HORIZON ACADEMY®

Since 2003

Medical | IIT-JEE | Foundations

(Divisions of Horizon Study Circle Pvt. Ltd.)

Name.: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Date : 18/10/2015

Test No.: 1 0

Subject Code.: 2 2 2

Time : 3 Hrs. **M.M. : 720**

HORIZON TEST SERIES

for

Medical Entrance Exam. 2016

[Test No. 10 Batch 1]

INSTRUCTIONS FOR STUDENTS

1. Read each question carefully.
2. It is mandatory to use Blue/Black Ball Point Pen to darken the appropriate circle in the answer sheet.
3. Mark should be dark and should complete fill the circle.
4. Rough work must be done on the Question Paper, no additional sheet will be provided for this purpose.
5. Do not use white-fluid or any other rubbing material on answer sheet. No change in the answer once marked.
6. Student cannot use log tables and calculators or any other material in the examination hall.
7. Before attempting the question paper, student should ensure that the test paper contains all pages and no page is missing.
8. Each correct answer carries four marks. One mark will be deducted for each incorrect answer from the total score.
9. Before handing over the answer sheet to the invigilator, candidate should check the particulars have been filled and marked correctly.
10. Immediately after the prescribed examination time is over, the answer sheet to be returned to the invigilator.
11. Use of Calculator and other Electronic device is not permitted.

Test No. 10

Topics of The Test

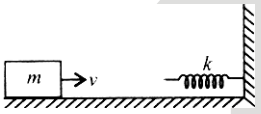
Physics	Work, Energy and Power.
Chemistry	Solutions.
Biology	Zoology : Excretion. Botany : Transportation in plants.

Test No. 10

[PHYSICS]

1. A raindrop of mass 1 g falling from a height of 1 km hits the ground with a speed of 50 m s^{-1}. If the resistive force is proportional to the speed of the drop, then the work done by the resistive force is
(Take g = 10 m s^{-2})
(A) 10 J (B) –10 J
(C) 8.75 J (D) –8.75 J

2. A block of mass *m* is moving with a speed v on a horizontal rough surface and collides with a horizontally mounted spring of spring constant *k* as shown in the figure. The coefficient of friction between the block and the floor is μ. The maximum compression of the spring is



(A) $-\frac{\mu mg}{k}+\frac{1}{k}\sqrt{(\mu mg)^2+mkv^2}$

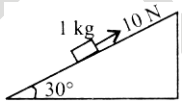
(B) $\frac{\mu mg}{k}+\frac{1}{k}\sqrt{(\mu mg)^2-mkv^2}$

(C) $-\frac{\mu mg}{k}-\frac{1}{k}\sqrt{(\mu mg)^2-mkv^2}$

(D) $\frac{\mu mg}{k}+\frac{1}{k}\sqrt{(\mu mg)^2+mkv^2}$

3. A body is being raised to a height *h* from the surface of earth. What is the sign of work done by
(i) applied force (ii) gravitational force ?
(A) Positive, Positive
(B) Positive, Negative
(C) Negative, Positive
(D) Negative, Negative

4. A block of mass 1 kg is pushed up a surface inclined to horizontal at an angle of 30° by a force of 10 N parallel to the inclined surface as shown in the figure.



The coefficient of friction between block and the incline is 0.1. If the block is pushed up by 10 m along the incline, then the work against gravity is
(Take g = 10 m s^{-2})
(A) 10 J (B) 50 J
(C) 100 J (D) 150 J

5. A particle acted upon by constant forces $(4\hat{i}+\hat{j}-3\hat{k})$N and $(3\hat{i}+\hat{j}-\hat{k})$N is displaced from the point $(\hat{i}+2\hat{j}+3\hat{k})$ to point $(5\hat{i}+4\hat{j}+\hat{k})$. The total work done by the forces in SI unit is
(A) 20 (B) 40
(C) 50 (D) 30

6. A weightlifter lifts a weight off the ground and holds it up
(A) work is done in lifting as well as holding the weight.
(B) no work is done in both lifting and holding the weight.
(C) work is done in lifting the weight but no work is required to done in holding it up.
(D) no work is done in lifting the weight but work is required to be done in holding it up.

Space for Rough Work

7. A uniform chain of length 2 m is kept on a table such that a length of 60 cm hanges freely from the edge of the table. The total mass of the chain is 4 kg. The work done in pulling the entire chain on the table (Take g = 10 m s^{-2})

(A) 12.9 J (B) 6.3 J

(C) 3.6 J (D) 2.0 J

8. An electron and a proton are detected in a cosmic ray experiment, the first with kinetic energy 10 keV, and the second with 100 keV. The ratio of their speeds is (where m_e and m_p are masses of electron and proton respectively)

(A) $\sqrt{\frac{1}{10}\frac{m_e}{m_p}}$ (B) $\sqrt{\frac{1}{10}\frac{m_p}{m_e}}$

(C) $\frac{1}{10}\frac{m_e}{m_p}$ (D) $\frac{1}{10}\frac{m_p}{m_e}$

9. The blades of a windmill sweep out a circle of area A. If the wind flows at a velocity v perpendicular to the circle, then the mass of the air of density ρ passing through it in time *t* is

(A) $Av\rho t$ (B) $2Av\rho t$

(C) $Av^2\rho t$ (D) $\frac{1}{2}Av\rho t$

10. A 120 g mass has a velocity $\vec{v} = 2\hat{i} + 5\hat{j}$ m s^{-1} at a certain instant. Its kinetic energy is

(A) 3 J (B) 4 J

(C) 5 J (D) 1.74 J

11. In a ballistics demonstration a police officer fires a bullet of mass 50 g with speed 200 m s^{-1} on soft plywood of thickness 2 cm. The bullet emerges with only 10% of its initial kinetic energy. The emergent speed of the bullet is

(A) $2\sqrt{10}$ m s^{-1} (B) $20\sqrt{10}$ m s^{-1}

(C) $10\sqrt{2}$ m s^{-1} (D) $10\sqrt{20}$ m s^{-1}

12. A running man has half the kinetic energy than a boy of half his mass has. The man speed up by 1.0 m s^{-1} and then he has the same energy as the boy. The original speeds of the man and boy respectively are

(A) 2.4 m s^{-1}, 1.2 m s^{-1}

(B) 1.2 m s^{-1}, 4.4 m s^{-1}

(C) 2.4 m s^{-1}, 4.8 m s^{-1}

(D) 4.8 m s^{-1}, 2.4 m s^{-1}

13. Two bodies A and B have masses 20 kg and 5 kg respectively. Each one is acted upon by a force of 4 kg wt. If they acquire the same kinetic energy in times t_A and t_B, then the ratio $\frac{t_A}{t_B}$ is

(A) $\frac{1}{2}$ (B) 2

(C) $\frac{2}{5}$ (D) $\frac{5}{6}$

14. A bullet of mass *m* fired at 30° to the horizontal leaves the barrel of the gun with a velocity v. The bullet hits a soft target at a height *h* above the ground while it is moving downward and emerges out with half the kinetic energy it had before hitting the target.

Which of the following statements is correct in respect of bullet after it emerges out of the target ?

(A) The velocity of the bullet remains the same.

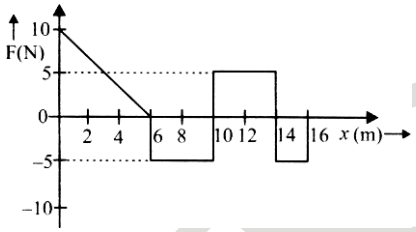
(B) The velocity of the bullet will be reduced to half its initial value.

(C) The velocity of the bullet will be more than half of its earlier velocity.

(D) The bullet will continue to move along the same parabolic path.

Space for Rough Work

15. A particle is acted upon by a force *F* which varies with position *x* as shown in figure. If the particle at *x* = 0 has kinetic energy of 25 J, then the kinetic energy of the particle at *x* = 16 m is



(A) 45 J (B) 30 J
(C) 70 J (D) 20 J

16. A block of mass 10 kg is moving in *x*-direction with a constant speed of 10 m s^{-1}. It is subjected to a retarding force $F_r = 0.1x$ J m^{-1} during its travel from *x* = 20 m to *x* = 30 m. Its final kinetic energy will be
(A) 250 J (B) 275 J
(C) 450 J (D) 475 J

17. A variable force, given by the 2-dimensional vector $\vec{F} = (3x^2\hat{i} + 4\hat{j})$, acts on a particle. The force is in newton and *x* is in metre. What is the change in the kinetic energy of the particle as it moves from the point with coordinates (2,3) to (3,0)? (The coordinates are in metres)
(A) –7 J (B) zero
(C) +7 J (D) +19 J

18. Two men with weights in the ratio 4:3 run up a staircase in time in the ratio 12:11. The ratio of power of the first to that of second is
(A) $\frac{4}{3}$ (B) $\frac{12}{11}$
(C) $\frac{48}{33}$ (D) $\frac{11}{9}$

19. A particle in a certain conservative force field has a potential energy given by $V = \frac{20xy}{z}$. The force exerted on it is
(A) $\left(\frac{20y}{z}\right)\hat{i} + \left(\frac{20x}{z}\right)\hat{j} + \left(\frac{20xy}{z^2}\right)\hat{k}$
(B) $-\left(\frac{20y}{z}\right)\hat{i} - \left(\frac{20x}{z}\right)\hat{j} + \left(\frac{20xy}{z^2}\right)\hat{k}$
(C) $-\left(\frac{20y}{z}\right)\hat{i} - \left(\frac{20x}{z}\right)\hat{j} - \left(\frac{20xy}{z^2}\right)\hat{k}$
(D) $\left(\frac{20y}{z}\right)\hat{i} + \left(\frac{20x}{z}\right)\hat{j} - \left(\frac{20xy}{z^2}\right)\hat{k}$

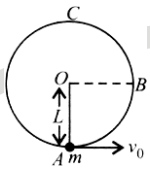
20. A bolt of mass 0.2 kg falls from the ceiling of an elevator moving down with an uniform speed of 5 m s^{-1}. It hits the floor of the elevator (length of the elevator = 5 m) and does not rebound. The amount of heat produced by the impact is (Take g = 10 m s^{-2})
(A) 5 J (B) 10 J
(C) 15 J (D) 20 J

21. Consider a one-dimensional motion of a particle with total energy *E*. There are four regions A,B,C and D in which the relation between potential energy V, kinetic energy (K) and total energy E is as given below :
Region A:V > E
Region B:V<E
Region C:K>E
Region D:V>K
Which of the following regions the particle cannot be found ?
(A) Region A (B) Region B
(C) Region C (D) Region D

Space for Rough Work

22. A bob of mass m is suspended by a light string of length L. It is imparted a horizontal velocity v_0 at the lowest point.

A such that it completes a semicircular trajectory in the vertical plane with the string becoming slack only on reaching the topmost point, C.



Match the Column I with Column II

Column I		Column II	
(A)	Velocity v_0 is	(p)	3
(B)	Velocity at point B is	(q)	$\sqrt{gL}$
(C)	Velocity at point C is	(r)	$\sqrt{5gL}$
(D)	Ratio of kinetic energy at B and C is	(s)	$\sqrt{3gL}$

(A) A-p, B-q, C-s, D-r
(B) A-q, B-r, C-p, D-s
(C) A-r, B-s, C-q, D-p
(D) A-s, B-p, C-r, D-q

23. In a shotput event an athlete throws the shotput of mass 10 kg with an initial speed of 1 m s^{-1} at 45° from a height 1.5 m above ground. Assuming air resistance to be negligible and acceleration due to gravity to be 10 m s^{-2}, the kinetic energy of the shotput when it just reaches the ground will be

(A) 2.5 J (B) 5 J
(C) 52.5 J (D) 155 J

24. A particle of mass m is moving in a horizontal circle of radius r, under a centripetal force equal to $-(k/r^2)$ where k is constant. The total energy of the particle is

(A) $-\frac{k}{r}$ (B) $-\frac{k}{2r}$

(C) $\frac{k}{2r}$ (D) $\frac{2k}{r}$

25. A bullet of mass m moving horizontally with a velocity v strikes a block of wood of mass M and gets embedded in the block. The block is suspended from the ceiling by a massless string. The height to which block rises is

(A) $\frac{v^2}{2g}\left(\frac{m}{M+m}\right)^2$ (B) $\frac{v^2}{2g}\left(\frac{M+m}{m}\right)^2$

(C) $\frac{v^2}{2g}\left(\frac{m}{M}\right)^2$ (D) $\frac{v^2}{2g}\left(\frac{M}{m}\right)^2$

26. The bob of a pendulum is released from a horizontal position. If the length of pendulum is 2 m, what is the speed with which the bob arrives at the lower most point. Assume that 10% of its energy is dissipated against air resistance.

(Take g = 10 m s^{-2})

(A) 4 m s^{-1} (B) 6 m s^{-1}
(C) 8 m s^{-1} (D) 10 m s^{-1}

27. An adult weighing 600 N raises the centre of gravity of his body by 0.25 m while taking each step of 1 m length in jogging. If he jogs for 6 km, the energy utilised by him in jogging is

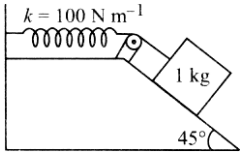
(A) 9×10^6 J (B) 9×10^5 J
(C) 6×10^6 J (D) 6×10^5 J

28. One man takes 1 minute to raise a box to a height of 1 metre and another man takes $\frac{1}{2}$ minute to do so. The energy of the two is

(A) different
(B) same
(C) energy of the first is more
(D) energy of the second is more

Space for Rough Work

29. A 1 kg block situated on a rough incline is connected to a spring of negligible mass having spring constant 100 N m^{-1} as shown in the figure.



The block is released from rest with the spring in the unstretched position. The block moves 10 cm down the incline before coming to rest. The coefficient of friction between the block and the incline is

(Take g = 10 m s^{-2} and assume that the pulley is frictionless)

(A) 0.2 (B) 0.3
(C) 0.5 (D) 0.6

30. Match the Column I with Column II.

Column I		Column II	
(A)	When a body does work against friction, its kinetic energy	(p)	independent of time
(B)	Work done by a body is	(q)	time
(C)	Power of a body varies inversely as	(r)	force must be conservative
(D)	When work done over a closed path is zero	(s)	decreases

(A) A-p, B-q, C-r, D-s
(B) A-q, B-r, C-s, D-p
(C) A-s, B-r, C-q, D-p
(D) A-s, B-p, C-q, D-r

31. An elevator can carry a maximum load of 1800 kg (elevator + passengers) is moving up with a constant speed of 2 m s^{-1}. The frictional force opposing the motion is 4000 N. What is minimum power delivered by the motor to the elevator ?

(A) 22 kW (B) 44 kW
(C) 66 kW (D) 88 kW

32. Water is flowing in a river at 2 ms^{-1}. The river is 50 m wide and has an average depth of 5 m. The power available from the current in the river is

(Density of water = 1000 kg m^{-3})

(A) 0.5 MW (B) 1 MW
(C) 1.5 MW (D) 2 MW

33. A spherical ball of mass m_1 collides head on with another ball of mass m_2 at rest. The collision is elastic. The fraction of kinetic energy lost by m_1 is

(A) $\frac{4m_1m_2}{(m_1+m_2)^2}$ (B) $\frac{m_1}{m_1+m_2}$

(C) $\frac{m_2}{m_1+m_2}$ (D) $\frac{m_1m_2}{(m_1+m_2)^2}$

34. A ball falls under gravity from a height of 10 m with an initial downward velocity *u*. It collides with the ground, losses 50% of its energy in collision and then rises back to the same height. The initial velocity *u* is

(A) 7 m s^{-1} (B) 25 m s^{-1}
(C) 14 m s^{-1} (D) 28 m s^{-1}

35. A ball of mass *m* moving with a speed $2v_0$ collides head-on with an identical ball at rest. If *e* is the coefficient of restitution, then what will be the ratio of velocity of two balls after collision ?

(A) $\frac{1-e}{1+e}$ (B) $\frac{1+e}{1-e}$

(C) $\frac{e-1}{e+1}$ (D) $\frac{e+1}{e-1}$

36. A ball of mass *M* falls from a height *h* on a floor which the coefficient of restitution is *e*. The height attained by the ball after two rebounds is

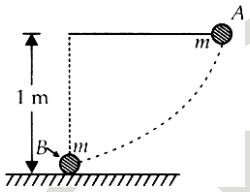
(A) e^2h (B) eh^2

(C) e^4h (D) $\frac{h}{e^4}$

Space for Rough Work

37. The bob A of a pendulum of mass m released from horizontal to the vertical hits another bob B of the same mass at rest on a table as shown in figure. If the length of the pendulum is 1 m, what is the speed with which bob B starts moving.

(Neglect the size of the bobs and assume the collision to be elastic) (Take g = 10 m s^{-2})



(A) 4.47 m s^{-1} (B) 5.47 m s^{-1}

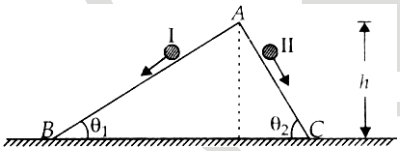
(C) 6.47 m s^{-1} (D) 3.47 m s^{-1}

38. A trolley of mass 200 kg moves with a uniform speed of 36 km h^{-1} on a frictionless track. A child of mass 20 kg runs on the trolley from on end to the other (10 m away) with a speed 4 m s^{-1} relative to the trolley in a direction opposite to its motion, and jumps out of the trolley. The final speed of the trolley is

(A) 8.4 m s^{-1} (B) 10.4 m s^{-1}

(C) 12.2 m s^{-1} (D) 14.6 m s^{-1}

39. Two inclined frictionless tracks, one gradual and the other steep meet at A from where two stones are allowed to slide down from rest, one on each track as shown in figure. Which of the following statements is correct ?



(A) Both the stones reach the bottom at the same time but not with the same speed.

(B) Both the stones reach the bottom with the same speed and stone I reaches the bottom earlier than stone II.

(C) Both the stones reach the bottom with the same speed and stone II reaches the bottom earlier than stone I.

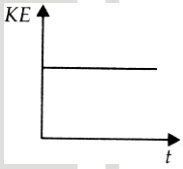
(D) Both the stones reach the bottom at different times and with different speeds.

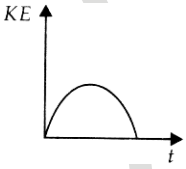
40. A body of mass 0.5 kg travels in a straight line with velocity $v = ax^{3/2}$ where $a = 5\ m^{-1/2}s^{-1}$. The work done by the net force during its displacement from x = 0 to x = 2 m is

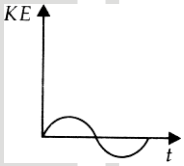
(A) 1.5 J (B) 50 J

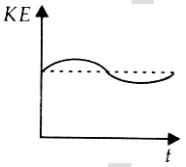
(C) 10 J (D) 100 J

41. Which of the diagrams shown in figure most closely shows the variation in kinetic energy of the earth as it moves once around the sun in its elliptical orbit ?

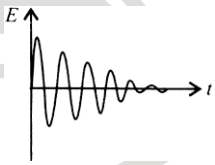
(A) 

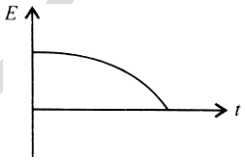
(B) 

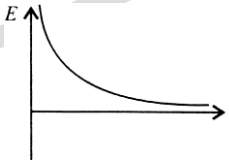
(C) 

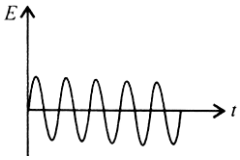
(D) 

42. Which of the diagrams shown in figure represents variation of total mechanical energy of a pendulum oscillating in air as function of time ?

(A) 

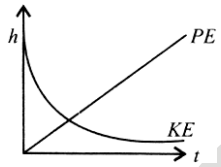
(B) 

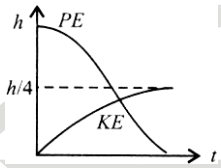
(C) 

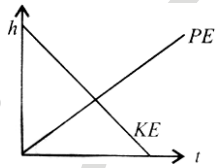
(D) 

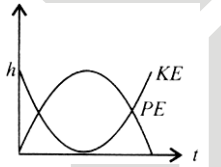
Space for Rough Work

43. A raindrop falling from a height *h* above ground, attains a near terminal velocity when it has fallen through a height $\left(\frac{3}{4}\right)h$. Which of the diagrams shown in figure correctly shows the change in kinetic and potential energy of the drop during its fall up to the ground ?

(A) 

(B) 

(C) 

(D) 

44. A spherical ball A of mass 4 kg, moving along a straight line strikes another spherical ball B of mass 1 kg at rest. After the collision, A and B move with velocities v_1 m s^{-1} and v_2 m s^{-1} respectively making angles of 30° and 60° with respect to the original direction of motion of A. The ratio $\frac{v_1}{v_2}$ will be

(A) $\frac{\sqrt{3}}{4}$ (B) $\frac{4}{\sqrt{3}}$

(C) $\frac{1}{\sqrt{3}}$ (D) $\sqrt{3}$

45. A cricket ball of mass 150 g moving with a speed of 126 km/h hits at the middle of the bat, held firmly at its position by the batsman. The ball moves straight back to the bowler after hitting the bat same velocity. Assuming that collision between ball and bat is completely elastic and the two remain in contact for 0.001 s, the force that the batsman had to apply to hold the bat firmly at its place would be

(A) 10.5 N (B) 21 N

(C) 1.05×10^4 N (D) 2.1×10^4 N

[CHEMISTRY]

46. The volume of ethyl alcohol (density 1.15 g/cc) that has to be added to prepare 100 cc of 0.5 M ethyl alcohol solution in water is

(A) 1.15 cc (B) 2 cc

(C) 2.15 cc (D) 2.30 cc

47. The normality of orthophosphoric acid having purity of 70% by weight and specific gravity 1.54 is

(A) 11 N (B) 22 N

(C) 33 N (D) 44 N

48. The molarity of H_2SO_4 solution, which has a density 1.84 g/cc at 35°C and contains 98% by weight is

(A) 1.84 M (B) 18.4 M

(C) 20.6 M (D) 24.5 M

49. Mole fraction of the solute in a 1.00 molal aqueous solution is

(A) 1.7700 (B) 0.1770

(C) 0.0177 (D) 0.0344

50. How many grams of sulphuric acid is to be dissolved to prepare 200 mL aqueous solution having concentration of $[H_3O^+]$ions 1 M at 25° temperature? (H = 1, O = 16, S = 32 mol^{-1})

(A) 4.9 g (B) 19.6 g

(C) 9.8 g (D) 0.98 g

51. 450 mg of glucose is dissolved in 100 g of solvent. What is the molality of solution ?

(A) 0.0025 m (B) 0.025 m

(C) 0.25 m (D) 2.5 m

52. Calculate the mass of urea (NH_2CONH_2) required in making 2.5 kg of 0.25 molal aqueous solution.

(A) 37.5 g (B) 73.5 g

(C) 53.7 g (D) 75.3 g

53. The molarity of a solution containing 5.0 g of NaOH in 250 mL solution is

(A) 0.1 M (B) 0.5 M

(C) 1.0 M (D) 2.0 M

Space for Rough Work

54. 25 g of a solute of molar mass 250 mol^{-1} is dissolved in 100 mL of water to obtain a solution whose density is 1.25 g mL^{-1}. The molarity and molality of the solution are respectively
(A) 0.75 and 1 (B) 0.8 and 1
(C) 1 and 0.8 (D) 1 and 0.75

55. The molarity of a solution obtained by mixing 800 mL of 0.5 M HCl with 200 mL of 1 M HCl will be
(A) 0.8 M (B) 0.6 M
(C) 0.4 M (D) 0.2 M

56. Common salt obtained from sea water contains 95% NaCl by mass. The approximate number of molecules present in 10.0 g of the salt is
(A) 10^{21} (B) 10^{22}
(C) 10^{23} (D) 10^{24}

57. An aqueous solution of 6.3 g of oxalic acid dihydrate is made up to 250 mL. The volume of 0.1 NaOH required to made up to completely neutralise 10 mL of this solution is
(A) 40 mL (B) 20 mL
(C) 10 mL (D) 4 mL

58. The volume of water to be added to 100 cm^3 of 0.5 N H_2SO_4 to get decinormal concentration is
(A) 400 cm^3 (B) 450 cm^3
(C) 500 cm^3 (D) 100 cm^3

59. An aqueous solution of glucose is 10% in strength. The volume in which 1 g mole of it is dissolved will be
(A) 18 L (B) 9 L
(C) 0.9 L (D) 1.8 L

60. Mole fraction of a solute in benzene is 0.2 then find molelity of solute.
(A) 3.2 (B) 2
(C) 4 (D) 3.6

61. Vapour pressure of chloroform ($CHCl_3$) and dichloro methane (CH_2Cl_2) at 25°C are 200 mm Hg and 41.5 mm Hg respectively. Vepour pressure of the solution obtained by mixing 25.5 g of $CHCl_3$ and 40 g of CH_2Cl_2 at the same temperature will be
(Molecular mass of $CHCl_3$ = 119.5 u and molecular mass of CH_2Cl_2 = 85 u)
(A) 173.9 mm Hg (B) 615.0 mm Hg
(C) 347.9 mm Hg (D) 90.63 mm Hg

62. The system that forms maximum boiling axeotrope is
(A) carbon disulphide - acetone
(B) benzene - toluene
(C) acetone - chloroform
(D) n-hexane - n-heptane

63. A solution of two liquids boils at a temperature more than the boiling point of either of them.
Hence, the binary solution shows
(A) negative deviation form Raoult's law
(B) positive deviation from Raoult's law
(C) no deviation from Raoult's law
(D) positive or negative deviation from Raoult's law depending upon the composition

64. Choose the correct statement.
(A) boiling point increases while vapour pressure decreases
(B) boiling point decreases while vapour pressure increases
(C) freezing point decreases while vapour pressure increases
(D) freezing point increases while vapour pressure decreases

65. An aqueous solution is 1.00 molal in KI. Which change will cause the vapour pressure of the solution to increases ?
(A) Addition of water
(B) Addition of NaCl
(C) Addition of Na_2SO_4
(D) Addition of 1.00 molal KI

66. The vapour pressure of pure solvent is 0.8 mm of Hg at a particular temperature. On addition of a non-volatile solute 'A' the vapour pressure of solution becomes 0.6 mm of Hg. The mole fraction of component 'A' is
(A) 0.25 (B) 0.75
(C) 0.5 (D) 0.35

Space for Rough Work

67. At a constant temperature, which of the following aqueous solutions will have the maximum vapour pressure ?

(Molecular weight NaCl = 58.5, H_2SO_4 = 9.8 g mol^{-1})

(A) 1 molal NaCl (aq)
(B) 1 molar NaCl (aq)
(C) 1 molal H_2SO_4(aq)
(D) 1 molar H_2SO_4(aq)

68. At 300 K two pure liquids A and B have vapour pressures respectively 150 mm Hg and 100 mm Hg. In an equimolar liquid mixture of A and B, the mole fraction of B in the vapour mixture at this temperature is

(A) 0.6 (B) 0.5
(C) 0.8 (D) 0.4

69. Vapour pressure of pure 'A' is 70 mm of Hg at 25°C. It forms an ideal solution with 'B' in which mole fraction of A is 0.8. If the vapour pressure of the solution is 84 mm of Hg at 25°C, the vapour pressure of pure 'B' at 25°C is

(A) 56 mm (B) 70 mm
(C) 140 mm (D) 28 mm

70. At 25°C, the total pressure of an ideal solution obtained by mixing 3 moles of 'A' and 2 moles of 'B', is 184 torr. What is the vapour pressure (in torr) of pure 'B' at the same temperature ? (Vapour pressure of pure 'A' at 25°C, is 200 torr).

(A) 180 (B) 160
(C) 16 (D) 100

71. To observe an elevation of boiling point of 0.05°C, the amount of a solute (molecular weight = 100) to be added to 100 g of water ($K_b = 0.5$) is

(A) 2 g (B) 0.05 g
(C) 1 g (D) 0.75 g

72. If α is the degree of dissociation of Na_2SO_4 the van't Hoff factor (i) used for calculating the molecular mass is

(A) $1+\alpha$ (B) $1-\alpha$
(C) $1+2\alpha$ (D) $1-2\alpha$

73. A solution of 1.25 of 'P' in 50 g of water lowers freezing point by 0.3°C. Molar mass of 'P' is 94.

$K_{f(water)}$ = 1.86 K kg mol^{-1}. The degree of association of 'P' in water is

(A) 80% (B) 60%
(C) 65% (D) 75%

74. Distribution law was given by

(A) Ostwald (B) Nernst
(C) Henry (D) vant's Hoff

75. 58.5 g of NaCl and and 180 of glucose were separately dissolved in 1000 ml of water. Identify the correct statement regarding the elevation of boiling point of the resulting solution

(A) NaCl solution will show higher elevation of bp
(B) glucose solution will show higher elevation of bp
(C) both the solution will show equal elevation of bp
(D) the bp elevation will be shown by neither of the solutions

76. 1×10^{-3} m solution of $Pt(NH_3)_4Cl_4$ in H_2O shows depression in freezing point by 0.0054°C. The structure of the compound will be(given $K_{sp}(H_2O)$ = 1.860 km^{-1})

(A) $[Pt(NH_3)_4]Cl_4$ (B) $[Pt(NH_3)_3Cl]Cl_3$
(C) $[Pt(NH_3)_2Cl_2]Cl_2$ (D) $[Pt(NH_3)Cl_3]Cl$

77. Dissolution of 1.5 g of a non-volatile solute (molecular weight = 60) in 250 g of a solvent reduces its freezing point by 0.01°C. Find the molal depression constant of the solvent.

(A) 0.01 (B) 0.001
(C) 0.0001 (D) 0.1

78. If the elevation in boiling point of a solution of 10 g of solute (molecular weight = 100) in 100 g of water is ΔT_b, the ebulliscopic constant of water is

(A) 10 (B) $100T_b$
(C) ΔT_b (D) $\frac{\Delta T_b}{10}$

Space for Rough Work

79. The boiling point of water is 100°C. What will be the boiling point of an aqueous solution containing 0.6 g of urea (molar mass = 60) in 100 g of water ?

(K_b for water = 0.52 K/m)

(A) 1000.052°C (B) 101.052°C
(C) 120.52°C (D) None of these

80. What is the freezing point of a solution containing 8.1 g HBr in 100 g water assuming the acid to be 90% ionised ?

(K_f for water = 1.86 K mol^{-1})

(A) 0.85°C (B) 3.53°C
(C) 0°C (D) – 0.35°C

81. The concentration (in mol/L) of the solution having osmotic pressure 0.0821 atm at 300 K will be

(A) 0.33 (B) 0.066
(C) 0.3×10^{-2} (D) 3

82. During the depression of freezing point experiment an equilibrium is established between the molecules of

(A) liquid solvent and solid solvent
(B) liquid solute and solid solvent
(C) liquid solute and solid solute
(D) liquid solvent and solid solute

83. A 6% solution of urea is isotonic with

(A) 0.05 M solution of glucose
(B) 6% solution of glucose
(C) 25% solution of glucose
(D) 1 M solution of glucose

84. van't Hoff factor more than unity indicates that the solute in solution is

(A) dissociated
(B) associated
(C) Both (a) and (b)
(D) canot say anything

85. The temperature at which 10% aqueous solution (w/V) of glucose will exhibit the osmotic pressure of 16.4 atm, is (R = 0.082 dm^3 atm K^{-1} mol^{-1})

(A) 360° (B) 180 K
(C) 90 K (D) 360 K

86. A solution containing 4 g of polyvinyl chloride polymer in 1 L of dioxane was found to have an osmotic pressure of 4.1×10^{-4} atm at 27°C. The approximate molecular weight of the polymer is

(A) 1500 (B) 10000
(C) 2.4×10^{5} (D) 2×10^{12}

87. Camphor is often used molecular mass determination because

(A) it is readily available
(B) it has a very high cryoscopic constant
(C) it is volatile nature
(D) it is solvent for organic substances

88. The degree of dissocation of XY in case of the following reaction is found to be 0.4 from vapour density measurement. If the observed vapour density of XY be 100 then its molecular weight is $XY \rightarrow X + Y$

(A) 140 (B) 70
(C) 280 (D) 210

89. A solution containing 10 g per dm^3 of urea (molecular mass = 60 g mol^{-1}) is isotonic with a 5% solution of a non-volatile solute. The molecular mass of this non-volatile solute is

(A) 250 g mol^{-1} (B) 300 g mol^{-1}
(C) 350 g mol^{-1} (D) 200 g mol^{-1}

90. Which of the following colligative properties can provide molar mass of proteins (or polymers or colloids) with greater precision ?

(A) Relative lowering of vapour pressure
(B) Elevation in boiling point
(C) Depression in freezing point
(D) Osmotic pressure

Space for Rough Work

[ZOOLOGY]

91. Protozoa like Amoeba that live in fresh water
(A) pump out excess water and salt through contractile vacuoles
(B) eliminate water and salt through cell membrane
(C) actually do not gain any water from the environment
(D) have contractile vacuole that pump out excess water

92. Animals living in fresh water
I. Do not drink water
II. Are covered by impervious body covering
III. Lose salts to the environment through ionocytes
(A) I only is correct
(B) I and II are correct
(C) II and III are correct
(D) I, II and III are correct

93. A terrestrial organism must
(A) conserve water
(B) have a large body size
(C) have a separate genitary and urinary system
(D) store large amount of water in alimentary canal

94. In humans small amount of uric acid is produced in metabolism of
(A) Urea (B) Creatinine
(C) Purines (D) Pyrimidines

95. Which of the following are ureotelic ?
(A) Mammals, most adult amphibians living on land, and many marine fish and turtles
(B) Mammals living on land but not aquatic mammals, most adult amphibians living on land, many marine fishes and turles
(C) All mammals, all amphibians and all marine fishes but not turtles
(D) All amniotes

96. Crocodiles excrete
(A) Ammonia and urea
(B) Ammonia and uric acid
(C) Urea and uric acid
(D) Ammonia, urea and uric acid

97. Flame cells / solenocytes are excretory organs of
(A) Platyhelminthes (B) Annelids
(C) Arthropods (D) Mollusks

98. Most crustaceans have a pair of specialized excretory structures called as
(A) Book lungs (B) Malphighian tubules
(C) Flame cells (D) Green gland

99. The vertebral levels that correspond to the location of the human kidney are
(A) T-10 to T-12 (B) L1 to L5
(C) T12 to L-2 (D) L4 to S1

100. Urine produced by each nephron empties into the collecting duct, which passes through a ..... into a ..... that drains urine into the .....
(A) Calyx, papilla, ureter
(B) Papilla, calyx, ureter
(C) Calyx, papilla, renal pelvis
(D) Papilla, calyx, renal pelvis

101. Which of the following is common to many nephrons?
(A) Bowman's capsule
(B) PCT
(C) DCT
(D) Collecting duct

102. In the epithelial cells lining the PCT,
(A) The apical membrane is thrown into many microvilli and mitochondria are concentrated near the basolateral surface
(B) The apical membrane is thrown into only a few microvilli and mitochondria are concentrated near the apical surface
(C) Microvilli are absent
(D) Many microvilli are present all around the cell and mitochondria are randomly distributed

103. The filtrates that are almost completely reabsorbed in the tubule do not include
(A) sugar (B) vitamins
(C) organic nutrients (D) water

104. The only mechanism for reabsorption of any protein present in the filtrate is by
(A) Passive diffusion (B) Pinocytosis
(C) Active transport (D) Facilitated diffusion

Space for Rough Work

105. About how many nephrons are present in each kidney?
(A) 1 lakh (B) 1 Million
(C) 2 million (D) 10 Million

106. The location of the kidney can be described as :
(A) Retroperitoneal (B) Retrosternal
(C) Intrapelvic (D) Epigastrium

107. The Renal plasma flow per minute is approximately
(A) 125 ml/min (B) 650 ml/min
(C) 1200 ml/min (D) 1500 ml/min

108. The net filtration pressure estimated in human kidney is about
(A) 20 mm Hg (B) 30 mm Hg
(C) 40 mm Hg (D) 60 mm Hg

109. The filtration fraction in humans is approximately
(A) 19% (B) 25%
(C) 33% (D) 50%

110. The normal blood urea level varies between
(A) < 1.0 mg / dL (B) 15-40 mg / dL
(C) 70-100 mg / dL (D) 100-140 mg / dL

111. The minimal amount of urine output required to eliminate urea normally produced in human body per day is about
(A) 1000 ml (B) 1500 ml
(C) 500 ml (D) 750 ml

112. Filtration slits are
(A) Pores in the vascular endothelium
(B) Fine cellular processes of podocytes (foot cells)
(C) Spaces between inter-digitations of foot cells
(D) Pores in the non cellular basement membrane

113. Angiotensinogen is secreted into the blood by
(A) Macula densa
(B) Juxta-glomerular cells
(C) Juxta-medullary nephrons
(D) Liver

114. Renin released by juxtaglomerular cells is a/an
(A) Proenzyme (B) Prohormone
(C) Enzyme (D) Hormone

115. Macula densa are
(A) Endothelium lining afferent and efferent arterioles
(B) Epithelium in DCT near afferent and efferent arterioles
(C) Specialized epithelium of thick segments of loop of Henle
(D) Specialized epithelium of PCT of the nephron

116. Macula densa are stimulated by
(A) Low concentration of Na^+ in the fluid in DCT
(B) Low concentration of Cl^- in the fluid in DCT
(C) High concentration of Na^+ in the fluid in DCT
(D) High concentration of Cl^- in the fluid in DCT

117. The part of the nephron that is least permeable to water is
(A) Thick segment of ascending limb of loop of Henle
(B) Thick segment of descending limb of loop of Henle
(C) Distal convoluted tubule
(D) Collecting duct

118. The normal plasma osmolality is about
(A) 100 mOsm / L (B) 200 mOsm / L
(C) 300 mOsm / L (D) 400 mOsm / L

119. 'Columns of Bertini' are
(A) Extensions of cortical tissue into medulla
(B) Extensions of medullary tissue into cortex
(C) Connection between testicular ducts and renal ducts
(D) Connection between ovarian and renal ducts

Space for Rough Work

120. Which of the following statements is correct ?
(A) Angiotensinogen causes vasoconstriction
(B) Renin is secreted by macula densa
(C) Aldosterone is produced by adrenal medulla
(D) ADH is secreted when plasma osmolality is increased.

121. Which one of the following is not a function of kidney?
(A) Regulation of blood pH
(B) Production of proteins from glucose
(C) Regulation of blood volume and blood pressure
(D) Regulation of RBC production

122. The main site of the action of aldosterone is the
(A) Collecting duct (B) DCT
(C) PCT (D) Loop of henle

123. The part of the nephron that is most important during concentration of urine is
(A) PCT
(B) Thick segment of ascending limb of loop of henle
(C) Hair pin bend of loop of Henle
(D) Collecting duct

124. The two kidneys of a human being are interconnected by
(A) Corpus renalis (B) Perinephric fat
(C) Bidders canals (D) None of these

125. The correct sequence of amino acids in the urea cycle is
(A) ORNITHINE $\rightarrow$ CITRULLINE $\rightarrow$ ARGININE
(B) ORNITHINE $\rightarrow$ ARGININE $\rightarrow$ CITRULLINE
(C) CITRULLINE $\rightarrow$ ORNITHINE $\rightarrow$ ARGININE
(D) CITRULLINE $\rightarrow$ TYROSINE $\rightarrow$ PHENYLALANINE

126. The maximum amount of water is reabsorbed by the
(A) PCT
(B) Descending limb of loop of Henle
(C) Ascending limb of loop of Henle
(D) DCT

127. Consider the following :
I. Myogenic mechanisms
II. Juxtaglomerular mechanism
III. Extrinsic neural control mechanism
Which of the above are involved in the regulation of GFR?
(A) I, II and III (B) I and III
(C) I and II (D) II and III

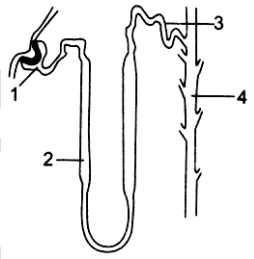
128. Consider the following part of a nephron :
I. Thick segment of descending limb of loop of henle
II. Thin segment of descending limb of loop of henle
III. Thick segment of ascending limb of loop of henle
IV. DCT
Which of the above is/are nor lined by cuboidal epithelium ?
(A) I and III (B) II and IV
(C) II only (D) IV only

129. During urea cycle
(A) One molecule of ammonia & one molecule of CO_2 are eliminated
(B) Urea gets converted to ammonia
(C) Urea gets converted to uric acid
(D) Two molecules of ammonia & one molecule of CO_2 are excreted

130. The smooth muscle of urinary bladder involved in mictuirition is
(A) Sartorius (B) Cremaster
(C) Trygon (D) Detrussor

131. Deamination in the liver initially produces
(A) ammonia (B) arginine
(C) ornithine (D) urea

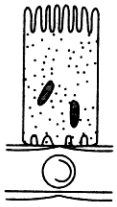
132. Study the following diagram of the human nephron:



In which region, the fluid can first be called as urine under normal physiological conditions ?
(A) 1 (B) 2
(C) 3 (D) 4

Space for Rough Work

133. What part of the human nephron is represented in the following diagram ?



(A) PCT (B) DCT
(C) Loop of henle (D) Collecting duct

134. The main site for the reabsorption of the amino acids in the human nephron is the :
(A) PCT (B) DCT
(C) Loop of Henle (D) Collecting duct

135. In diabetes insipidus :
(A) concentrated urine is produced by the kidneys
(B) concentrated urine with glycosuria will be produced by the kidneys
(C) dilute urine with glycosuria will be produced by the kidneys
(D) dilute urine without glycosuria will be produced by the kidneys.

[BOTANY]

136. Who is called father of plant physiology ?
(A) Calvin (B) J.C. Bose
(C) Stephen Hales (D) Van Helmont

137. In terms of permeability, the cell wall and plasmalemma are :
(A) Permeable and differentially permeable
(B) Both semipermeable
(C) Semipermeable and differentially permeable
(D) Both differentially permeable

138. If the cell is placed in hypertonic solution, what will happen ?
(A) Endosmosis (B) Exosmosis
(C) Deplasmolysis (D) No change

139. Diffusion pressure of pure solvent is :
(A) Always more than its solution
(B) Sometimes more than its solution
(C) Less than its solution
(D) Equal to its solution

140. What will be zero in a fully turgid cell ?
(A) T.P. (B) W.P.
(C) S.P. (D) O.P.

141. In a flaccid cell :
(A) S.P. = 0 (B) S.P. = O.P.
(C) S.P. > O.P. (D) S.P. < O.P.

142. Seeds when placed in water swell because of :
(A) Osmosis (B) Root pressure
(C) Imbibition (D) Diffusion

143. Cell A with O.P. = 6 and W.P. = 5 is surrounded by the cells with O.P. = 3 and T.P. = 2, what will be direction of water movement ?
(A) From A to other cells
(B) From other cells to A
(C) No movement
(D) Water will move up

144. What determines the diffusion of water from one cell to other cell ?
(A) O.P. (B) W.P.
(C) D.P.D (D) T.P.

145. The soil is physiologically dry when :
(A) It has no hygroscopic water
(B) Conc. of soil solution is higher than cell
(C) Soil temp. is 4°C
(D) Excess of CO_2 in soil

146. Root pressure is measured by
(A) Potometer (B) Barometer
(C) Manometer (D) Auxanometer

147. Cohesion tension theory of ascent of sap was given by
(A) Curtis
(B) Dixon and Jolly
(C) Kramer and Kozlowski
(D) None of the above

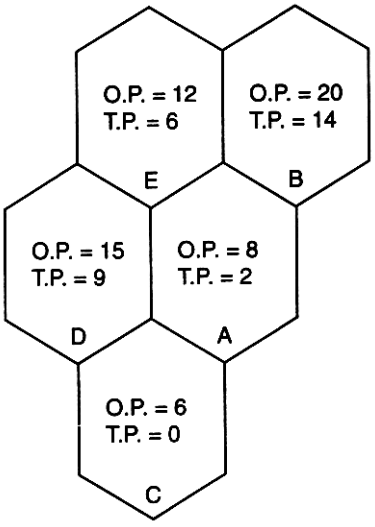
Space for Rough Work

148. Wilting occurs when :
(A) Phloem is blocked
(B) Xylem is blocked
(C) Both xylem and phloem are blocked
(D) A few roots are removed

149. The most widely accepted theory' of ascent of sap is:
(A) Capillary force theory
(B) Atmospheric pressure theory
(C) Pulsating action of living cells
(D) Transpiration pull and cohesion tension theory

150. Many transplanted plants do not survive due to :
(A) They do not like new soil
(B) They do not get required mineral salt
(C) Most of the root hairs are lost during transplantation
(D) Leaves get damaged

151. In the following diagram, if the T.P. of cell B increases to 18, what would be the changes with regard to water movement ?



(A) A, C, D and E absorb water from B
(B) Water diffuses into B
(C) B actively absorbs water from neighbouring cells
(D) No movement

152. The osmotic potential of a solution is denoted by the symbol :
(A) ψ_x (B) $\Delta\psi$
(C) ψ_p (D) ψ_s

153. Transpiration–cohesion–tension theory operates in :
(A) Active absorption
(B) Passive absorption
(C) Both active and passive
(D) None of these

154. Girdling experiment cannot be performed in sugarcane because :
(A) It cannot withstand injury
(B) Vascular bundles in it are scattered
(C) Phloem in it situated internal to xylem
(D) Sugarcane plants are too delicate

155. Water potential in a cell of root hair absorbing water is :
(A) Zero
(B) Less than zero
(C) More than zero
(D) More than that of soil water

156. At incipient plasmolysis, water potential (ψ_w) is equal to :
(A) $\psi_s + \psi_p$ (B) ψ_s
(C) $\psi_s + \psi_p + \psi_m$ (D) $\psi_p + \psi_m$

157. When water moves through a semipermeable membrane then which of the following pressure develops ?
(A) O.P. (B) S.P.
(C) T.P. (D) W.P.

158. Addition of a solute to pure water causes :
(A) Negative water potential
(B) More negative water potential
(C) Positive water potential
(D) More positive water potential

Space for Rough Work

159. What will be the direction of net osmotic movement of water if a solution 'A', enclosed in a semipermeable membrane, having an osmotic potential of –30 bars and turgor pressure of 5 bars is submerged in a solution 'B' with an osmotic potential of –10 bars and 0 turgor pressure ?
(A) Equal movement in both directions
(B) B to A
(C) No movement
(D) A to B

160. Change in diffusion pressure of a pure solvent when it is added with a solute is called :
(A) Osmosis (B) Diffusion
(C) Active transport (D) All of these

161. The risk of spoilage is less in salted pickles because of :
(A) Guttation (B) Plasmolysis
(C) Imbibition (D) Diffusion

162. When a plasmolysed cell is placed in a hypotonic solution then water will move inside the cell. Which force causes this ?
(A) D.P.D. (B) O.P.
(C) W.P. (D) None of these

163. O.P. of a solution is :
(A) Greater than pure solvent
(B) Less than pure solvent
(C) Equal to the pure solvent
(D) Less than or greater than pure solvent

164. A sufficient atmospheric pressure required to push the water upto the top of tall plants must be :
(A) 6 atm (B) 2 atm
(C) 20 atm (D) all of these

165. The continuity of water column in xylem is maintained due to :
(A) Evaporation of water
(B) Cohesive property of water
(C) Presence of air bubbles
(D) None of the above

166. When plant cell wall is kept in saline drip, cell :
(A) Decreases in size
(B) Bursts out
(C) Increases in size
(D) Remains unchanged

167. If water enters in a cell, the pressure exerted by its swollen protoplast is :
(A) Turgor pressure
(B) D.P.D.
(C) Osmotic pressure
(D) Imbibition

168. Which of the following maintains the shape of the cell?
(A) Osmotic pressure
(B) Turgor pressure
(C) Wall pressure
(D) Osmosis

169. The values of osmotic potential (π) and pressure potential (p) of cells A, B, C and D are given below :

	(π)	**(p)**
Cell A	–1.0	0.5
Cell B	–0.6	0.3
Cell C	–1.2	0.6
Cell D	–0.8	0.4

Identify the correct sequence that shows the path of movement of water from among the following :
(A) $D \rightarrow C \rightarrow A \rightarrow B$ (B) $B \rightarrow D \rightarrow A \rightarrow C$
(C) $B \rightarrow C \rightarrow D \rightarrow A$ (D) $C \rightarrow B \rightarrow A \rightarrow D$

170. The potential energy of water is referred as :
(A) Water potential (B) Osmotic potential
(C) Gravity potential (D) Pressure potential

171. Water can be absorbed from a hypertonic external solution by :
(A) Adding more water in the external solution
(B) Auxin treated cells
(C) Adding a buffer in the external solution
(D) Cytokinin treated cells

Space for Rough Work

172. Which is incorrect ?
(A) Diffusion is movement of particles from low electrochemical potential to high electrochemical potential
(B) Rate of diffusion is directly proportional to concentration
(C) Rate of diffusion is inversely proportional to distance
(D) Example of diffusion is opening of a bottle of scent in one corner

173. The magnitude of root pressure ranges between :
(A) 2 – 5 atm (B) 1 – 5 atm
(C) 0.1 – 0.2 atm (D) 4 – 6 atm

174. Which of the following has the highest water potential?
(A) 1 M salt solution
(B) 1 M sugar solution
(C) Distilled water
(D) 1 M sugar solution with 2–3 bars pressure applied to it.

175. Two cells 'A' and 'B' are contiguous. Cell 'A' has osmotic pressure 10 atm, turgor pressure –7 atm and diffusion pressure deficit 3 atm cell 'B' has osmotic pressure 8 atm, turgor pressure 3 atm and diffusion pressure deficit 5 atm. The result will be :
(A) No movement of water
(B) Equilibrium between the two
(C) Movement of water from cell 'A' to 'B'
(D) Movement of water from cell 'B' to 'A'

176. If flowers are cut and dipped in dilute NaCl solution, then:
(A) Transpiration is low
(B) Endosmosis occurs
(C) No bacterial growth takes place
(D) Absorption of solute inside flower cell takes place

177. In plants, water supply is due to :
(A) Osmosis (B) Imbibition
(C) Guttation (D) Adhesion force

178. Which of the following plant material is an efficient water imbibant ?
(A) Lignin (B) Pectin
(C) Agar (D) Cellulose

179. Active transport :
(A) Releases energy
(B) Requires energy
(C) Produces energy
(D) Produces a toxic substance

180. Which of the following would be in insignificant amount in the xylem sap ?
(A) Phosphate (B) Water
(C) Sugar (D) Nitrate

❑ ❑ ❑

Space for Rough Work