
1.	$\frac{1}{12}Mv^2$	2.	$\frac{1}{3}Mv^2$
3.	$\frac{1}{6}Mv^2$	4.	$\frac{2}{3}Mv^2$

5 Given below are two statements:

Statement I:	The motion of the centre-of-mass of a system of particles is not affected by internal forces within the system.
Statement II:	The internal forces within a system of particles constitute action-reaction pairs, and their vector sum is zero.

1.	**Statement I** is incorrect and **Statement II** is correct.
2.	Both **Statement I** and **Statement II** are correct.
3.	Both **Statement I** and **Statement II** are incorrect.
4.	**Statement I** is correct and **Statement II** is incorrect.

6 Two wires of equal lengths (L) and cross-section (A) but different Young's moduli Y_1 and Y_2 are joined as shown. The total elongation of the composite wire, if a force F is applied at the bottom, is:



1.	$\frac{F}{AY_1}+\frac{F}{AY_2}$	2.	$\frac{FY_1}{A}+\frac{FY_2}{A}$
3.	$\frac{FL}{AY_1}+\frac{FL}{AY_2}$	4.	$\frac{FL}{A\left(\frac{Y_1+Y_2}{2}\right)}$

7 Given below are two statements:

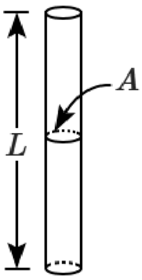
Assertion (A):	The centre-of-mass of a solid body lies within the body.
Reason (R):	The centre-of-mass of any two particles lies between them, on the straight line segment joining them.

1.	Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**.
2.	Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**.
3.	**(A)** is True but **(R)** is False.
4.	**(A)** is False but **(R)** is True.

8 Consider a small body falling freely onto the surface of the earth from a height $2R$ above its surface (R being the radius of the earth). Ignore any air resistance. The change in the gravitational potential energy of the body, per unit mass, is: (take the acceleration due to gravity on the surface to be g)

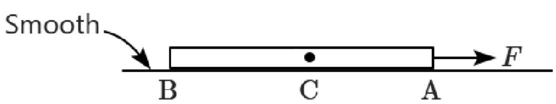
1.	$4gR$	2.	$\frac{4gR}{3}$
3.	$\frac{2gR}{3}$	4.	$\frac{gR}{3}$

9 A large beam sits vertically as shown in the figure. The beam has length L, cross-sectional area A, and the density of its material is ρ. The compressive stress, in the middle of the beam, is: (take acceleration due to gravity as g)



1.	ρLg	2.	$\frac{\rho Lg}{2}$
3.	$\frac{\rho Lg}{4}$	4.	$2\rho Lg$

10 Consider a uniform beam AB, which is being pulled by a horizontal force F applied at the end A, so that it is accelerated uniformly. The cross-section of the beam is A. Let the stress at the ends A, B be S_A, S_B and that at the centre C be S_C. Then:

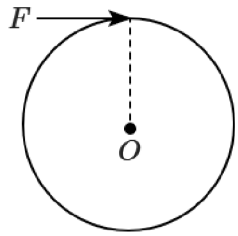


1.	$S_A =$ zero, $S_B =$ maximum, $S_C =$ intermediate
2.	$S_A =$ maximum, $S_B = 0$, $S_C =$ intermediate
3.	$S_A = S_B =$ maximum, $S_C =$ zero
4.	$S_A = S_B = S_C =$ constant throughout

11 The angular momentum of a uniform solid sphere of mass M, radius R rotating about a diameter, with a surface speed v on its equator, is:

1.	$\frac{1}{2}MRv$	2.	$\frac{2}{3}MRv$
3.	$\frac{2}{5}MRv$	4.	$\frac{2}{7}MRv$

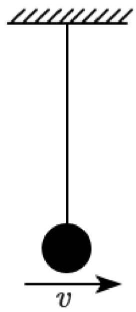
12 A uniform disc of mass M and radius R is fixed, so that it is free to rotate in its own plane, about the centre O. A force F is applied tangentially to the disc, continuously, for one complete revolution, starting from rest.



The angular acceleration (α) of the disc is:

1.	$\frac{F}{2MR}$	2.	$\frac{F}{MR}$
3.	$\frac{2F}{MR}$	4.	$\frac{3F}{2MR}$

13 Consider the bob of a pendulum of mass M, suspended by a wire of length L, cross-section A. As the bob oscillates, it has a speed v, at its lowest point. The stress in the wire, at the lowest point, is:



1.	$\frac{Mg}{A}$	2.	$\frac{M}{A}\left(g+\frac{v^2}{L}\right)$
3.	$\frac{M}{A}\left(g-\frac{v^2}{L}\right)$	4.	$\frac{M}{A}\left(g+\frac{v^2}{2L}\right)$

14 The radius of gyration for a solid sphere of radius R and mass M rotating about an axis passing through its centre is:

1.	$\frac{2}{5}R$	2.	$\frac{2}{3}R$
3.	$\sqrt{\frac{2}{5}}R$	4.	$\sqrt{\frac{2}{3}}R$

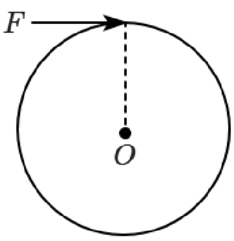
15 If the escape velocity from a planet's surface is v_{esc} and its radius R, then the gravitational acceleration on its surface equals:

1.	$\frac{v^2_{esc}}{R}$	2.	$\frac{v^2_{esc}}{2R}$
3.	$\frac{v^2_{esc}}{2\pi R}$	4.	$\frac{2\pi v^2_{esc}}{R}$

16 An empty cylindrical tank is filled with water upto a height h. The centre-of-mass of the water in the tank rises by:

1.	$\frac{h}{2}$	2.	$\frac{h}{3}$
3.	$\frac{h}{4}$	4.	h

17 A uniform disc of mass M and radius R is fixed, so that it is free to rotate in its own plane, about the centre O. A force F is applied tangentially to the disc, continuously, for one complete revolution, starting from rest.



The time taken to complete a revolution is:

1.	$\sqrt{\frac{4\pi MR}{F}}$	2.	$\sqrt{\frac{2\pi MR}{F}}$
3.	$\sqrt{\frac{MR}{F}}$	4.	$\sqrt{\frac{MR}{2\pi F}}$

18 Choose the incorrect statement from the given statements.

(A)	Planets revolve around the Sun with constant linear speed.
(B)	Energy of planet in an elliptical orbit is constant.
(C)	A satellite in circular motion has constant energy.
(D)	A body falling towards the Earth results in negligible displacement of the Earth.

1.	(A)
2.	(B)
3.	(C)
4.	(D)

19 Given below are two statements:

Assertion (A):	The kinetic energies of two identical particles of a rotating rigid body are proportional to the square of their respective distances from the axis of rotation.
Reason (R):	The kinetic energy of a particle is $\frac{1}{2}mv^2$, while the velocity v is proportional to the distance from the axis of rotation (r): $v = \omega r$, ω is the angular speed.

1.	Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**.
2.	Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**.
3.	**(A)** is True but **(R)** is False.
4.	**(A)** is False but **(R)** is True.

20 Two stars of equal mass rotate about a common centre of mass in a common circular orbit of radius R. The total mass of the stars is M.
The gravitational force exerted by the stars, on each other, is:

1.	$\frac{GM^2}{4R^2}$	2.	$\frac{GM^2}{R^2}$
3.	$\frac{GM^2}{16R^2}$	4.	$\frac{4GM^2}{R^2}$

21 The mass and radius of orbit for the two satellites are (m, r) and $(3m, 3r)$ respectively. What will be the ratio of their orbital velocity about earth?

1.	$\sqrt{3} : 1$	2.	$1 : \sqrt{3}$
3.	$\sqrt{2} : 1$	4.	$1 : 2$

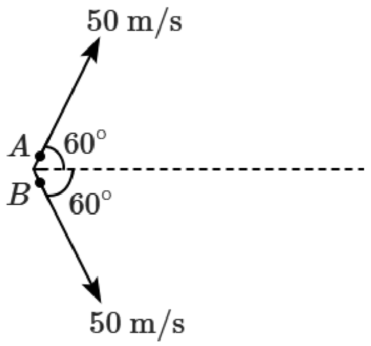
22 A shell, fired from a gun, follows a parabolic trajectory and it explodes into two identical fragments at the highest point of its trajectory. The centre-of-mass of the fragments:

1.	travels in a horizontal line.
2.	travels vertically downward.
3.	moves along the same parabolic path as before, continuing its trajectory.
4.	abruptly comes to a stop, after the explosion.

23 Consider the earth to be a uniform solid sphere of radius R, and take the acceleration due to gravity to be g, on its surface. Ignore the rotation of the earth. At what distance from the surface of the earth will the gravitational acceleration fall to $\frac{g}{9}$, outside?

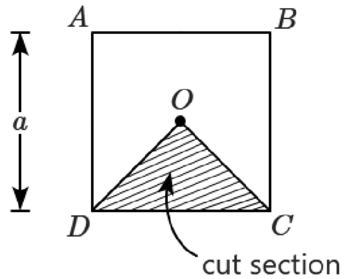
1.	$\frac{R}{3}$	2.	$3R$
3.	$\frac{2R}{3}$	4.	$2R$

24 Two projectiles are projected from the same point, simultaneously. The first one (A) is projected at 60° above the horizontal, with a velocity of 50 m/s while a second identical one (B) is projected with the same speed at 60° below the same horizontal. The acceleration of their centre-of-mass (during the time both are in air) is:



1.	zero	2.	along the horizontal
3.	$\frac{g}{2}$ downward	4.	g downward

25 A uniform square sheet of metal $(ABCD)$ has a triangular piece OCD cut out of it, where O is the centre of the original square. The side of the original square is a. The distance, of the centre-of-mass of the remaining portion, from the centre O is:



1.	$\frac{a}{6}$	2.	$\frac{a}{12}$
3.	$\frac{a}{9}$	4.	$\frac{a}{4}$

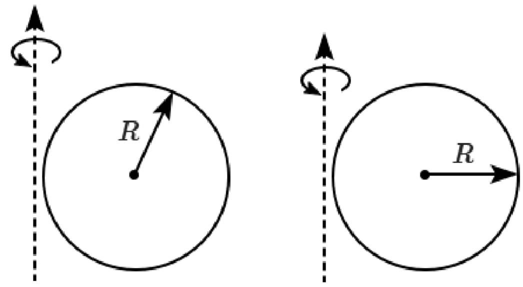
26 A well-greased laboratory centrifuge operates at 1500 rpm, and is later turned off. If it decelerates at 136 rev/min^2, how long will it take to stop spinning?

1.	15 min	2.	11 min
3.	9 min	4.	7 min

27 An observer, at origin, is observing a force acting on a body at $(5, 4)$. If no angular acceleration is observed, then the force acting on the body can be:

1.	$8\hat{i} + 10\hat{j}$	2.	$10\hat{i} + 8\hat{j}$
3.	$8\hat{i} - 10\hat{j}$	4.	$10\hat{i} - 8\hat{j}$

28 A disk and a solid sphere of the same radius are rotated as shown in the figure. If masses of disk and solid sphere are 4 kg and 5 kg respectively then, $\frac{I_{\text{disc}}}{I_{\text{solid sphere}}} =$



1.	$\frac{7}{5}$	2.	$\frac{25}{28}$
3.	$\frac{5}{7}$	4.	$\frac{28}{25}$

29 Given below are two statements:

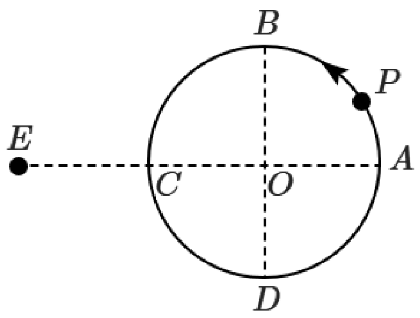
Statement I:	The force of gravitation between two particles acts on the respective particles only when there is no other medium between them.
Statement II:	The gravitational force between two uniform spheres is inversely proportional to the square of the distance between their centres.

1.	**Statement I** is incorrect and **Statement II** is correct.
2.	Both **Statement I** and **Statement II** are correct.
3.	Both **Statement I** and **Statement II** are incorrect.
4.	**Statement I** is correct and **Statement II** is incorrect.

30 A motor that is switched on, accelerates uniformly from rest to a maximum speed of 600 rpm in 20 s. The angular acceleration is:

1. 30 rad/s^2
2. 30 rev/s^2
3. 1 rev/s^2
4. $\frac{1}{2}$ rev/s^2

31 A particle P moves with constant speed on a circle in an anticlockwise direction as shown in the figure.



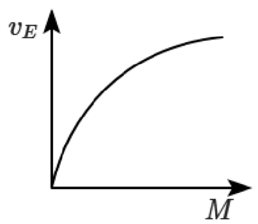
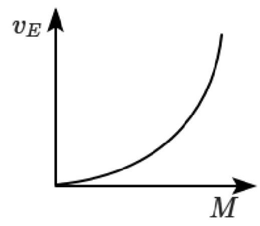
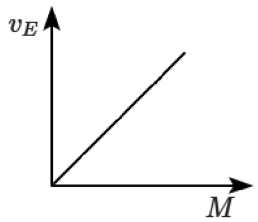
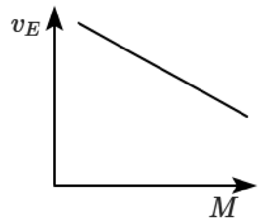
Match Column-I and with Column-II.

	Column-I		Column-II
A.	The angular momentum of the particle about O	p.	is minimum when the particle is at A
B.	The angular momentum of the particle about E	q.	is maximum when the particle is at A
C.	The angular velocity of the particle about O	r.	does not remain constant
D.	Angular velocity of the particle about E	s.	remains constant

Codes:

	A	B	C	D
1.	s	q, r	s	p, r
2.	q	r	s	p
3.	p	q	r	s
4.	q, p	r	s	p

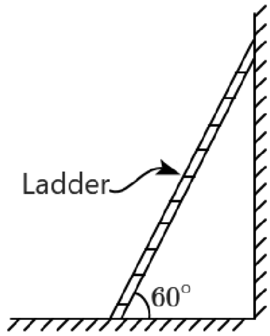
32 Which graph represents the best possible variation of escape velocity (v_E) of earth with the mass of earth (M)? (The radius of earth is constant.)

1.		2.	
3.		4.	

33 A small block (A) of mass 1 kg moving with a velocity of 5 m/s, strikes a stationary block (B) of mass 4 kg resting on a smooth horizontal plane. The blocks A, B stick together after the collision.
The velocity of the centre-of-mass of the two blocks (A, B) before the collision is:

1.	5 m/s	2.	4 m/s
3.	$\frac{5}{4}$ m/s	4.	1 m/s

34 A ladder leaning against a wall makes an angle of 60° with the horizontal, as shown below. A person needs to climb this ladder.



The ladder is more likely to slip when the person:

1.	just steps on the very bottom end of the ladder.
2.	stands on the ladder near the bottom end.
3.	stands on the ladder near the middle.
4.	stands on the ladder near the top end.

35 Two particles of masses M, m are separated by a distance r. Their relative acceleration due to their mutual gravitational forces is (of magnitude):

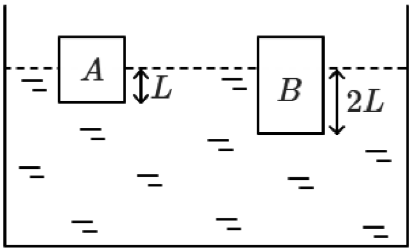
1.	$\frac{2GMm}{r^2(M+m)}$	2.	$\frac{GMm}{r^2(M+m)}$
3.	$\frac{G(M-m)}{r^2}$	4.	$\frac{G(M+m)}{r^2}$

Physics - Section B

36 Bernoulli's equation in fluid flow can be derived by using:

1.	Conservation of momentum
2.	Conservation of angular momentum
3.	Work-energy theorem
4.	Torricelli's theorem

37 When two homogeneous bodies A, B are floated in water, they are found to be submerged differently. Both bodies have the same cross-section, and the exposed parts of both are of the same height L.Then:

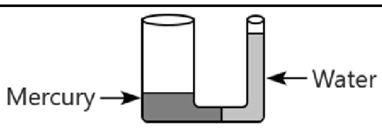
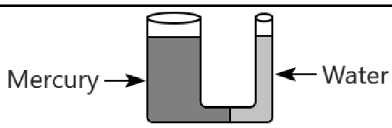
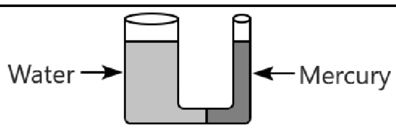
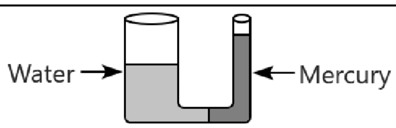


1.	Weight of $A = \frac{1}{3}$ weight of B
2.	Weight of submerged part of $A = \frac{1}{2}$ weight of submerged part of B
3.	Density of $A = \frac{3}{4}$ the density of B
4.	Weight of exposed part of $A =$weight of exposed part of B

38 The dimensions of velocity gradient, defined symbolically by: $\frac{dv_x}{dy}$,
where v_x is the x-component of velocity and y represents the y-coordinate is:

1.	$\frac{L^2}{T}$	2.	$\frac{L}{T^2}$
3.	$\frac{1}{T}$	4.	$\frac{1}{L}$

39 Water and mercury are poured into the two arms of a U-tube with different cross-sectional areas (A_{left}, A_{right}). Which, of the following diagrams, represents the correct levels of water and mercury? Their cross-sections have the ratio $A_{\text{left}} : A_{\text{right}} = 100 : 1$.

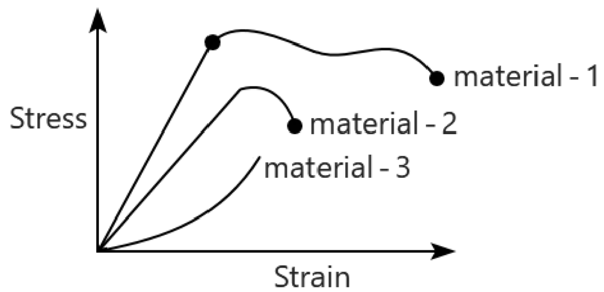
1.	
2.	
3.	
4.	

40 Given below are two statements:

Statement I:	Stress is proportional to the strain, within elastic limit (Hooke's law limit).
Statement II:	The energy stored locally in an elastic body, when it is under stress (within Hooke's law limit), is proportional to the product of the stress and the strain.

1.	**Statement I** is incorrect and **Statement II** is correct.
2.	Both **Statement I** and **Statement II** are correct.
3.	Both **Statement I** and **Statement II** are incorrect.
4.	**Statement I** is correct and **Statement II** is incorrect.

41 The figure shows the relationship between tensile stress and strain for some typical materials. A material which is good for making wires by stretching, is:

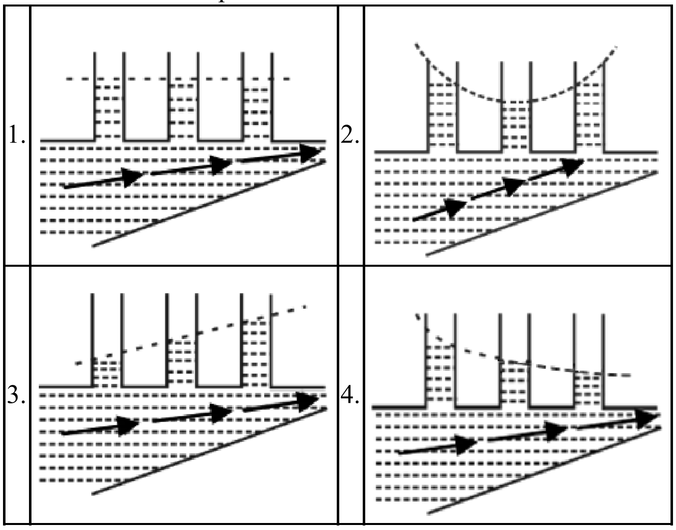


1.	material-1
2.	material-2
3.	material-3
4.	material-2 and material-3

42 The terminal speed of a raindrop falling through air depends on:

1.	the size of the raindrop
2.	the viscosity of air
3.	the acceleration due to gravity
4.	all of the above

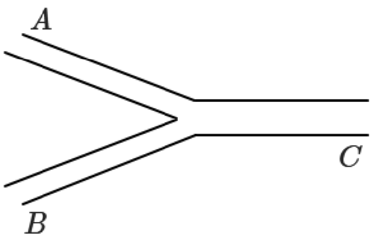
43 The following figures show a liquid flowing ideally through a tapered tube. Single-tube manometers are connected at three positions along the tube. Identify the diagram showing the correct rise of liquid in the tubes.



44 A soap bubble of radius r is blown up to form a bubble of radius $2r$. If σ is the surface tension of soap solution, the energy spent in doing so is: (Assuming surface tension is constant.)

1.	$3\pi\sigma r^2$	2.	$6\pi\sigma r^2$
3.	$12\pi\sigma r^2$	4.	$24\pi\sigma r^2$

45 Two identically wide and deep streams A, B merge together to form a stream C : the latter having the same depth but double the width of the former. The speeds of water in A and B are v_A, v_B while that in C is v_C. Then:

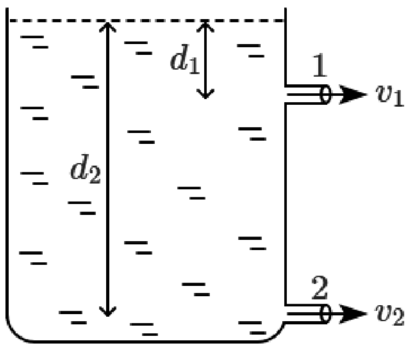


1. $v_A + v_B = v_C$
2. $v_A + v_B = \frac{1}{2} v_C$
3. $v_A + v_B = 2v_C$
4. $v_A + v_B = 4v_C$

46 The excess pressure inside a soap bubble of radius R and surface tension T is:

1.	$\frac{T}{R}$	2.	$\frac{2T}{R}$
3.	$\frac{3T}{R}$	4.	$\frac{4T}{R}$

47 Two small pipes are inserted into a water tank, and the depths of water d_1 and d_2 are in the ratio $d_1 : d_2 = 1 : 4$.



The ratio of the water pressures (P_1/P_2) at the two depths d_1 and d_2 is given by (far from the outlets):

1. $\frac{1}{2}$
2. $\frac{1}{4}$
3. $\frac{2}{1}$
4. $\frac{4}{1}$

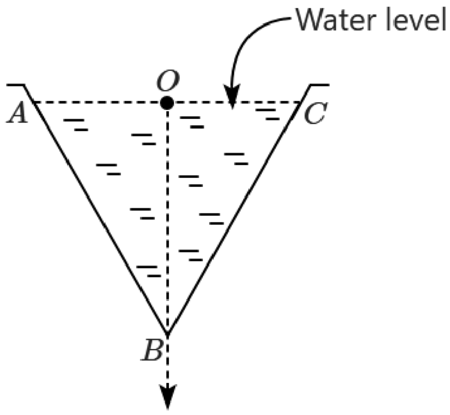
48 The amount of elastic potential energy per unit volume (in SI unit) of a steel wire of length 100 cm to stretch it by 1 mm is: (if Young's modulus of the wire = 2.0×10^{11} Nm^{-2})

1.	10^{11}	2.	10^{17}
3.	10^7	4.	10^5

49 A vessel of water (A) contains pure water while a second vessel of water (B) is filled with sea water. If a toy-boat is floated in both the vessels, then:

1.	it will displace less weight of water in A than in B.
2.	it will displace less volume of water in A than in B.
3.	it will displace more weight of water in A than in B.
4.	it will displace more volume of water in A than in B.

50 A wedge shaped vessel holds water. As one moves downward along OB or AB pressure changes. The increase in pressure per unit distance traversed,



1.	is more along AB compared to OB
2.	is more along OB compared to AB
3.	is the same along AB or OB
4.	is zero along AB, but non-zero along OB

CHEMISTRY - SECTION A

51 Five moles of an ideal gas at 1 bar and 298 K are expanded into a vacuum till the volume doubles. The work done is:
1. $-RT \ln V_2/V_1$
2. $C_V(T_2 - T_1)$
3. zero
4. $-RT(V_2 - V_1)$

52 For a weak acid HA, the percentage of dissociation is nearly 1% at equilibrium. If the concentration of acid is 0.1 mol L^{-1}, then the correct option for its K_a at the same temperature will be:

1.	1×10^{-4}
2.	1×10^{-6}
3.	1×10^{-5}
4.	1×10^{-3}

53 0.5 M solutions are prepared for each of the following compounds. Which of the following compound would give an acidic solution?
1. Ammonium chloride
2. Sodium acetate
3. Sodium chloride
4. Slaked lime

54 Given, the following reaction:
$N_2H_4(g) \longrightarrow N_2H_2(g) + H_2(g)$;
Given: ΔH° = 109 kJ/mol
B.E. of (N-N) = 163 kJ/mol
B.E. of (N-H) = 391 kJ/mol
B.E. of (H-H) = 436 kJ/mol
Calculate the bond enthalpy of N = N.

1. 182 kJ/mol
2. 400 kJ/mol
3. 300 kJ/mol
4. 218 kJ/mol

55 For a given reaction - $2\,Zn(s) + O_2(g) \rightarrow 2\,ZnO(s)$,
$\Delta H = -693.8\ kJ\ mol^{-1}$
The correct statements among the following are :

a.	The enthalpy of two moles of ZnO is less than the total enthalpy of two moles of Zn and one mole of oxygen by 693.8 kJ
b.	The enthalpy of two moles of ZnO is more than the total enthalpy of two moles of Zn and one mole of oxygen by 693.8 kJ
c.	$693.8\ kJ\ mol^{-1}$ energy is evolved in the reaction
d.	$693.8\ kJ\ mol^{-1}$ energy is absorbed in the reaction

1. (a, b)
2. (b, c)
3. (c, d)
4. (a, c)

56 The concentrations of A, B and C that represent the equilibrium concentration for the reaction $A + 2B \rightleftharpoons 2C$ having $K_c = 2M^{-1}$ are:
1. [A]= 1 M; [B]= 2 M; [C]= 2 M
2. [A]= 2 M; [B]= 2 M; [C]= 1 M
3. [A]= 1 M; [B]= 2 M; [C]= 1 M
4. [A]= 2 M; [B]= 1 M; [C]= 2 M

57 Given the following reaction:
$\frac{1}{2}H_2 + \frac{1}{2}Cl_2 \rightarrow HCl$
$\Delta H_f(HCl) = -93\ kJ/mol$
B.E $(H_2) = 434\ kJ/mol$, B.E $(Cl_2) = 242\ kJ/mol$
The bond dissociation energy of HCl in the above reaction will be:
1. 232 kJ/mol
2. 331 kJ/mol
3. 431 kJ/mol
4. 530 kJ/mol

58 Maximum work is obtained by the system in:

1.	Irreversible process	2.	Reversible process
3.	Adiabatic process	4.	Isobaric process

59 For the given reaction:

$2A(g)+B(g)+C(s) \rightarrow 2D(g)$

$\Delta U^{\circ}=-10.5$ kJ and $\Delta S^{\circ}=-44.1 \mathrm{JK}^{-1}$

The value of ΔG^{o} for the above reaction at 25 °C will be :

1.	1.2 kJ	2.	0.16 kJ
3.	3.2 kJ	4.	1.6 kJ

60 Among the following, the correct statement about a chemical equilibrium is :

1.	Equilibrium constant is independent of temperature.
2.	Equilibrium constant tells us how fast the reaction reaches equilibrium.
3.	At equilibrium, the forward and the backward reactions stop so that the concentrations of reactants and products are constant.
4.	The value of equilibrium constant is independent of initial concentrations of the reactants and products.

61 A certain reversible reaction comes to equilibrium with high concentration of products and low concentration of reactants. Of the following, which is the most likely value of the equilibrium constant for this reaction?

1.	$K_{eq} = -1 \times 10^{-5}$	2.	$K_{eq} = 1 \times 10^{-5}$
3.	$K_{eq} = 1$	4.	$K_{eq} = 1 \times 10^{5}$

62 For a chemical reaction,

$CO(g)+3H_2(g) \rightleftharpoons CH_4(g)+H_2O(g)$

at equilibrium, the amount of products formed is affected by:

1. Temperature
2. Pressure
3. Temperature and pressure
4. Temperature, pressure and catalyst

63 An example of homogeneous equilibrium among the following is:

1. $2SO_{2(g)}+O_{2(g)} \rightleftharpoons 2SO_3(g)$
2. $C_{(s)}+H_2O_{(g)} \rightleftharpoons CO_{(g)}+H_{2(g)}$
3. $CaCO_{3(s)} \rightleftharpoons CaO_{(s)}+CO_{2(g)}$
4. $NH_4HS_{(s)} \rightleftharpoons NH_{3(s)}+H_2S_{(g)}$

64 Among the following reactions, which reaction will exhibit the greatest positive entropy change:

1.	$2NO(g)+O_2(g) \rightarrow 2NO_2(g)$
2.	$2HCl(aq)+Mg(s) \rightarrow MgCl_2(aq)+H_2(g)$
3.	$2H_2O(g)+Br_2(g)+SO_2(g) \rightarrow 2HBr(g)+H_2SO_4(aq)$
4.	$2I^{-}(aq)+Cl_2(g) \rightarrow I_2(s)+2Cl^{-}(aq)$

65 Match the following reactions in Column-I to the correct enthalpy associated with them given in Column-II:

Column-I	Column-II
A. $C_6H_6(l)+\frac{15}{2}O_2 \rightarrow 6CO_2(g)+3H_2O(l)$	I. $\Delta_{\text{lattice}}H^{\circ}$
B. $NaCl(s) \rightarrow Na^{+}(g)+Cl^{-}(g)$	II. $\Delta_{\text{hyd}}H^{\circ}$
C. $AB(s) \rightarrow A^{+}(aq)+B^{-}(aq)$	III. $\Delta_{c}H^{\circ}$
D. $A^{+}(g)+B^{-}(g) \rightarrow A^{+}(aq)+B^{-}(aq)$	IV. $\Delta_{\text{sol}}H^{\circ}$

Choose the correct option from the following:

1. A - (III); B - (I); C - (IV); D - (II)
2. A - (III); B - (I); C - (II); D - (IV)
3. A - (II); B - (I); C - (IV); D - (III)
4. A - (III); B - (II); C - (I); D - (IV)

66 The solution that is most basic is:

1. $[H_3O^{+}]=10^{-6}$
2. pH $=8$
3. $[OH^{-}]=10^{-4}$
4. $[H_3O^{+}]=10^{-9}$

67 9.2g N_2O_4 is heated in a 1 L vessel till an equilibrium state is established as per the following reaction:
$N_2O_4(g) \rightleftharpoons 2NO_2(g)$
At equilibrium, 50 % N_2O_4 was dissociated. It can be inferred that equilibrium constant will be: (mol. wt. of N_2O_4 = 92)

1.	0.05	2.	0.4
3.	0.02	4.	0.2

68 The dissociation constant of a weak acid is 1×10^{-4} in order to prepare a buffer solution with pH=5 the [salt]/ [Acid] ratio should be:
1. 4 : 5
2. 10 : 1
3. 5 : 4
4. 1 : 10

69 Which of the following molecules is not a potential Lewis base/ligand?
1. CO_2
2. CO
3. CN^-
4. CH_3^-

70 The dissociation constant of acids HA, HB, HC, and HD are 1.3×10^{-13}, 1.8×10^{-2}, 6.23 $\times10^{-7}$, and 8.5×10^{8} respectively. The weakest acid is:
1. HA
2. HB
3. HC
4. HD

71 The lowest degree of ionisation among the following is:
1. 0.0001 M CH_3COOH
2. 0.001 M CH_3COOH
3. 0.01 M CH_3COOH
4. 0.1 M CH_3COOH

72

Assertion (A):	Enthalpy and entropy of any elementary substance in the standard states are taken as zero.
Reason (R):	At absolute zero, particles of the perfectly crystalline substance become completely motionless.

1.	Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**.
2.	Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**.
3.	**(A)** is True but **(R)** is False.
4.	**(A)** is False but **(R)** is True.

73 For the spontaneous process $H_2O_{(l)} \rightarrow H_2O_{(s)}$ at 268 K, the correct option is:
1. $\Delta S_{sys} < 0$
2. $\Delta S_{sys} > 0$
3. $\Delta S_{surr} < 0$
4. $\Delta S_{sys} = -\Delta S_{surr}$

74 Among the following reactions, change in entropy is less than zero for:
1. Sublimation of iodine.
2. Dissociation of hydrogen.
3. Formation of water.
4. Thermal decomposition of calcium carbonate.

75 Given below are two statements:

Statement I:	A process or change is said to be reversible if it is brought out in such a way that the process can, at any point, be reversed by an infinitesimal change.
Statement II:	A reversible process proceeds infinitely slowly through a series of equilibrium states such that the system and its surroundings are always in near equilibrium with each other.

In light of the above statements, choose the correct answer from the options given below:

1.	Both statement I and statement II are true.
2.	Both statement I and statement II are false.
3.	Statement I is correct but statement II is false.
4.	Statement I is incorrect but statement II is true.

76 Which pair will show common ion effect?
1. $BaCI_2 + Ba(NO_3)2$
2. NaCI + HCI
3. $NH_4OH + NH_4CI$
4. NaCN + KCN

77 The correct statement(s) among the following is/are:

(I)	The equilibrium constant is independent of the initial concentration
(II)	K >1 implies a spontaneous reaction
(III)	For homogeneous equilibrium, always $K_P = K_C$

1. (I) only
2. (II) and (III) only
3. (I) and (II) only
4. (I), (II) and (III)

78 If 50 ml of 0.1 M HBr is mixed with 50 ml 0.2 M NaOH, then pH of the resulting mixture will be:
1. 2.7
2. 12.7
3. 10.7
4. 1.3

79 The value of K_C for the reaction, $2A \rightleftharpoons B + C$ is 2×10^{-3}. At a given time, the composition of the reaction mixture is [A]=[B]=[C] = 3×10^{-4} M. The reaction will proceed in:
1. Forward direction
2. Reverse direction
3. No net reaction occurs
4. None of these

80
The solubility product of a salt having the general formula MX_2, in water is 4×10^{-12}. The concentration of M^{2+} ions in the aqueous solution of the salt is:
1. 4.0×10^{-10} M
2. 1.6×10^{-4} M
3. 1.0×10^{-4} M
4. 2.0×10^{-6} M

81 The work done when 1 mole of gas expands reversibly and isothermally from a pressure of 5 atm to 1 atm at 300 K is:
(Given log 5 = 0.6989 and R = 8.314 J K^{-1} mol^{-1})
1. zero J
2. 150 J
3. +4014.6 J
4. -4014.6 J

82 The K_p for the reaction 2NOCl (g) ⇄ 2NO (g) + Cl_2 (g) is 0.027 atm at 673 K. The K_c for the reverse reaction will be:
1. 1500.8 mol L^{-1}
2. 2044.08 (mol $L^{-1})^{-1}$
3. 2565.7 (mol $L^{-1})^{-1}$
4. 2040.81 mol L^{-1}

83 The number of H^+ ions present in 1 ml of a solution whose pH is 13 are:
1. 10^{-16}
2. 6.022×10^{13}
3. 6.022×10^{7}
4. 6.022×10^{23}

84 From the equilibriums given below, the one that is best represented as a Lewis acid-base reaction rather than a Bronsted acid-base reaction is:
1. $H_2O + CH_3COOH \rightleftharpoons H_3O^+ + CH_3COO^-$
2. $2NH_3 + H_2SO_4 \rightleftharpoons 2NH_4^+ + SO_4^{2-}$
3. $NH_3 + CH_3COOH \rightleftharpoons NH_4^+ + CH_3COO^-$
4. $Cu^{+2} + 4NH_3 \rightleftharpoons [Cu(NH_3)_4]^{2+}$

85 The number of intensive properties among the following is/are: Gibbs free energy, E^0_{cell} , Volume and Molarity.
1. Two
2. One
3. Three
4. Zero

CHEMISTRY - SECTION B

86 Increasing order of oxidation state of Mn in $KMnO_4$, $MnCl_2$, MnO_2, $Mn(OH)_3$ is:
1. $Mn(OH)_3$ <$MnCl_2$ <MnO_2 <$KMnO_4$
2. $KMnO_4$ <$Mn(OH)_3$ <MnO_2 < $MnCl_2$
3. $MnCl_2$ <$Mn(OH)_3$ <$KMnO_4$ <MnO_2
4. $MnCl_2$ <$Mn(OH)_3$<MnO_2<$KMnO_4$

87 (i) $Cu^+ \rightarrow Cu(s)$; E°= 0.52 V
(ii) $Cr^{3+} \rightarrow Cr^{2+}$; E° = -0.41 V
(iii) $Fe^{3+} \rightarrow Fe^{2+}$; E° = 0.77 V
(iv) $Fe^{2+} \rightarrow Fe(s)$; E° = -0.44 V
Which of the above reactions can be carried out by using HI as a reducing agent?
[Given: $I_2(s) \rightarrow 2I^-$; E°= 0.54 V]
1. (i) and (iii)
2. (ii) and (iv)
3. only (iii)
4. Only (ii)

88 Match column I (reactions) with column II (types of reactions) and mark the appropriate answer.

Column-I		Column-II	
A.	$3Mg_{(s)} + N_{2(g)} \xrightarrow{\Delta} Mg_3N_{2(s)}$	i.	Displacement
B.	$NaH_{(s)} + H_2O_{(l)} \rightarrow NaOH_{(aq)} + H_{2(g)}$	ii.	Decomposition
C.	$3ClO^-_{(aq)} \rightarrow 2Cl^-_{(aq)} + ClO_{3(aq)}$	iii.	Combination
D.	$2KClO_{3(s)} \rightarrow 2KCl_{(s)} + 3O_{2(g)}$	iv.	Disproportionation

1.(A) →(i), (B)→(iii), (C) →(ii), (D)→ (iv)
2. (A) →(iv), (B)→(iii), (C) →(ii), (D)→ (i)
3. (A) →(ii), (B)→(i), (C) →(iii), (D)→ (iv)
4. (A) →(iii), (B)→(i), (C) →(iv), (D)→ (ii)

89 The oxidation number of sulphur in S_8 molecule is:
1. 6
2. 0
3. 2
4. 3

90 A set of species capable of showing disproportionation reactions is:

1.	ClO^-_2, ClO^-_3, ClO^-_4, Cl_2
2.	Cl_2, ClO^-_2, ClO^-_3, S_8
3.	ClO^-_4, ClO^-, ClO^-_2, F_2
4.	ClO^-_3, ClO^-_4, H_2O_2, ClO^-

91 The compound among the following that has the highest oxidation number of sulphur is:
1. H_2SO_4
2. SO_3
3. $H_2S_2O_7$
4. All have the same oxidation number for sulphur

92 Match the underlined atom of compounds given in column I with the oxidation state given in column II and mark the correct option.

	Column-I (Underline atom)		Column-II (Oxidation state)
(a)	$H\underline{Cl}O_3$	(i)	+4
(b)	$K_2\underline{Mn}O_4$	(ii)	-2
(c)	$H_4\underline{P_2}O_6$	(iii)	+5
(d)	$\underline{N_2}H_4$	(iv)	+6

1. a=(iii), b=(iv), c=(i), d=(ii)
2. a=(iii), b=(i), c=(iv), d=(ii)
3. a=(iv), b=(iii), c=(i), d=(ii)
4. a=(i), b=(ii), c=(iii), d=(iv)

93 BrO_3^- changes into Br_2 in the acidic medium. The number of electrons that are needed to balance the equation are:
1. 10 electrons on the left-hand side
2. 6 electrons on the left-hand side
3. 3 electrons on the left-hand side
4. 3 electrons on the right-hand side

94 In the given reaction, the oxidation state of Cl in the major product will be:
$Cl_2O_7 + H_2O_2 \rightarrow$
1. +1
2. +2
3. +3
4. +5

95 Given below are two statements:

Statement I:	According to Lewis's concept, H_2O acts as an amphoteric substance.
Statement II:	H_2O act as an acid on reaction with NH_3, while it acts as a base on reaction with H_2S.

In light of the above statements choose the correct answer from the options given below:

1.	Both Statement I and Statement II are correct.
2.	Both Statement I and Statement II are incorrect.
3.	Statement I is correct and Statement II is incorrect.
4.	Statement I is incorrect and Statement II is correct.

96 The process of reduction can be defined as:
1. loss of electrons
2. increase in oxidation number
3. addition of an electropositive element to a substance
4. addition of an electronegative element to a substance

97 The oxidation states of P atom in $POCl_3$, H_2PO_3 and $H_4P_2O_6$ respectively, are:
1. +5, +4, +4
2. +5, +5, +4
3. +4, +4, +5
4. +3, +4, +5

98

Statement I:	$KMnO_4$ acts as a self-indicator.
Statement II:	$K_2Cr_2O_7$ is not used as a self-indicator.

Choose the correct option:

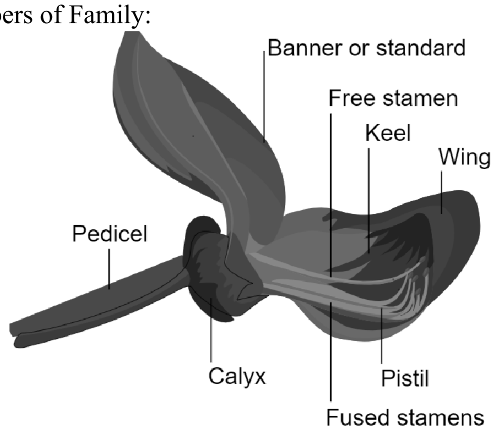
1.	Statement I is correct but statement II is incorrect.
2.	Statement I and statement II both are correct.
3.	Statement I and statement II both are incorrect.
4.	Statement I is incorrect but statement II is correct.

99 A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of the CO_2 is converted into CO on the addition of graphite. If the total pressure at equilibrium is 0.8 atm, the value of K is :
1. 1.8 atm
2. 3 atm
3. 0.3 atm
4. 0.18 atm

100 The given reaction: $NaOH + HCl \rightarrow NaCl + H_2O$ is an example of:
1. Intramolecular redox reaction
2. Disproportionation reaction
3. Acid-base reaction
4. Decomposition reaction

Biology I - Section A

101 The flower shown in the given figure represents the members of Family:



1. Leguminosae
2. Malvaceae
3. Cruciferae
4. Compositae

102 Primary xylem is of two types – protoxylem and metaxylem.

Statement I:	In roots, the protoxylem lies towards the center (pith) and the metaxylem lies towards the periphery of the organ. This type of primary xylem is called endarch.
Statement II:	In stems, the protoxylem lies towards the periphery and the metaxylem lies towards the center. Such an arrangement of the primary xylem is called an exarch.

1. Statement I is correct; Statement II is correct
2. Statement I is incorrect; Statement II is correct
3. Statement I is correct; Statement II is incorrect
4. Statement I is incorrect; Statement II is incorrect

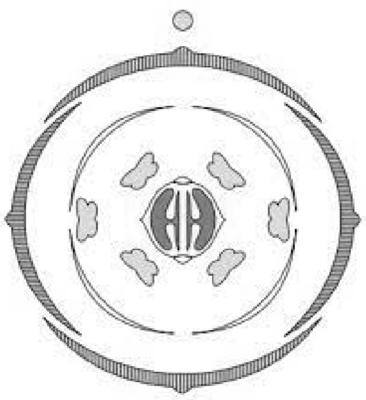
103 Phylloclade:

I:	is a stem modification to facilitate photosynthesis.
II:	a flattened/cylindrical stem or branches of unlimited growth.
III:	is seen in Cactus.

1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II, and III are correct

104 Runner, a stem modification for vegetative propagation, is found in all of the following except:
1. Cyanodon dactylon
2. Oxalis
3. Pistia
4. Marsilea

105 The floral diagram given below describes a typical plant belonging to the family:



1. Gramineae
2. Malvaceae
3. Cruciferae
4. Leguminosae

106 Collenchyma in plants:

I:	occurs in layers below the epidermis in most of the dicotyledonous plants.
II:	consists of cells that are much thickened at the corners due to deposition of cellulose, hemicellulose, and pectin.
III:	never contains chloroplasts.
IV:	provides mechanical support to the growing parts of the plant such as the young stem and petiole of a leaf.

1. Only I, II, and III are correct
2. Only I, II, and IV are correct
3. Only II, II, and IV are correct
4. Only I, III, and IV are correct

107 All the following plants belong to family Liliaceae except:
1. Gloriosa
2. Aloe
3. Asparagus
4. Trifolium

108 Consider the two statements:

Assertion (A):	Cymose inflorescence is determinate – limited in growth.
Reason (R):	The terminal bud keeps growing and forming lateral flowers; a terminal flower is never formed.

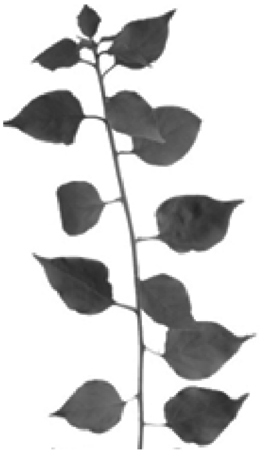
1.	Both **(A)** and **(R)** are True but **(R)** does not correctly explain the **(A)**.
2.	**(A)** is True but **(R)** is False.
3.	Both **(A)** and **(R)** are True and **(R)** correctly explains the Assertion.
4.	**(A)** is False but **(R)** is True.

109 Roots are modified in some plants for storing reserve food materials. These modified roots usually are swollen and assume different forms. Which of the following such roots does not have any definite shape?
1. radish
2. beet
3. carrot
4. sweet potato

110 All the following are floral characteristics of plants belonging to the Gramineae family except:
1. Flowers are characteristically arranged in spikelets
2. The flowers are usually unisexual
3. The perianth is reduced to two scales, called lodicules
4. The fruit is a caryopsis

111 The ovary is superior and the flower is hypogynous in:
1. Guava
2. Brinjal
3. Cucumber
4. Ray florets of sunflower

112 The phyllotaxy shown in the given figure is seen in:



1. Alstonia
2. Calotropis
3. China rose
4. Guava

113 Consider the given two statements:

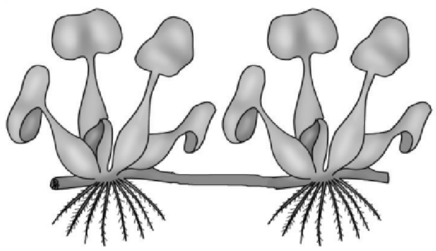
Statement I:	Fascicular vascular cambium, interfascicular cambium, and cork-cambium are examples of lateral meristems.
Statement II:	These are responsible for producing secondary tissues.

1. Statement I is correct; Statement II is correct
2. Statement I is incorrect; Statement II is correct
3. Statement I is correct; Statement II is incorrect
4. Statement I is incorrect; Statement II is incorrect

114 Thorns, as a modification of stem, are found in all the following plants except:
1. Duranta
2. Pomegranate
3. Citrus
4. Bignonia

115 The fruit is a drupe in:
I: Mango
II: Coconut
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

116 The modification of the stem shown in the given figure is called a/an



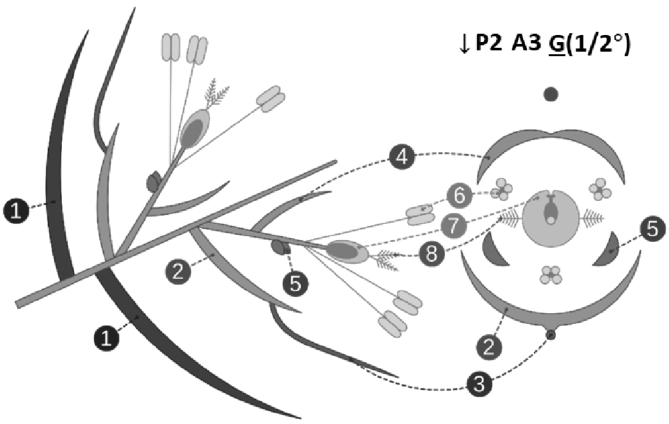
1. Offset
2. Runner
3. Stolon
4. Cladode

117 All the following are members of family Malvaceae except:
1. Gossypium species
2. Abelmoschus esculentus
3. Arabidopsis thaliana
4. Hibiscus rosa-sinensis

118 Identify the incorrect statement regarding the floral characters of family Liliaceae:

1.	Flower is bisexual; zygomorphic
2.	Perianth tepal six (3+3), often united into a tube; valvate aestivation
3.	Androecium: stamen six, 3+3, epitepalous
4.	Gynoecium: tri carpellary, syncarpous, ovary superior, trilocular with many ovules

119 The diagram shows the inflorescence scheme and the floral diagram of the family:



1. Liliaceae
2. Gramineae
3. Leguminosae
4. Rosaceae

120 Which family is regarded as the most advanced & highly evolved and is considered to occupy the highest position in the plant kingdom?
1. Compositae
2. Gramineae
3. Cruciferae
4. Orchidaceae

121 Match each item in Column I with one in Column II and select the correct match from the codes given:

	COLUMN I [Aestivation type]		COLUMN II [Example]
A	Valvate	P	Lady's finger
B	Twisted	Q	Bean
C	Imbricate	R	Calotropis
D	Vexillary	S	Cassia

Codes:

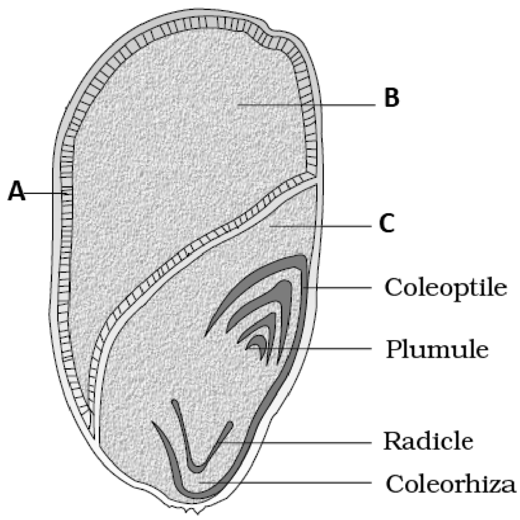
	A	B	C	D
1.	P	R	Q	S
2.	R	P	Q	S
3.	R	P	S	Q
4.	P	R	S	Q

122 That potato, ginger, and garlic are underground modifications of the stem is indicated by:

I:	Presence of an eye (node) in potato
II:	Distinct nodes with internodes and scaly leaves in ginger
III:	A cluster of roots at the base of the reduced stem in garlic

1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II, and III are correct

123 Identify A, B, and C in the given figure:



	A	B	C
1.	Aleurone layer	Scutellum	Endosperm
2.	Scutellum	Endosperm	Aleurone layer
3.	Aleurone layer	Endosperm	Scutellum
4.	Endosperm	Scutellum	Aleurone layer

124 How many of the given pairs are correctly matched?

A:	Actinomorphic flower	Pea
B:	Zygomorphic flower	Mustard
C:	Asymmetric flower	Canna

1. 0
2. 1
3. 2
4. 3

125 How many of the given pairs are correctly matched?

	Leaf modification for	Example
A:	Protection	Argemone
B:	Mechanical support	Pea
C:	Storage of food	Onion
D:	Trapping insects	Nepenthes

1. 1
2. 2
3. 3
4. 4

126 Match each item in Column I with one in Column II and select the correct match from the codes given:

	COLUMN I [Placentation]		COLUMN II [Example]
A	Marginal	P	Pea
B	Axile	Q	Argemone
C	Parietal	R	Tomato
D	Basal	S	Marigold

Codes:

	A	B	C	D
1.	P	R	Q	S
2.	R	P	Q	S
3.	R	P	S	Q
4.	P	R	S	Q

127 Guard cells:

1. are bean-shaped in grasses
2. have a thin inner and a thick outer wall
3. do not contain chloroplasts
4. regulate the opening and closing of stomata

128 The given floral formula represents plants belonging to the family:

$$\oplus \; ⚥ \; Epi_{3\rightarrow8}\, K_{(5)}\, \overparen{C_{(5)}\, A_{\infty}}\, G_{(2-\infty)}$$

1. Gramineae
2. Malvaceae
3. Cruciferae
4. Leguminosae

129 Vegetables such as cabbage, broccoli, cauliflower, kale, Brussels sprouts belong to the family:

1. Gramineae
2. Malvaceae
3. Cruciferae
4. Leguminosae

130 Regarding regions of roots in angiosperms

I:	the apex is covered by a thimble-like structure called the root cap
II:	cells of the region of meristematic activity divide repeatedly
III:	Root hairs are found in the region of elongation

1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II, and III are correct

131 Roots are modified to provide mechanical support as seen in:

I:	prop roots of banyan
II:	stilt roots of maize
III:	betel/black where nodes and internodes bear roots that help in climbing

1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II, and III are correct

132 Consider the two statements:

Assertion (A):	Prop and stilt roots are aerial in origin yet they are called roots.
Reason (R):	These roots are modified to provide mechanical support

1.	Both **(A)** and **(R)** are True but **(R)** does not correctly explain the **(A)**.
2.	**(A)** is True but **(R)** is False.
3.	Both **(A)** and **(R)** are True and **(R)** correctly explains the **(A)**.
4.	**(A)** is False but **(R)** is True.

133 Identify the incorrectly matched pair regarding floral characters of the family Solanaceae:

1.	Calyx	sepals five, united, persistent, valvate aestivation
2.	Corolla	petals five, united; valvate aestivation
3.	Androecium	stamens five, epipetalous
4.	Gynoecium	bicarpellary obliquely placed, syncarpous, inferior ovary

134 How many of the given statements are true?

A:	When stamens are attached to the petals, they are epipetalous as in brinjal
B:	When stamens are attached to the perianth, they are epiphyllous as in lily
C:	The stamens may be united into one bunch or one bundle (monadelphous) as in China rose
D:	There may be a variation in the length of filaments within a flower, as in Salvia and mustard

1. 1
2. 2
3. 3
4. 4

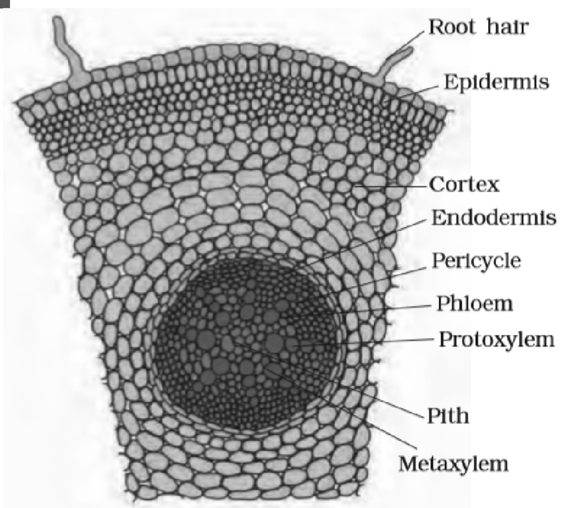
135

Statement I:	Phloem fibers (bast fibers) are made up of sclerenchymatous cells and are absent in the primary phloem but are found in the secondary phloem.
Statement II:	The phloem parenchyma stores food material and other substances like resins, latex, and mucilage and is absent in most of the monocotyledons.

1. Statement I is correct; Statement II is correct
2. Statement I is incorrect; Statement II is correct
3. Statement I is correct; Statement II is incorrect
4. Statement I is incorrect; Statement II is incorrect

BIOLOGY I - SECTION B

136 The given figure shows a T.S. of:



1. Monocot root
2. Dicot root
3. Dicot stem
4. Monocot stem

137 Consider the given two statements:

Assertion(A)	Monocotyledonous roots do not undergo any secondary growth.
Reason (R):	There are usually more than six (polyarch) xylem bundles in the monocot root.

1.	Both **(A)** and **(R)** are True but **(R)** does not correctly explain the **(A)**.
2.	**(A)** is True but **(R)** is False.
3.	Both **(A)** and **(R)** are True and **(R)** correctly explains the **(A)**.
4.	**(A)** is False but **(R)** is True.

138 All the following would be true for a typical leaf in flowering plants except:

1.	The leaf develops at the node and bears a bud in its axil.
2.	Leaves originate from shoot apical meristems.
3.	Leaves are arranged in a basipetal order.
4.	Leaves are the most important vegetative organs for photosynthesis.

139 Roots that arise from any point other than the radicle (embryonic root) or the root axis of a plant are called:

1. Tap roots
2. Fibrous roots
3. Adventitious roots
4. Assimilatory roots

140 In an isobilateral leaf:

I:	the stomata are present on both the surfaces of the epidermis
II:	the mesophyll is not differentiated into palisade and spongy parenchyma

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

141 Initiation of lateral roots and vascular cambium during the secondary growth in dicot roots takes place in:

1. Epidermal cells
2. Cortex cells
3. Pericycle
4. Endodermis

142 Consider the given two statements:

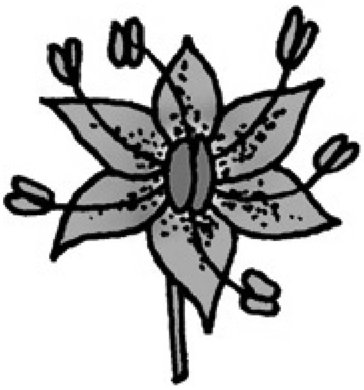
Statement I:	In a pinnately compound leaf, several leaflets are present on a common axis, the rachis, which represents the midrib of the leaf as in neem.
Statement II:	In palmately compound leaves, the leaflets are attached at a common point, i.e., at the tip of the petiole, as in silk cotton.

1.	Statement I is correct; Statement II is correct
2.	Statement I is incorrect; Statement II is correct
3.	Statement I is correct; Statement II is incorrect
4.	Statement I is incorrect; Statement II is incorrect

143 'Pericarp' is a derivative of which of the following structures?
1. integuments
2. endosperm
3. ovule wall
4. ovary wall

144 What structure covers the embryonic root in monocots?
1. hypodermis
2. scutellum
3. coleorhiza
4. radicle

145 The flower shown in the given figure most likely is of a plant that belongs to the family:



1. Fabaceae
2. Liliaceae
3. Solanaceae
4. Cruciferae

146 The 'ring' arrangement of vascular bundles is a characteristic of:
1. Monocot root
2. Dicot root
3. Dicot stem
4. Monocot stem

147 Which of the following is missing in sieve tube elements when they attain maturity?
1. Nuclei
2. Cytoplasm
3. P-protein
4. Callose

148 Which of the following is not an anatomical feature of monocot stems?

1.	Collenchymatous hypodermis
2.	A large number of scattered vascular bundles, each surrounded by a sclerenchymatous bundle sheath
3.	Vascular bundles are conjoint and closed
4.	Water-containing cavities are present within the vascular bundles

149 The term 'bast fibers' is associated with:
1. Xylem
2. Phloem
3. Meristem
4. Collenchyma

150 The term 'stele' [in the context of the anatomy of the dicot root] includes all the following structures except:
1. pericycle
2. vascular bundles
3. pith
4. endodermis

Biology II - Section A

151 Identify the correctly matched pairs:

	Layer in the wall of artery/vein	Made up of
I:	Tunica intima	Squamous epithelium
II:	Tunica media	Skeletal muscle/elastic fibres
III:	Tunica externa	Fibrous connective tissue

1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II and III are correct

152 At lungs, the factors favourable for the formation of oxyhaemoglobin include all of the following except:

1.	high pO_2	2.	low pCO_2
3.	lesser H^+ concentration	4.	higher temperature

153 Rh incompatibility can lead to grave consequence in cases where:

1.	an Rh negative mother is carrying an Rh positive foetus
2.	an Rh negative mother is carrying an Rh negative foetus
3.	an Rh positive mother is carrying an Rh positive foetus
4.	an Rh positive mother is carrying an Rh negative foetus

154 Consider the given two statements:

Statement I:	pO_2 in alveolar air is less than the pO_2 in atmospheric air.
Statement II:	pCO_2 in alveolar air is less than the pCO_2 in atmospheric air.

1. Statement I is correct; Statement II is correct
2. Statement I is incorrect; Statement II is correct
3. Statement I is correct; Statement II is incorrect
4. Statement I is incorrect; Statement II is incorrect

155 The thoracic chamber is formed:

	Column I		Column II
A	Dorsally by	P	The Sternum
B	Ventrally by	Q	The vertebral column
C.	Laterally by	R	The rib cage
D.	Inferiorly by	S	The Diaphragm

Select the correct match from the codes given:

	A	B	C	D
1.	Q	P	R	S
2.	Q	P	S	R
3.	P	Q	R	S
4.	P	Q	S	R

156 Identify the incorrect statement regarding respiratory organs:

1.	Lower invertebrates like sponges, coelenterates, flatworms, etc., exchange O_2 with CO_2 by simple diffusion over their entire body surface.
2.	Earthworms use their moist cuticle as respiratory surface.
3.	Insects have a network of tubes (tracheal tubes) to transport atmospheric air within the body.
4.	All vertebrates use lungs as respiratory organs.

157 O_2 and CO_2 are exchanged by simple diffusion mainly based on pressure/concentration gradient at:
I: Alveoli
II: Tissues
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

158 Inspiration is initiated by:

1.	the contraction of diaphragm which increases the volume of thoracic chamber in the antero-posterior axis.
2.	the contraction of diaphragm which increases the volume of thoracic chamber in the dorso-ventral axis.
3.	the contraction of external inter-costal muscles which increases the volume of the thoracic chamber in the dorso-ventral axis.
4.	the contraction of external inter-costal muscles which increases the volume of the thoracic chamber in the antero-posterior axis.

159 Identify the correctly matched pairs:

I.	Asthma	inflammation of bronchi and bronchioles
II.	Emphysema	alveolar walls are damaged due to which respiratory surface is decreased
III.	Occupational Respiratory Disorders	fibrosis [proliferation of fibrous tissues]

1. I and II only
2. I and III only
3. II and III only
4. I, II and III

160 Which of the following major plasma proteins is primarily responsible for helping in the maintenance of colloid osmotic balance in the intravascular fluid?
1. Albumin
2. α Globulin
3. β Globulin
4. γ Globulin

161 The respiratory volume that averages 1100 mL to 1200 mL in a healthy adult male will be:
1. Tidal volume
2. Inspiratory Reserve Volume
3. Expiratory Reserve Volume
4. Residual Volume

162 Consider the two statements:

Assertion (A):	Carbon dioxide (CO_2) diffuses faster than oxygen (O_2) across the respiratory membrane.
Reason (R):	CO_2 is 20–25 times more soluble in blood and alveolar fluids than O_2.

1.	Both **(A)** and **(R)** are True but **(R)** does not correctly explain the **(A)**.
2.	**(A)** is True but **(R)** is False.
3.	Both **(A)** and **(R)** are True and **(R)** correctly explains the **(A)**.
4.	**(A)** is False but **(R)** is True.

163 An enzyme complex required to initiate the process of coagulation or clotting in response to an injury or trauma is:
1. Plasmin
2. Fibrinolysis
3. Thrombokinase
4. Streptokinase

164 Which tracing on the standard ECG leads to contraction of the ventricles during a cardiac cycle?
1. P wave
2. QRS complex
3. ST segment
4. T wave

165 Regarding the transport of respiratory gases by human blood:

Statement I:	Every 100 ml of oxygenated blood can deliver around 5 ml of O_2 to the tissues under normal physiological conditions.
Statement II:	Every 100 ml of deoxygenated blood delivers approximately 4 ml of CO_2 to the alveoli.

1. Statement I is correct; Statement II is correct
2. Statement I is incorrect; Statement II is correct
3. Statement I is correct; Statement II is incorrect
4. Statement I is incorrect; Statement II is incorrect

166 Semilunar valves:

I:	allow the flow of blood from ventricles to the pulmonary artery or aorta.
II:	prevent any backward flow of blood from the pulmonary artery or aorta into the ventricles.

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

167 A person has a cardiac output of 6000 ml per minute. 20% of this is received by kidneys. What is the renal plasma flow in this person?
1. 480 ml
2. 660 ml
3. 800 ml
4. 1200 ml

168 Trachea is a straight tube extending up to the mid-thoracic cavity, which divides into a right and left primary bronchi at the level corresponding to:
1. Seventh cervical vertebra
2. Second thoracic vertebra
3. Fifth thoracic vertebra
4. Seventh thoracic vertebra

169 The volume of blood pumped out by each ventricle per minute is called as the:
1. stroke volume
2. ejection fraction
3. cardiac output
4. end diastolic volume

170 Which of the following would not be correct regarding vital capacity in human lungs?

1.	It is the maximum volume of air a person can breathe in after a forced expiration.
2.	It includes ERV, TV, RV and IRV
3.	It can also be defined as the maximum volume of air a person can breathe out after a forced inspiration.
4.	It can be calculated as the difference between total lung capacity and residual volume.

171 Interstitial fluid:

I:	has the same mineral distribution as that in plasma.
II:	has more protein than that in plasma.

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

172 Regarding the regulation of respiration by brain:

I.	The rhythm center is located in the medulla oblongata.
II:	Pneumotaxic center is located in the mid brain

1.	Statement I is correct; Statement II is correct
2.	Statement I is incorrect; Statement II is correct
3.	Statement I is correct; Statement II is incorrect
4.	Statement I is incorrect; Statement II is incorrect

173 Blood pumped by the heart is always circulated through a closed network of blood vessels in:
a. arthropods
b. molluscs
c. annelids
d. chordates
1. Only a and b
2. Only c and d
3. Only a and c
4. Only b and d

174 Consider the given two statements:

Assertion(A)	Neural signals through the sympathetic nerves (part of ANS) can increase the cardiac output.
Reason (R):	Neural signals through the sympathetic nerves can increase the rate of heart beat and the strength of ventricular contraction.

1.	Both **(A)** and **(R)** are True and **(R)** correctly explains the **(A)**.
2.	Both **(A)** and **(R)** are True but **(R)** does not correctly explain the **(A)**.
3.	**(A)** is True; **(R)** is False.
4.	Both **(A)** and **(R)** are False.

175 Which of the following white blood cells is not correctly matched to its abundance out of the total white blood cells in a healthy human being?

1.	Neutrophils	60 – 65 %
2.	Eosinophils	2 – 3 %
3.	Monocytes	6 – 8 %
4.	Basophils	20 – 25 %

176 When compared to the adult red blood cells in human blood, the adult white blood cells are:
I: lesser in number
II: longer lived
III: nucleated
1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II and III are correct

177 Consider the given two statements:

Assertion (A):	SA node is called the pacemaker of the human heart.
Reason (R):	SA node is auto-excitable.

1.	Both **(A)** and **(R)** are True and **(R)** correctly explains the **(A)**.
2.	Both **(A)** and **(R)** are True but **(R)** does not correctly explain the **(A)**.
3.	**(A)** is True; **(R)** is False.
4.	Both **(A)** and **(R)** are False.

178 A chemosensitive area is situated adjacent to the rhythm centre which is highly sensitive to:
I: CO_2
II: O_2
III: hydrogen ions
1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

179 Consider the given two statements:

Statement I:	ABO grouping is based on the presence or absence of three surface antigens on the RBCs namely A, B and O.
Statement II:	Rh grouping is based on the presence or absence of the type of antibody present in the plasma.

1.	Statement I is correct; Statement II is correct
2.	Statement I is incorrect; Statement II is incorrect
3.	Statement I is incorrect; Statement II is correct
4.	Statement I is correct; Statement II is incorrect

180 Transport as carbaminohaemoglobin accounts for what percent of total carbon dioxide transport in blood?
1. 5 to 7
2. 20 to 25
3. 50 to 55
4. 70

181 During each cardiac cycle, two prominent sounds are produced which can be easily heard through a stethoscope where:

I:	The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves
II:	The second heart sound (dub) is associated with the opening of the semilunar valves.

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

182 The conducting part of the human respiratory system:

I:	clears the air from foreign particles
II:	humidifies the air
III:	brings the air to body temperature.

1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II and III are correct

183 The cumulative thickness of the three layers of the diffusion [respiratory] membrane is:
1. less than 1 µm
2. less than 1mm
3. between 2 µm and 5 µm
4. between 2 mm and 5 mm

184 What event occurs during the joint diastole in the human heart?
1. Opening of AV valves
2. Closure of AV valves
3. Opening of semilunar valves
4. Closure of semilunar valves

185 The atrio-ventricular node (AVN) in the human heart is located:

1.	in the right upper corner of the right atrium.
2.	in the lower left corner of the right atrium close to the atrio-ventricular septum.
3.	in the lower right corner of the left atrium close to the atrio-ventricular septum.
4.	in the interventricular septum

BIOLOGY II - SECTION B

186 Consider the given two statements:

Assertion (A):	It is important that the proximal convoluted tubule of the nephron is lined with simple cuboidal brush bordered epithelium.
Reason (R):	Maximum reabsorption from the ultrafiltrate takes place in this segment of the nephron.

1.	Both **(A)** and **(R)** are True and **(R)** correctly explains the **(A)**.
2.	Both **(A)** and **(R)** are True but **(R)** does not correctly explain the **(A)**.
3.	**(A)** is True; **(R)** is False.
4.	Both **(R)** and **(R)** are False.

187 Sodium reabsorption by the distal tubule is mediated by the hormone:
1. Aldosterone
2. ADH
3. Cortisol
4. Epinephrine

188 The glomerular ultrafiltrate does not contain:
1. Proteins
2. Glucose
3. Sodium
4. Urea

189 Juxtamedullary nephrons:

1.	are located entirely in the renal cortex.
2.	do not form urine.
3.	have long loop of Henle running deep into the medulla.
4.	do not have an associated vasa recta.

190 Identify the correct statements:
I: Cartilaginous fishes are ammonotelic.
II: Mammals are ureotelic.
III: Land snails are uricotelic.
1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

191 Identify the incorrect statement:

1.	An adult human excretes, on an average, 1 to 1.5 litres of urine per day.
2.	The urine formed is slightly basic (pH-7.5).
3.	On an average, 25-30 gm of urea is excreted out per day.
4.	Presence of glucose (Glycosuria) and ketone bodies (Ketonuria) in urine are indicative of diabetes mellitus.

192 Juxta glomerular apparatus is a special sensitive region formed by cellular modifications in the:

1.	proximal convoluted tubule and the afferent arteriole at the point of their contact.
2.	distal convoluted tubule and the afferent arteriole at the point of their contact.
3.	proximal convoluted tubule and the efferent arteriole at the point of their contact.
4.	distal convoluted tubule and the efferent arteriole at the point of their contact.

193 Identify the correct statements:

I:	The flow of filtrate in the two limbs of Henle's loop is in opposite directions and thus forms a counter current.
II:	The flow of blood through the two limbs of vasa recta is also in a counter current pattern.
III:	Although there is proximity between the Henle's loop and vasa recta, yet they do not form a counter current.

1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

194 Consider the given two statements:

Assertion(A):	As the filtrate moves down the descending limb of Loop of Henle, it gets concentrated.
Reason(R):	The descending limb of loop of Henle is permeable to water but almost impermeable to electrolytes.

1.	Both **(A)** and **(R)** are True and **(R)** correctly explains the **(A)**.
2.	Both **(A)** and **(R)** are True but **(R)** does not correctly explain the **(A)**.
3.	**(A)** is True; **(R)** is False.
4.	Both **(A)** and **(R)** are False.

195 Which of the following recordings in a sphygmomanometer will not be considered as 'hypertension'?
1. 150/80 mm Hg
2. 130/100 mm Hg
3. 160/96 mm Hg
4. 130/70 mm Hg

196 Protonephridia are osmoregulatory and excretory structures in all the following animals except:
1. *Amphioxus*
2. Flatworms
3. Rotifers
4. Crustaceans

197 During concentration of urine by the human kidneys, an increasing osmolarity towards the medullary inner medullary interstitium is mainly caused by:
1. NaCl and HCO_3^-
2. Urea and Uric acid
3. NaCl and Urea
4. H^+ ions and TMAO

198 ADH:

I:	facilitates water reabsorption from latter parts of the tubule, thereby preventing diuresis.
II:	is a potent vasodilator.

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

199 The most common renal stones are:
1. oxalates
2. urates
3. cysteine
4. struvites

200 Consider the given two statements:

Assertion (A):	Atrial Natriuretic Factor (ANF) mechanism acts as a check on the renin-angiotensin mechanism.
Reason (R):	An increase in blood flow to the atria of the heart can cause the release of ANF.

1.	Both **(A)** and **(R)** are True and **(R)** correctly explains the **(A)**.
2.	Both **(A)** and **(R)** are True but **(R)** does not correctly explain the **(A)**.
3.	**(A)** is True; **(R)** is False.
4.	Both **(A)** and **(R)** are False.

Fill OMR Sheet*

*If above link doesn't work, please go to test link from where you got the pdf and fill OMR from there. After filling the OMR, you would get answers and explanations for the questions in the test.