# HORIZON ACADEMY®

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## Medical | IIT-JEE | Foundations

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Name.: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Date : 27/09/2015

Test No.: 0 7

Subject Code.: 2 2 2

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

# HORIZON TEST SERIES

for

## Medical Entrance Exam. 2016

**[ Test No. 7 Batch I ]**

## 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 not 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. 7

## Topics of The Test

| | |
|---|---|
| **Physics** | Vectors + Laws of Motion |
| **Chemistry** | Solid state |
| **Biology** | Zoology : Circulation.<br>Botany : Photosynthesis, Respiration and Molecular Biology. |

# Test No. 7

## [PHYSICS]

1. Given $A = 2\hat{i} + 3\hat{j}$ and $B = \hat{i} + \hat{j}$. The component of vector A along vector B is

(A) $\frac{1}{\sqrt{2}}$ (B) $\frac{3}{\sqrt{2}}$

(C) $\frac{5}{\sqrt{2}}$ (D) $\frac{7}{\sqrt{2}}$

2. For any two vectors A and B, if $A \cdot B = |A \times B|$, the magnitude of C = A + B is equal to

(A) $\sqrt{A^2 + B^2}$ (B) A + B

(C) $\sqrt{A^2 + B^2 + \frac{AB}{\sqrt{2}}}$ (D) $\sqrt{A^2 + B^2 + \sqrt{2}AB}$

3. A variable force, given by the two dimensional vector $F = (3x^2\hat{i} + 4\hat{j})$, acts on a particle. The force is in newton and x is in metre. What is the change in the kinetic energy of the particles 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

4. A particle moves from position $3\hat{i} + 2\hat{j} + 6\hat{k}$ to $14\hat{i} + 13\hat{j} + 9\hat{k}$ due to a uniform force of $4\hat{i} + \hat{j} + 3\hat{k}$ N. Find the work done, if the displacement is in metre.

(A) 16 J (B) 64 J

(C) 32 J (D) 48 J

5. If a vector $2\hat{i} + 3\hat{j} + 8\hat{k}$ is perpendicular to the vector $4\hat{j} - 4\hat{i} + \alpha\hat{k}$, then the value of $\alpha$ is

(A) – 1 (B) $\frac{1}{2}$

(C) $-\frac{1}{2}$ (D) 1

6. The position vector of a particle is

$r = (a\cos\omega t)\hat{i} + (a\sin\omega t)\hat{j}$

The velocity vector of the particle is

(A) parallel to position vector
(B) perpendicular to position vector
(C) directed towards the origin
(D) directed away from the origin

7. If $|A \times B| = \sqrt{3}A \cdot B$, then the value of |A + B| is

(A) $(A^2 + B^2 + AB)^{1/2}$

(B) $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$

(C) A + B

(D) $(A^2 + B^2 + \sqrt{3}AB)^{1/2}$

8. A river is flowing from west to east with a speed of 5 m $min^{-1}$. A man can swim in still water with a velocity 10 m $min^{-1}$. In which direction should the man swim so as to take the shortest possible path to go to the south ?

(A) 30° east of south
(B) 60° east of south
(C) 60° west of south
(D) 30° west of north

**Space for Rough Work**

9. A boat moves with a speed of 5 km $h^{-1}$ relative to water in a river flowing with a speed of 3 $kmh^{-1}$ and having a width of 1 km. The time taken around a round trip is
(A) 5 min (B) 60 min
(C) 20 min (D) 30 min

10. Two vectors are perpendicular, if
(A) $A \cdot B = 1$ (B) A × B = 0
(C) $A \cdot B = 0$ (D) $A \times B = AB$

11. A car moving with a speed of 50 km/h can be stopped by brakes, over a distance of 6 m. If the same car is moving at a speed of 100 km/h, the stopping distance is
(A) 12 m (B) 18 m
(C) 6 m (D) 24 m

12. In non-inertial frame, the second law of motion is written as
(A) $\vec{F} = m\vec{a}$ (B) $\vec{F} = m\vec{a} + \vec{F}_P$
(C) $\vec{F} = m\vec{a} - \vec{F}_P$ (D) $\vec{F} = 2m\vec{a}$
where, $\vec{F}_P$ is pseudo force while $\vec{a}$ is the acceleration of the body relative to non-inertial frame.

13. A man of mass 60 kg is riding in a lift. The weight of the man, when the lift is accelerating upwards and downwards at 2 $ms^{-2}$, are respectively
(Taking g = 10 $ms^{-2}$)
(A) 720 N and 480 N
(B) 480 N and 720 N
(C) 600 N and 600 N
(D) None of the above

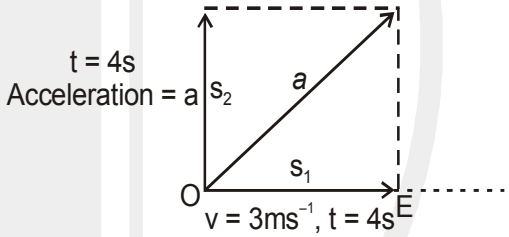
14. The x and y-coordinates of a particle at any time *t* are given by $x = 7t + 4t^2$ and y = 5t, where x and y are in metre and *t* is in second. The acceleration of the particle at t = 5 s is
(A) Zero (B) 8 $ms^{-2}$
(C) 20 $ms^{-2}$ (D) 40 $ms^{-2}$

15. A ball of mass 0.5 kg is moving with a velocity $v$ of 2$ms^{-1}$. It is subjected to a force of *x* Newton in 2s. Because of this force, the ball moves with a velocity of 3$ms^{-1}$. The value of *x* is
(A) 5 N (B) 8.25 N
(C) 0.25 N (D) 1 N

16. A force $F_1$ of 500 N is required to push a car of mass 1000 kg slowly at constant speed on a leveled road. If a force $F_2$ of 1000 N is applied, the acceleration of the car will be
(A) zero (B) 1.5 $ms^{-2}$
(C) 1 $ms^{-2}$ (D) 0.5 $ms^{-2}$

17. A ball hits a vertical wall horizontally at 10 m/s and bounces back at 10 m/s, then
(A) there is no acceleration because 10 m/s – 10 m/s = 0
(B) there may be an acceleration because its initial direction is horizontal
(C) there is an acceleration because there is a momentum change
(D) even though there is no change in momentum there is a change in direction. Hence, it has an acceleration.

18. A body of mass 2 kg has an initial velocity of 3 $ms^{-1}$ along OE and it is subjected to a force of 4 N in a direction perpendicular to OE. The distance of body from O after 4 s will be



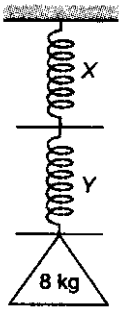

(A) 12 m (B) 20 m
(C) 8 m (D) 48 m

19. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m. If a force P is applied at the free end of the rope, the force exerted by the rope on the block is
(A) $\frac{Pm}{M+m}$ (B) $\frac{Pm}{M-m}$
(C) P (D) $\frac{PM}{M+m}$

**Space for Rough Work**

20. A coin is dropped in a lift. It takes time $t_1$ to reach the floor when lift is stationary. It takes time $t_2$ when lift is moving up with constant acceleration. Then
(A) $t_1 > t_2$ (B) $t_2 > t_1$
(C) $t_1 = t_2$ (D) $t_1 >> t_2$

21. A body of mass 8 kg is suspended through two light springs X and Y connected in series as shown in figure. The readings in X and Y respectively are




(A) 8 kg, zero (B) zero, 8 kg
(C) 6 kg, 2 kg (D) 8 kg, 8 kg

22. Same force acts on two bodies of different masses 3 kg and 5 kg initially at rest. The ratio of times required to acquire same final velocity is
(A) 5 : 3 (B) 25 : 9
(C) 9 : 25 (D) 3 : 5

23. The mass of ship is $2 \times 10^7$ kg. On applying a force of $25 \times 10^5$ N, it is displaced through 25 m. After the displacement, the speed aquired by the ship will be
(A) 12.5 $ms^{-1}$ (B) 5 $ms^{-1}$
(C) 3.7 $ms^{-1}$ (D) 2.5 $ms^{-1}$

24. A ball of mass *m* moves with speed $\nu$ and it strikes normally with a wall and reflected back normally. If its time of contact with wall is *t*, then find force exerted by ball on the wall.
(A) $\frac{2m\nu}{t}$ (B) $\frac{m\nu}{t}$
(C) $m\nu t$ (D) $\frac{m\nu}{2t}$

25. A ball of mass 150 g moving with an acceleration 20 $ms^{-2}$ is hit by a force, which acts on it for 0.1 s. The impulsive force is
(A) 0.5 N-s (B) 0.1 N-s
(C) 0.3 N-s (D) 1.2 N-s

26. A particle of mass *m* is projected with velocity $\nu$ making an angle of 45° with the horizontal. When the particle lands on the level ground the magnitude of the change in its momentum will be
(A) $2m\nu$ (B) $\frac{m\nu}{\sqrt{2}}$
(C) $m\nu\sqrt{2}$ (D) zero

27. Sand is being dropped on a conveyor belt at the rate of M $kgs^{-1}$. The force necessary to keep the belt moving with a constant velocity of $\nu$ $ms^{-1}$ will be
(A) $M\nu$ Newton (B) $2M\nu$ Newton
(C) $\frac{M\nu}{2}$ Newton (D) Zero

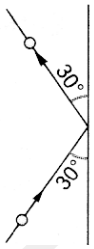
28. A Machine gun is mounted on a 200 kg vehicle on horizontal smooth road (friction negligible). The gun fires 10 bullets/s with a velocity of 500 $ms^{-1}$. If the mass of each bullet be 10 g, what is the acceleration produced in the vehicle ?
(A) 25 cm $s^{-2}$ (B) 30 cm $s^{-2}$
(C) 40 cm $s^{-2}$ (D) 50 cm $s^{-2}$

29. Diwali rocket is ejecting 50 g of gases/s at a velocity of 400 $ms^{-1}$. The accelerating force on the rocket will be
(A) 22 dyne (B) 20 N
(C) 20 dyne (D) 100 N

30. A disc of mass 100 g is kept floating horizontally in air by firing bullets, each of mass 5 g with the same velocity at the same rate of 10 bullets per second. The bullets rebound with the same speed in opposite direction, the velocity of each bullet at the time of impact is
(A) 196 cm $s^{-1}$ (B) 9.8 cm $s^{-1}$
(C) 98 cm $s^{-1}$ (D) 980 cm $s^{-1}$

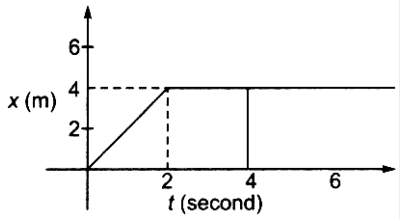
**Space for Rough Work**

31. A 0.5 kg ball moving with a speed of 12 $ms^{-1}$ strikes a hard wall at an angle of 30° with the wall. It is reflected with the same speed and at the same angle. If the ball is in contact with the wall for 0.25 s, the average force acting on the wall is




(A) 48 N (B) 24 N
(C) 12 N (D) 96 N

32. In the figure given the position-time graph of a particle of mass 0.1 kg is shown. The impulse at t = 2s is




(A) 0.2 kg-$ms^{-1}$ (B) –0.2 kg-$ms^{-1}$
(C) 0.1 kg-$ms^{-1}$ (D) – 0.4 kg-$ms^{-1}$

33. A 5000 kg rocket is set for vertical firing. The exhaust speed is 800 $ms^{-1}$. To give an initial upward acceleration of 20 $ms^{-2}$, the amount of gas ejected per second to supply the needed thrust will be
(A) 137.5 $kgs^{-1}$ (B) 185.5 $kgs^{-1}$
(C) 127.5 $kgs^{-1}$ (D) 187.5 $kgs^{-1}$

34. The resultant of two forces acting at an angle of 120° is 10 kg-wt and is perpendicular to one of the forces. That force is
(A) $10\sqrt{3}$ kg-wt (B) $20\sqrt{3}$ kg-wt
(C) 10 kg-wt (D) $\frac{10}{\sqrt{3}}$ kg-wt

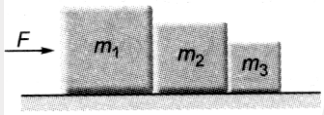
35. The square of resultant of two equal forces is three times their product. Angle between the forces is
(A) $\pi$ (B) $\pi/2$
(C) $\pi/4$ (D) $\pi/3$

36. Two equal forces are acting at a point with an angle of 60° between them. If the resultant force is equal to $40\sqrt{3}$ N, the magnitude of each force is
(A) 40 N (B) 20 N
(C) 80 N (D) 30 N

37. Two forces of 12 N and 8 N act upon a body. The resultant force on the body has a maximum value of
(A) 4 N (B) 0 N
(C) 20 N (D) 8 N

38. An object is moving on a plane surface with uniform velocity 10 $ms^{-1}$ in presence of a force 10 N. The frictional force between the object and the surface is
(A) 1 N (B) –10 N
(C) 10 N (D) 100 N

39. Three blocks of masses $m_1$, $m_2$ and $m_3$ kg are placed in contact with each other on a frictionless table. A force F is applied on the heaviest mass $m_1$; the acceleration of $m_3$ will be

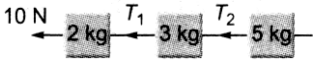



(A) $\frac{F}{m_1}$ (B) $\frac{F}{m_1+m_2}$
(C) $\frac{F}{m_2+m_3}$ (D) $\frac{F}{m_1+m_2+m_3}$

40. Masses m and M on pulley move 0.6 m in 4 s. What is ratio of $\frac{m}{M}$?
(A) $\frac{55}{57}$ (B) $\frac{113}{117}$
(C) $\frac{57}{55}$ (D) $\frac{397}{403}$

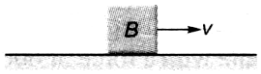
**Space for Rough Work**

41. Three blocks of masses 2 kg, 3 kg and 5 kg are connected to each other with light string and are then placed on a frictionless surface as shown in the figure. The system is pulled by a force F = 10 N, then tension $T_1$ is equal to



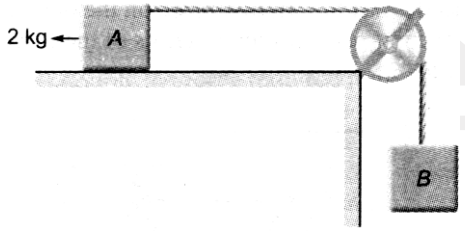

(A) 1 N (B) 5 N
(C) 8 N (D) 10 N

42. A block B is pushed momentarily along a horizontal surface with an initial velocity $v$. If $\mu$ is the coefficient of sliding friction between B and the surface, block B will come to rest after a time




(A) $\frac{v}{g\mu}$ (B) $\frac{g\mu}{v}$
(C) $\frac{g}{v}$ (D) $\frac{v}{g}$

43. The coefficient of static friction $\mu_s$, between block A of mass 2 kg and the table as shown in the figure is 0.2. What would be the maximum mass value of block B so that the two blocks do not move ? The string and the pulley are assumed to be smooth and massless ($g = 10\ ms^{-2}$)




(A) 2.0 kg (B) 4.0 kg
(C) 0.2 kg (D) 0.4 kg

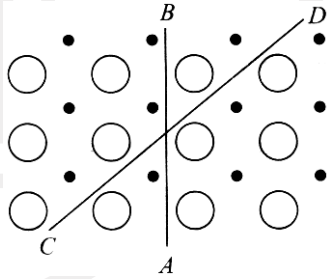
44. A solid sphere rolls down two different inclined planes of same height, but of different inclinations. In both cases
(A) speed and time of descent will be same
(B) speed will be same, but time of descent will be different
(C) speed will be different, but time of descent will be same
(D) speed and time of descent both are different.

45. A cannon of mass 1000 kg, located at the base of an inclined plane fires a shell of mass 100 kg in a horizontal direction with a velocity 180 $kmh^{-1}$. The angle of inclination of the inclined plane with the horizontal is 45°. The coefficient of friction between the cannon and the inclined plane is 0.5. The height, in metre, to which the cannon ascends the inclined plane as a result of the recoil is ($g = 10\ ms^{-2}$)

(A) $\frac{7}{6}$ (B) $\frac{5}{9}$
(C) $\frac{2}{6}$ (D) $\frac{1}{6}$

## [CHEMISTRY]

46. Study the figure of a solid given below depicting the arrangement of particles. Which is the most appropriate term used for the figure ?




(A) Isotropy (B) Anisotropy
(C) Irregular shape (D) Amorphous nature

**Space for Rough Work**

47. Ionic solids conduct electricity in molten state but not in solid state because

(A) in molten state free ions are furnished which are not free to move in solid state

(B) in solid state ionic solids are hard, brittle and become soft in molten state

(C) all solids conduct electricity in molten state

(D) in solid state ions are converted to atoms which are insulators.

48. Examples of few solids are given below. Find out the example which is not correctly matched.

(A) Ionic solids - NaCl, ZnS

(B) Covalent solids - $H_2$, $I_2$

(C) Molecular solids - $H_2O_{(s)}$

(D) Metallic solids - Cu, Sn

49. Which of the following statements is not correct about molecular crystals ?

(A) They are generally soft and easily compressible.

(B) They are good conductors of electricity as the electrons are delocalised in the bonds.

(C) They have low melting and boiling points.

(D) They consist of polar or non-polar molecules.

50. Monoclinic sulphur is an example of monoclinic crystal system. What are the characteristics of the crystal system ?

(A) $a \neq b \neq c, \alpha = \beta = \gamma = 90°$

(B) $a \neq b \neq c, \alpha \neq \beta \neq \gamma \neq 90°$

(C) $a = b \neq c, \alpha = \beta = \gamma = 90°$

(D) $a \neq b \neq c, \alpha = \gamma = 90°, \beta \neq 90°$

51. In the table given below, dimensions and angles of various crystals are given. Complete the table by filling the blanks.

| | Type of crystal | Dimensions | Angles |
|---|---|---|---|
| 1. | Cubic | $a = b = c$ | $\alpha = \beta = \gamma =$ ___p___ |
| 2. | Tetragonal | ___q___ | $\alpha = \beta = \gamma = 90°$ |
| 3. | Orthorhombic | $a \neq b \neq c$ | ___r___ |
| 4. | Hexagonal | ___s___ | $\alpha = \beta = 90°, \gamma =$ ___t___ |

| | *p* | *q* | *r* | *s* | *t* |
|---|---|---|---|---|---|
| (A) | 90° | $a = b \neq c$ | $\alpha = \beta = \gamma = 90°$ | $a = b \neq c$ | 120° |
| (B) | 120° | $a = b = c$ | $\alpha = 90°, \beta = \gamma = 120°$ | $a \neq b \neq c$ | 90° |
| (C) | 90° | $a \neq b = c$ | $\alpha = \beta = \gamma = 120°$ | $a \neq b \neq c$ | 90° |
| (D) | 120° | $a \neq b \neq c$ | $\alpha \neq \beta \neq \gamma \neq 90°$ | $a \neq b = c$ | 120° |

52. Which type of crystals contain more than one Bravais lattice ?

(A) Hexagonal (B) Triclinic

(C) Rhombohedral (D) Monoclinic

53. Match the column I having type of lattice point and its contribution to one unit cell in column II and mark the appropriate choice.

| Column I (Lattice point) | | Column II (Contribution to one unit cell) | |
|---|---|---|---|
| (A) | Corner | (i) | 1 |
| (B) | Edge | (ii) | 1/8 |
| (C) | Face centre | (iii) | 1/4 |
| (D) | Body centre | (iv) | 1/2 |

(A) (A) → (ii), (B) → (i), (C) → (iii), (D) → (iv)

(B) (A) → (ii), (B) → (iii), (C) → (iv), (D) → (i)

(C) (A) → (i), (B) → (ii), (C) → (iv), (D) → (iii)

(D) (A) → (iii), (B) → (iv), (C) → (i), (D) → (ii)

**Space for Rough Work**

54. A cubic solid is made up of two elements P and Q. Atoms of P are present at the corners of the cube and atoms of Q are present at body centre. What is the formula of the compound and what are coordination numbers of P and Q ?

(A) $PQ_2$, 6 : 6 (B) $PQ$, 6 : 6

(C) $P_2Q$, 6 : 8 (D) $PQ$, 8 : 8

55. Coordination numbers of $Cs^+$ and $Cl^-$ in CsCl crystal are

(A) 8, 8 (B) 4,4

(C) 6,6 (D) 8,4

56. In $CaF_2$ type (fluorite structure) $Ca^{2+}$ ions form (A) structure and $F^-$ ions are present in all (B) voids. The coordination number of $Ca^{2+}$ is (C) and $F^-$ is (D) . (A), (B), (C) and (D) respectively are

| | A | B | C | D |
|---|---|---|---|---|
| (A) | ccp | octahedral | 8 | 4 |
| (B) | bcc | tetrahedral | 4 | 8 |
| (C) | ccp | tetrahedral | 8 | 4 |
| (D) | ccp | octahedral | 4 | 8 |

57. Match the column I with column II and mark the appropriate choice.

| Column I (Radius ratio) | | Column II (Coordination number) | |
|---|---|---|---|
| (A) | 0.155 - 0.225 | (i) | 4 |
| (B) | 0.225 - 0.414 | (ii) | 8 |
| (C) | 0.414 - 0.732 | (iii) | 3 |
| (D) | 0.732 - 1.0 | (iv) | 6 |

(A) (A) → (i), (B) → (ii), (C) → (iv), (D) → (iii)
(B) (A) → (ii), (B) → (iv), (C) → (i), (D) → (iii)
(C) (A) → (iv), (B) → (iii), (C) → (i), (D) → (ii)
(D) (A) → (iii), (B) → (i), (C) → (iv), (D) → (ii)

58. If the radius of an octahedral void is $r$ and radius of atoms in close packing is R, the relation between $r$ and R is

(A) $r = 0.414R$ (B) $R = 0.414r$

(C) $r = 2R$ (D) $r = \sqrt{2}R$

59. Which of the following statements is not correct about hexagonal close packing ?

(A) In hcp, atoms occupy 74% the available space.

(B) It is AB AB type packing in which third layer is aligned with the first layer.

(C) Be, Mg, Mo etc. are found to have hcp structure.

(D) The coordination number is 6.

60. A solid AB has a rock salt structure. If radius of cation $A^+$ is 120 pm, what is the minimum value of radius of $B^-$ anion ?

(A) 120 pm (B) 240 pm

(C) 290 pm (D) 360 pm

61. Which of the following structures is not correctly matched ?

(A) NaCl type - $Cl^-$ ions in ccp structure. $Na^+$ ions in half octahedral holes.

(B) ZnS type - $S^{2-}$ ions in ccp structure. $Zn^{2+}$ ions in alternate tetrahedral voids.

(C) $CaF_2$ type - $Ca^{2+}$ ions in ccp structure $F^-$ions in all tetrahedral voids.

(D) $Na_2O$ type - $O^{2-}$ ions in ccp structure. $Na^+$ ions in all tetrahedral holes.

62. In ccp arrangement the pattern of successive layers can be designated as

(A) AB AB AB (B) ABC ABC ABC

(C) AB ABC AB (D) ABA ABA ABA

63. If the distance between $Na^+$ and $Cl^-$ in NaCl crystal is 265 pm, the edge length of the unit cell will be

(A) 265 pm (B) 795 pm

(C) 132.5 pm (D) 530 pm

**Space for Rough Work**

64. Which of the following does not represent radius of the atom correctly ?

(i) Simple cubic cell : Radius $= \frac{a}{2}$

(ii) Face centred cubic cell : Radius $= \frac{a}{3\sqrt{3}}$

(iii) Body centred cubic cell : Radius $= \frac{\sqrt{3}}{4}a$

(A) (i) (B) (iii)

(C) (ii) (D) (i) and (ii)

65. The radii of $Na^+$ and $Cl^-$ ions are 95 pm and 181 pm respectively. The edge length of NaCl unit cell is

(A) 276 pm (B) 138 pm

(C) 552 pm (D) 415 pm

66. Total volume of atoms present in a *fcc* unit cell of a metal with radius *r* is

(A) $\frac{12}{3}\pi r^3$ (B) $\frac{16}{3}\pi r^3$

(C) $\frac{20}{3}\pi r^3$ (D) $\frac{24}{3}\pi r^3$

67. The fraction of the total volume occupied by the atoms present in a simple cube is

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{6}$

(C) $\frac{\pi}{3\sqrt{2}}$ (D) $\frac{\pi}{4\sqrt{2}}$

68. Relationship between atomic radius and the edge length a of a body-centred cubic unit cell is

(A) $r = a/2$ (B) $r = \sqrt{a/2}$

(C) $r = \frac{\sqrt{3}}{4}a$ (D) $r = \frac{3a}{2}$

69. An element crystallises in a structure having a fcc unit cell of an edge 200 pm. If 200 g of this element contains $24\times10^{23}$ atoms then its density is

(A) 41.66 g $cm^{-3}$ (B) 313.9 g $cm^{-3}$

(C) 8.117 g $cm^{-3}$ (D) 400 g $cm^{-3}$

70. How many lithium atoms are present in a unit cell with edge length 3.5 Å and density 0.53 g $cm^{-3}$ ? (Atomic mass of Li = 6.94)

(A) 2 (B) 1

(C) 4 (D) 6

71. The distance between $Na^+$ and $Cl^-$ ions in NaCl with a density 2.165 g $cm^{-3}$ is

(A) 564 pm (B) 282 pm

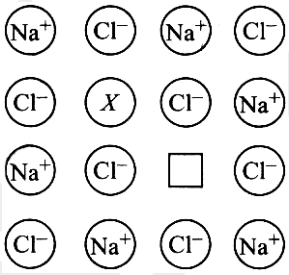
(C) 234 pm (D) 538 pm

72. A metal crystallises in a bcc lattice. Its unit cell edge length is about 300 pm and its molar mass is about 50 g $mol^{-1}$. What would be the density of the metal ?

(A) 6.2 g $cm^{-3}$ (B) 3.1 g $cm^{-3}$

(C) 9.3 g $cm^{-3}$ (D) 12.4 g $cm^{-3}$

73. In the given crystal structure what should be the cation X which replaces $Na^+$ to create a cation vacancy ?

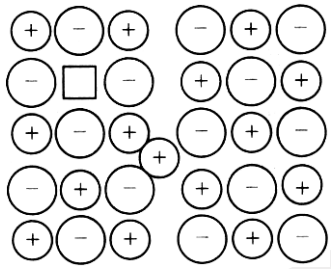



(A) $Sr^{2+}$ (B) $K^+$

(C) $Li^+$ (D) $Br^-$

**Space for Rough Work**

74. Which is the defect represented by the given figure ?



(A) Schottky defect (B) Frenkel defect
(C) Vacancy defect (D) Interstitial defect

75. What type of stoichiometric defect is shown by ZnS?
(A) Schottky defect
(B) Frenkel defect
(C) Both Frenkel and Schottky defects
(D) Non-stoichiometric defect

76. Which of the following will have metal deficiency defect?
(A) NaCl (B) FeO
(C) KCl (D) ZnO

77. An electron trapped in an anion site in a crystal is called
(A) F-centre (B) Frenkel defect
(C) Schottky defect (D) interstitial defect

78. Experimentally it was found that a metal oxide has formula $M_{0.98}O$. Metal M, is present as $M^{2+}$ and $M^{3+}$ in its oxide. Fraction of the metal which exists as $M^{3+}$ would be
(A) 5.08% (B) 7.01%
(C) 4.08% (D) 6.05%

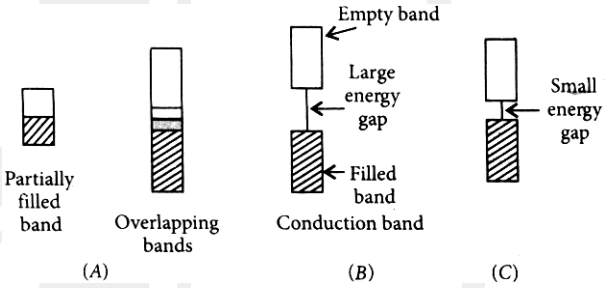
79. What is the effect of Frenkel defect on the density of ionic solids ?
(A) The density of the crystal increases.
(B) The density of the crystal decreases.
(C) The density of the crystal remains unchanged.
(D) There is no relationship between density of a crystal and defect present in it.

80. Zinc oxide loses oxygen on heating according to the reaction,

$$ZnO \xrightarrow{heat} Zn^{2+} + \frac{1}{2}O_2 + 2e^-$$

It becomes yellow on heating because
(A) $Zn^{2+}$ ions and electrons move to interstitial sites and F-centres are created
(B) oxygen and electrons move out of the crystal and ions become yellow
(C) $Zn^{2+}$ again combine with oxygen to give yellow oxide
(D) $Zn^{2+}$ are replaced by oxygen

81. Three types of bands are shown in the figures given below showing the position of the valence band and conduction band. The figures A, B and C represent




| | A | B | C |
|---|---|---|---|
| (A) | Non-metal | Metal | Semiconductor |
| (B) | Semiconductor | Insulator | Conductor |
| (C) | Metal | Insulator | Semiconductor |
| (D) | Insulator | Conductor | Semiconductor |

82. Which type of semiconductor is formed when germanium is doped in the gallium as indicated in the figure ?

| | | | | |
|---|---|---|---|---|
| (A) p-type semiconductor | Ge | Ge | Ge | Ge |
| (B) n-type semiconductor | Ge | Ge | Ga | Ge |
| (C) No change in conductivity | Ge | Ge | Ge | Ge |
| (D) It becomes superconductor | Ge | Ge | Ge | Ge |

**Space for Rough Work**

83. To get n-type of semiconductor, germanium should be doped with
(A) gallium (B) arsenic
(C) aluminium (D) boron

84. Which one of the following statements is wrong ?
(A) The conductivity of metals decreases with increase in temperature.
(B) The conductivity of semiconductors increases with increase in temperature.
(C) There is no superconductor at room temperature.
(D) Ionic solids conduct electricity due to presence of ions.

85. Which of the following shows correct range of conductivity ?
(i) Conductors : $10^4$ to $10^7$ $ohm^{-1}$ $m^{-1}$
(ii) Insulators : $10^{-6}$ to $10^4$ $ohm^{-1}m^{-1}$
(iii) Semiconductors : $10^{-10}$ to $10^{-6}$ $ohm^{-1}m^{-1}$
(A) (i) and (ii) (B) (i) only
(C) (ii) and (iii) (D) (i), (ii) and (iii)

86. The conductivity of intrinsic semiconductors can be increased by adding a suitable impurity. This process is called (P). This can be done with an impurity which is (Q) rich or deficient as compared to the semiconductor. Such impurities introduce (R) defects in them. Electron rich impurities result in (S) type semiconductors while electron deficit impurities result in (T) type semiconductors.

| | P | Q | R | S | T |
|---|---|---|---|---|---|
| (A) | doping | proton | point | p | n |
| (B) | doping | electron | non-stoichiometric | p | n |
| (C) | energy gap | charged | impurity | n | p |
| (D) | doping | electron | electronic | n | p |

87. Match the column I with column II and mark the appropriate choice.

| | Column I | | Column II |
|---|---|---|---|
| (A) | Fe in solid state | (i) | Electrolytic conductor |
| (B) | NaCl in molten state | (ii) | *p*-type semiconductor |
| (C) | $CO_2$ in solid state | (iii) | Electronic conductor |
| (D) | Si doped with aluminium | (iv) | Non-polar insulator |

(A) (A) → (iv), (B) → (ii), (C) → (i), (D) → (iii)
(B) (A) → (ii), (B) → (iii), (C) → (i), (D) → (iv)
(C) (A) → (iii), (B) → (i), (C) → (iv), (D) → (ii)
(D) (A) → (i), (B) → (iv), (C) → (iii), (D) → (ii)

88. Match the column I with column II and mark the appropriate choice.

| | Column I | | Column II |
|---|---|---|---|
| (A) | Ferromagnetic | (i) | ↑↑↓↑↑↓↑↑ |
| (B) | Ferrimagnetic | (ii) | ↑↓↑↓↑↓↑↓ |
| (C) | Antiferromagnetic | (iii) | ↑↑↑↑↑↑↑↑ |
| (D) | Diamagnetic | (iv) | ⇅⇅⇅⇅⇅ |
| (E) | Paramagnetic | (v) | ↖ ↙ → ↑ ↘ ↗ |

(A) (A) → (iii), (B) → (i), (C) → (ii), (D) → (iv), (E) → (v)
(B) (A) → (i), (B) → (ii), (C) → (iii), (D) → (iv), (E) → (v)
(C) (A) → (iv), (B) → (i), (C) → (iii), (D) → (ii), (E) → (v)
(D) (A) → (v), (B) → (iv), (C) → (iii), (D) → (ii), (E) → (i)

89. Ferrimagnetism is observed when the magnetic moments of the domains in the substance are
(A) oppositely oriented and cancel each other's magnetic moment.
(B) aligned in parallel and anti-parallel directions in unequal numbers
(C) randomly oriented and their magnetic moments get cancelled
(D) in same direction and get aligned in a magnetic field.

90. $Fe_3O_4$ is ferrimagnetic at room temperature but at 850 K, it becomes
(A) diamagnetic (B) ferrimagnetic
(C) paramagnetic (D) anti-ferromagnetic

**Space for Rough Work**

## [ZOOLOGY]

91. Match Column-I with Column-II and select the correct option from the codes given below :

| | Column-I | | Column-II |
|---|---|---|---|
| **A.** | Factor II | (i) | Thromboplastin |
| **B.** | Factor III | (ii) | Prothrombin |
| **C.** | Factor VIII | (iii) | Hageman factor |
| **D.** | Factor XII | (iv) | Antihaemophilic globulin |

(A) A–(iii), B–(iv), C–(ii), D–(i)
(B) A–(iv), B–(iii), C–(ii), D–(i)
(C) A–(ii), B–(i), C–(iv), D–(iii)
(D) A–(i), B–(ii), C–(iii), D–(iv)

92. Human blood maintains homeostasis in the internal environment of the body by
(1) replenishment of nutrients and oxygen and elimination of metabolic wastes from the extracellular fluid
(2) replenishment of oxygen and elimination of $CO_2$
(3) increasing the blood sugar level and conversion of urea into amino acids and destruction of wornout RBCs
(4) maintenance of ion concentration in the blood and body fluids by eliminating nitrogenous wastes.
Which of the above statements are correct.
(A) 1 only (B) 1 and 2
(C) 1, 2 and 4 (D) 2 and 4

93. Match the types of WBC listed under Column-I with the shape of nucleus given under Column-II and select the correct option from codes given below :

| | Column-I | | Column-II |
|---|---|---|---|
| **A.** | Neutrophils | (i) | Kidney-shaped |
| **B.** | Eosinophils | (ii) | S-shaped |
| **C.** | Basophils | (iii) | 3 to 5 lobes |
| **D.** | Monocytes | (iv) | 2 lobes |
| | | (v) | Disc-shaped |

(A) A–(iii), B–(v), C–(i), D–(ii)
(B) A–(v), B–(iii), C–(i), D–(iv)
(C) A–(ii), B–(i), C–(v), D–(iii)
(D) A–(iii), B–(iv), C–(ii), D–(i)

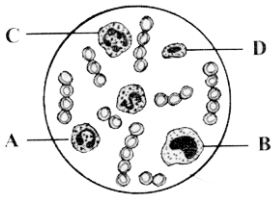
94. Which one of the following statements is correct with regard to the principle of safe blood transfusion ?
(A) The donor's red blood corpuscles should not contain antibodies against the recipient's serum.
(B) The recipients serum should not contain antigens against the donor's antibodies.
(C) The recipient's serum should not contain the antibodies against the red blood corpuscle of the donor.
(D) The recipient's red blood corpuscles should not contain antibodies against the donor's antigen.

95. In the clotting mechanism pathway, thrombin activates the factors
(A) XI, VIII, V (B) XI, IX, X
(C) VIII, X, V (D) IX, VIII, X

96. A drop of each of the following is placed separately on four slides. Which of them will not coagulate ?
(A) Blood serum
(B) Blood from pulmonary artery
(C) Whole blood from pulmonary vein
(D) Blood plasma

97. In which of the following situations, there is a risk factor for children acquiring erythroblastosis foetalis ?
(A) Mother is Rh – ve and father is Rh – ve
(B) Mother is Rh – ve and father is Rh + ve
(C) Mother is Rh + ve and father is Rh + ve
(D) Mother is Rh + ve and father is Rh – ve

98. Study the given figure and identify the cells labelled as A, B, C and D.




(A) A–Eosinophil, B–Erythrocyte, C–Neutrophil, D–Basophil
(B) A–Eosinophil, B–Lymphocyte, C–Neutrophil, D–Monocyte
(C) A–Erythrocyte, B–Basophil, C–Neutrophil, D–Lymphocyte
(D) A–Eosinophil, B–Monocyte, C–Neutrophil, D–Lymphocyte

**Space for Rough Work**

99. Consider the following four statements and select the correct option stating which ones are true (T) and which ones are false (F) ?
(i) Proteins contribute 6–8% of the blood plasma
(ii) Plasma contains very high amount of minerals
(iii) Plasma without the clotting factors is called serum
(iv) Glucose, amino acids, lipids, etc, are also present in the plasma as they are always in transit in the body

| | (i) | (ii) | (iii) | (iv) |
|---|---|---|---|---|
| (A) | F | F | T | T |
| (B) | T | F | T | T |
| (C) | T | T | F | F |
| (D) | F | F | F | T |

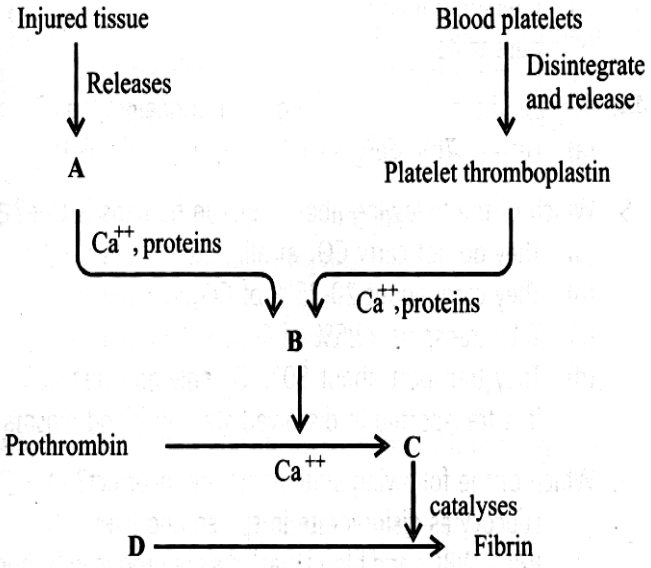
100. In the following table of human ABO blood groups, fill up the blanks (i), (ii), (iii) and (iv) from the options given below :

| Blood group | Antigens on RBCs | Antibody in Plasma | Donor groups |
|---|---|---|---|
| A | A | Anti – B | A, O |
| B | B | Anti – A | B, O |
| AB | AB | (ii) | A, B, AB, O |
| O | (i) | (iii) | (iv) |

| | (i) | (ii) | (iii) | (iv) |
|---|---|---|---|---|
| (A) | Nil | Nil | Nil | 0 |
| (B) | Nil | Nil | Anti-A, B | AB |
| (C) | Nil | Anti-A,B | Nil | 0 |
| (D) | Nil | Nil | Anti-A, B | 0 |

101. Find the correct descending order of percentage proportion of leucocytes in human blood.
(A) Neutrophils → Basophils → Lymphocytes → Acidophils (Eosinophils) → Monocytes
(B) Monocytes → Neutrophils → Lymphocytes → Acidophils → Basophils
(C) Neutrophils → Lymphocytes → Monocytes → Acidophils → Basophils
(D) Lymphocytes → Acidophils → Basophils → Neutrophils → Monocytes

102. Identify the components labelled (A–D) in the given flow chart of the blood clotting process.




| | A | B | C | D |
|---|---|---|---|---|
| (A) | Thrombo-plastin | Prothrom-binase | Thrombin | Fibrinogen |
| (B) | Fibrinogen | Thrombin | Prothrom-binase | Thrombo-plastin |
| (C) | Prothrom-binase | Fibrinogen | Thrombo-plastin | Thrombin |
| (D) | Thrombin | Thrombo-plastin | Fibrinogen | Prothrom-binase |

103. The life span of human granulocytic WBC is approximately
(A) between 2 to 3 months
(B) more than 4 months
(C) less than 10 days
(D) between 20 to 30 days

104. Which proteolytic enzyme induces lysis of fibrin during fibrinolysis ?
(A) Fibrin (B) Thrombin
(C) Plasmin (D) Platelet factor VIII

**Space for Rough Work**

105. Rh factor was discovered by
(A) Landsteiner and Weiner
(B) William Harvey
(C) Malpighi
(D) none of these

106. Read the following statements and select the correct option.

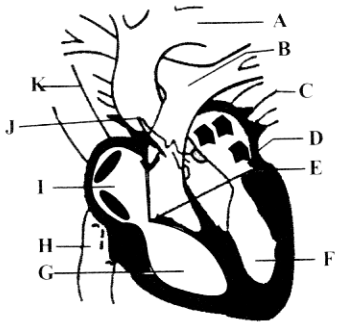
**Statement 1 :** Lymph capillaries are free and bind at one end.

**Statement 2 :** Lymph does not flow in a circular manner.

(A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
(B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
(C) Statement 1 is correct and statement 2 is incorrect.
(D) Both statements 1 and 2 are incorrect.

107. Which of the following statements is true for lymph ?
(A) WBCs + serum
(B) Blood–RBCs and some proteins
(C) RBCs + WBCs + Plasma
(D) RBCs + Proteins + Platelets

108. The given figure shows the vertical section of human heart. Identify the parts labelled as A to K.




(A) A–Aorta, B–Pulmonary vein, C–Pulmonary arteries, D–left ventricle, E–Semilunar valves, F–Left auricle, G–Right auricle, H–Superior vena cava, I–Right ventricle, J–Tricuspid valves, K–Inferior vena cava
(B) A–Aorta, B–Pulmonary artery, C–Pulmonary veins, D–Left auricle, E–Tricuspid valves, F–Left ventricle, G–Right ventricle, H–Inferior vena cava, I–Right auricle, J–Semilunar valves, K–Superior vena cava.
(C) A–Aorta, B–Superior vena cava, C–Inferior vena cava, D–Right ventricle, E–Tricuspid valves, F–Right auricle, G–Left auricle, H–Pulmonary vein, I–Right ventricle, J–Semilunar valves,K–Pulmonary artery.
(D) A–Aorta, B–Superior vena cava, C–Inferior vena cava, D–Left ventricle,E-Semilunar valves, F-Left auricle,G-Right auricle, H– Pulmonary artery, I–Rightventricle,J-Tricuspidvalves, K–Pulmonary vein.

109. Which of the following is correct about human heart?
(A) The volume of both atria > the volume of both ventricles
(B) The volume of both ventricles > the volume of both atria.
(C) The volume of both atria = the volume of both ventricles
(D) Ventricles are upper chambers and atria are lower chambers in our heart.

110. Read the following statements and select the correct option.

**Statement 1 :** The SA node acts as pacemaker.

**Statement 2 :** The SA node is located in the wall of the right atrium near the interatrial septum.

(A) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
(B) Both statement 1 and 2 are correct and statement 2 is not the correct explanation of statement 1.
(C) Statement 1 is correct and statement 2 is incorrect.
(D) Both statement 1 and 2 are incorrect.

**Space for Rough Work**

111. In thrombocytes, Sydersomes are
(A) 2-3 mitochondria in groups.
(B) Granules containing serotonin.
(C) Iron containing vesicles.
(D) Glycogen granules.

112. Read the following statements and select the correct ones.
(i) Nodal tissue is specialized cardiac musculature in human heart which has the ability to generate action.
(ii) Position of SAN - right corner of right atrium
(iii) Position of AVN - right corner of Ventricle
(iv) AV bundle continues from AVN
(v) Purkinje fibres are modified cardiac muscle fibres that originate from the atrioventricular node and spread into the two ventricles.
(A) (i) and (ii) (B) (i) and (iii)
(C) (ii), (iv) and (v) (D) All of these

113. Chordae tendineae are found in
(A) ventricles of brain
(B) joints of legs
(C) ventricles of heart
(D) atria of heart

114. During ventricular systole
(A) Oxygenated blood is pumped into the pulmonary artery and deoxygenated blood is pumped into the artery
(B) Oxygenated blood is pumped into the aorta and deoxygenated blood is pumped into the pulmonary vein
(C) Oxygenated blood is pumped into the pulmonary vein and deoxygenated blood is pumped into the pulmonary artery
(D) Oxygenated blood is pumped into the aorta and deoxygenated blood is pumped into the pulmonary artery.

115. Which of the following statements(s) regarding the cardiac system is/are correct ?
(i) Human heart is an ectodermal derivative.
(ii) Mitral valve, guards the opening between the right atrium and left ventricle
(iii) SAN is located on the left upper corner of the right atrium
(iv) Stroke volume × Heart rate = Cardiac output
(A) (i) only (B) (i) and (iv)
(C) (ii) and (iii) (D) (iv) only

116. The problem of electrical discontinuity caused in the normal heart by the connective tissue separating the atria from the ventricles is solved by
(A) coordinating electrical activity in the atria with electrical activity in the ventricles by connecting them via the bundle of His
(B) having the A–V node function as a secondary pacemaker
(C) having an ectopic pacemaker
(D) coordinating electrical activity in the atria with electrical activity in the ventricles by connecting them via the vagus nerve.

117. Which one of the following is a matching pair ?
(A) Lubb-sharp closure of AV valves at the beginning of ventricular systole
(B) Dup - sudden opening of semilunar valves at the beginning of ventricular diastole
(C) Pulsation of the radial artery - valves in the blood vessels
(D) Initiation of the heart beat - Purkinje fibres

118. In humans, blood passes from the post caval to the diastolic right atrium of heart due to
(A) stimulation of the sino auricular node
(B) pressure difference between the post caval and atrium
(C) pushing open of the venous valves
(D) suction pull

**Space for Rough Work**

119. Haemoglobin contains
(A) 70% globin + 30%haematin
(B) 80% globin + 20%haematin
(C) 96% globin + 04%haematin
(D) 89% globin + 11%haematin

120. Match Column-I with Column-II and select the correct option from the codes given below :

| | Column I | Column II |
|---|---|---|
| (A) | Superior vena cava | (i) Carries deoxygenated blood to lungs |
| (B) | Inferior vena cava | (ii) Carries oxygenated blood from lungs |
| (C) | Pulmonary artery | (iii) Brings deoxygenated blood from lower part of body to right atrium |
| (D) | Pulmonary vein | (iv) Bring deoxygenated blood from upper part of body to right atrium |

(A) A–(ii), B–(iv), C–(iii), D–(i)
(B) A–(iv), B–(i), C–(ii), D–(iii)
(C) A–(iv), B–(iii), C–(i), D–(ii)
(D) A–(iv), B–(i), C–(iii), D–(ii)

121. The figure given below shows three stages in the cardiac cycle.


Which of the following sequences is correct regarding this ?
(A) 2, 3, 1 (B) 1, 2, 3
(C) 2, 1, 3 (D) 3, 1, 2

122. A red blood cell, entering the right side of the heart passes by or through the following structures.
1. Atrioventricular valves
2. Semilunar valves
3. Right atrium
4. Right ventricle
5. SAN

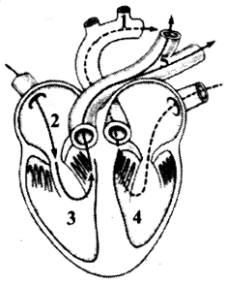
Which of the following options represents the correct sequence ?
(A) $2 \rightarrow 3 \rightarrow 1 \rightarrow 4 \rightarrow 5$
(B) $3 \rightarrow 1 \rightarrow 5 \rightarrow 2 \rightarrow 4$
(C) $3 \rightarrow 5 \rightarrow 1 \rightarrow 2 \rightarrow 4$
(D) $5 \rightarrow 3 \rightarrow 1 \rightarrow 4 \rightarrow 2$

123. Match Column-I with Column-II and select the correct option from the codes given below :

| | Column-I | | Column-II |
|---|---|---|---|
| **A.** | RBC | (i) | Coagulation |
| **B.** | Antibody | (ii) | Immunity |
| **C.** | Platelets | (iii) | Contraction |
| **D.** | Systole | (iv) | Gas transport |
| | | (v) | Hypertension |

(A) A–(v), B–(i), C–(iv), D–(iii)
(B) A–(ii), B–(iv), C–(iii), D–(i)
(C) A–(iv), B–(ii), C–(i),D–(iii)
(D) A–(iii), B–(v), C–(ii), D–(iv)

124. In the given figure of the heart which of the labelled part (1, 2, 3, 4, 5) carries oxygenated blood ?




(A) 1, 2, 3 and 4 (B) 1 and 5
(C) 1 and 4 (D) 3 and 5

**Space for Rough Work**

125. Choose the schematic diagram which properly represents pulmonary circulation in humans.

(A) Left auricle $\xrightarrow[\text{blood}]{\text{Deoxygenated}}$ Lungs $\xrightarrow[\text{blood}]{\text{Oxygenated}}$ Right ventricle

(B) Left auricle $\xrightarrow[\text{blood}]{\text{Oxygenated}}$ Lungs $\xrightarrow[\text{blood}]{\text{Deoxygenated}}$ Right ventricle

(C) Right ventricle $\xrightarrow[\text{blood}]{\text{Deoxygenated}}$ Lungs $\xrightarrow[\text{blood}]{\text{Oxygenated}}$ Left auricle

(D) Right ventricle $\xrightarrow[\text{blood}]{\text{Oxygenated}}$ Lungs $\xrightarrow[\text{blood}]{\text{Deoxygenated}}$ Left auricle

126. Which of the following sequences is truly a systemic circulation pathway ?

(A) Right ventricle → Pulmonary aorta → Tissues → Pulmonary veins → Left auricle

(B) Right auricle → Left ventricle → Aorta → Tissues → Veins → Right auricle

(C) Left auricle → Left ventricle → Pulmonary aorta → Tissues → Right auricle

(D) Left auricle → Left ventricle → Aorta → Arteries → Tissues → Veins → Right atrium.

127. The given figure is of circulatory system. Identify the labelled parts (A–D) from the list (i–vii).

(i) Pulmonary circulation

(ii) Systemic circulation

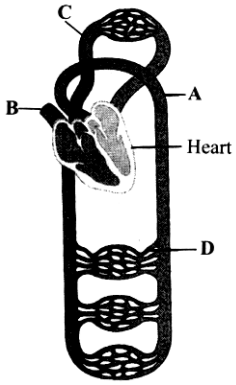
(iii) Superior vena cava

(iv) Inferior vena cava

(v) Aorta

(vi) Veins and venules

(vii) Arterioles and capillaries.




| | A | B | C | D |
|---|---|---|---|---|
| (A) | (v) | (iii) | (i) | (vii) |
| (B) | (vii) | (iv) | (i) | (vi) |
| (C) | (v) | (iii) | (ii) | (vii) |
| (D) | (vii) | (v) | (i) | (vi) |

128. Read the following statements and select the correct option.

**Statement 1 :** The 4-chambered heart of birds is superior to the 4-chambered heart of crocodiles.

**Statement 2 :** Crocodilian heart retains both systemic arches that join, causing mixing of blood in the dorsal aorta while avian heart has lost left systemic arch.

(A) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1.

(B) Both statement 1 and 2 are correct and statement 2 is not the correct explanation of statement 1.

(C) Statement 1 is correct and statement 2 is incorrect.

(D) Both statement 1 and 2 are incorrect.

**Space for Rough Work**

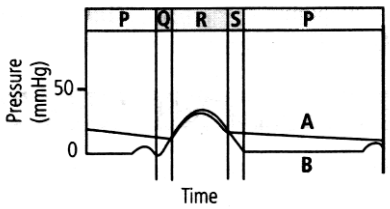
129. Consider the following four statements (i) - (iv) and select the correct option.
(i) Fish heart contains only oxygenated blood.
(ii) Closure of A-V valves produces the second heart sound.
(iii) Columnae carneae occur in the auricles.
(iv) Purkinje fibres are nerve fibres present in the heart wall.

| | (i) | (ii) | (iii) | (iv) |
|---|---|---|---|---|
| (A) | F | F | T | F |
| (B) | F | F | F | T |
| (C) | T | T | F | T |
| (D) | T | F | T | F |

130. Systemic heart refers to
(A) the heart that contracts under stimulation from nervous system.
(B) left auricle and left ventricle in higher vertebrates
(C) entire heart in lower vertebrates.
(D) the two ventricles together in humans.

131. Which of the following parts of heart first receives deoxygenated blood ?
(A) Right ventricle (B) Left auricle
(C) Right auricle (D) Left ventricle

132. Refer to the given figure in which A refers to pulmonary artery pressure and B refers to right ventricular pressure. Identify P, Q, R and S in the figure and match with the list (i – iv) given below :
(i) Isovolumetric ventricular contraction
(ii) ventricular ejection
(iii) Isovolumetric ventricular relaxation
(iv) Ventricular filling




(A) P–(iv), Q–(iii), R–(ii), S–(i)
(B) P–(ii), Q–(iii), R–(i), S–(iv)
(C) P–(iv), Q–(i), R–(ii), S–(iii)
(D) P–(i), Q–(ii), R–(iii), S–(iv)

133. Rapidity of conduction is greatest in the
(A) Atrial muscle
(B) Purkinje fibres
(C) AV nodal region
(D) Ventricular muscle.

134. The myocardial depressant is
(A) $Ca^{++}$ (B) $Mg^{++}$
(C) Digitatis (D) $Na^{+}$

135. Erythropoietin is stimulated by all except
(A) Low blood volume
(B) Polycythemia
(C) Poor blood flow
(D) Pulmonary disease.

## [BOTANY]

136. Which one of the following correctly depicts the biochemical reaction for photosynthesis ?

(A) $C_6H_{12}O_6 + 6O_2 \xrightarrow{\text{Enzymes}} 6CO_2 + 6H_2O + \text{energy}$

(B) $C_6H_{12}O_6 + 6O_2 + 6H_2O \longrightarrow 6CO_2 + 12H_2O + \text{energy}$

(C) $6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2$

(D) $6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2 + 6H_2O$

137. Ingenhousz in an experiment showed that in bright sunlight, small bubbles were formed around the green parts of the plant, while in the dark, they did not. He identified these bubbles to be of
(A) $CO_2$ (B) $H_2O$
(C) $O_2$ (D) $H_2$

138. Who used prism, green alga *Cladophora*, and aerobic bacteria and plotted the first action spectrum for photosynthesis ?
(A) Sachs (B) Arnon
(C) Arnold (D) Engelmann

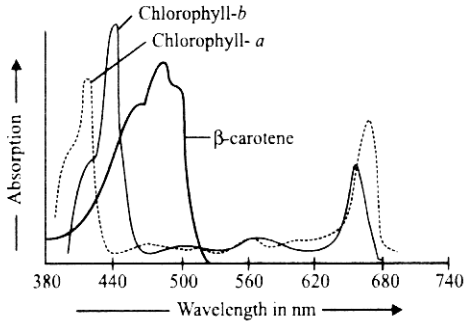
**Space for Rough Work**

139. Photosynthetic pigments such as chl a, chl b, xanthophyll and carotene can be separated by which of the following techniques ?
(A) Paper chromatography
(B) Gel Electrophoresis
(C) X-ray diffusion
(D) ELISA test

140. Which range of wavelength (in nm) is called as photosynthetically active radiation (PAR) ?
(A) 100 – 390 (B) 390 – 430
(C) 400 – 700 (D) 760 – 100

141. Study the following statements regarding chl a molecule.
(i) Molecular formula of chl *a* is $C_{55}H_{72}O_5N_4Mg$
(ii) It is the primary photosynthetic pigment.
(iii) In pure state, it is red in colour and thus it absorbs more blue wavelength of light than the red wavelength.
(iv) It is soluble in water as well as petroleum ether.
Which of the above statements is/are not correct ?
(A) (i) and (iii) (B) (iii) and (iv)
(C) (iii) only (D) (iv) only

142. Given graph represents the absorption spectra of three photosynthetic pigments, chl a, chl b and β-carotene. Select the correct statement regarding this.




(A) The curve showing the amount of absorption of different wavelengths of light by a photosynthetic pigment is called as absorption spectrum.
(B) Chl a and chl b absorb maximum light in blue and red wavelength of light
(C) Rate of photosynthesis is maximum in blue and red wavelength of light.
(D) All of these

143. Which of the following serves as the source of energy for chemosynthetic bacteria ?
(A) Sun
(B) Infra-red rays
(C) Organic substances
(D) Inorganic chemicals

144. Which of the following is produced during the light phase of photosynthesis ?
(A) ATP
(B) $NADPH_2$
(C) Both ATP and $NADPH_2$
(D) Carbohydrates

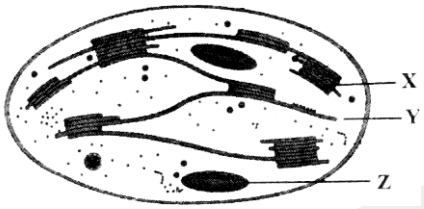
145. In cyclic photophosphorylation, the electron released by reaction centre ($P_{700}$) is ultimately accepted by
(A) ferrodoxin
(B) $NADP^+$
(C) reaction centre ($P_{700}$)
(D) Plastocyanin

146. Which of the following statements about dark reactions is correct ?
(A) They occur in darkness
(B) They are not light dependent
(C) They are dependent upon the products synthesized during light reactions.
(D) All of these.

147. Reaction centre of PS I is _____ and reaction centre of PS II is _____ .
(A) $P_{680}$, $P_{700}$ (B) $P_{700}$, $P_{680}$
(C) $P_{800}$, $P_{600}$ (D) $P_{700}$, $P_{900}$

**Space for Rough Work**

**Direction :** Refer the given diagramatic representation of an electron micrograph of a section of chloroplast to answer the Q. Nos. 148 and 149




148. Select the option that correctly identifies X, Y and Z.

| | X | Y | Z |
|---|---|---|---|
| (A) | Stroma | Grana | Chloroplast DNA |
| (B) | Stroma | Grana | Starch granule |
| (C) | Grana | Stroma | Starch granule |
| (D) | Grana | Stroma | Chloroplast DNA |

149. Select the option which correctly depicts the functions of parts X, Y and Z.

| | X | Y | Z |
|---|---|---|---|
| (A) | Dark reaction | Light reaction | Cytoplasmic inheritance |
| (B) | Light reaction | Carbohydrate synthesis | Carbohydrate storage |
| (C) | Light reaction | Carbohydrate storage | Carbohydrate synthesis |
| (D) | Carbohydrate synthesis | Carbohydrate storage | Cytoplasmic inheritance |

150. Which one is involved in Z-scheme of photosynthesis?
(A) PS I (B) PS II
(C) $e^-$ Carriers (D) All of these

151. Yellowish colour of autumn foliage is due to the presence of a type of xanthophyll pigment called as
(A) lutein (B) lycopene
(C) fucoxanthin (D) zeaxanthin

152. Which of these is a type of phycobilin pigments ?
(A) Phycocyanin (B) Allophycocyanin
(C) Phycoerythrin (D) All of these

153. Consider following statements with respect to the $C_4$ pathway and select the correct ones.
(i) Mesophyll cells possesses both RuBisCO and PEPcase enzymes.
(ii) Initial $CO_2$ fixation occurs in mesophyll cells.
(iii) Final $CO_2$ fixation occurs in bundle sheath cells.
(A) (i) and (ii) (B) (ii) and (iii)
(C) (i) and (iii) (D) (i), (ii) and (iii)

154. Which of the following conversions involve ATP synthesis during glycolysis ?
(A) Glucose $\rightarrow$ Glucose–6–phosphate
(B) Fructose-6-phosphate $\rightarrow$ Fructose-1,6 biphosphate
(C) 1,3-bisphosphoglyceric acid (BPGA) $\rightarrow$ 3-phosphoglyceric acid (PGA)
(D) All of these.

155. Select the wrong statement.
(A) Oxidative decarboxylation of pyruvic acid requires the presence of enzyme pyruvate dehydrogenase.
(B) All living cells whether aerobic or anaerobic, perform glycolysis.
(C) Cyanide does not stop chemiosmosis.
(D) Respiratory chain uses $O_2$ as final hydrogen acceptor.

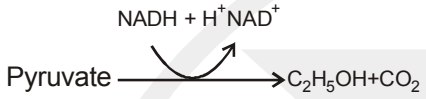
156. Pyruvic acid, the key product of glycolysis can have many metabolic fates. Under aerobic condition it forms
(A) lactic acid (B) $CO_2 + H_2O$
(C) Acetyl CoA+$CO_2$ (D) Ethanol + $CO_2$

157. Mitochondria are called powerhouses of the cell. Which of the following observations support this statement ?
(A) Mitochondria synthesize ATP.
(B) Mitochondria have a double membrane.
(C) The enzymes of the Krebs' cycle and the cytochromes are found in mitochondria
(D) Mitochondria are found in almost all plant and animal cells.

**Space for Rough Work**

158. Site of Krebs' cycle in mitochondria is
(A) outer membrane (B) matrix
(C) oxysomes (D) inner membrane

159. Value of RQ in succulents is
(A) unity (B) infinite
(C) less than unity (D) zero

160. Categorise the given summary equations under respective phases and select the correct option.
I. $C_6H_{12}O_6 + NAD^+ + 2ADP + 2Pi \rightarrow 2C_3H_4O_3 + 2ATP + 2NADH + 2H^+$
II. Pyruvic acid + $4NAD^+ + FAD^+ + 2H_2O + ADP + Pi \rightarrow 3CO_2 + 4NADH + 4H^+ + ATP + FADH_2$
III. 

III.

| | I | II | III |
|---|---|---|---|
| (A) | Glycolysis | Fermentation | Krebs' cycle |
| (B) | Krebs' cycle | Fermentation | Glycolysis |
| (C) | Krebs' cycle | Glycolysis | Fermentation |
| (D) | Glycolysis | Krebs' cycle | Fermentations |

161. Which of the following steps of respiration is amphibolic ?
(A) Glycolysis
(B) Oxidative decarboxylation of pyruvate
(C) TCA cycle
(D) Oxidative phosphorylation

162. Refer the given equation
$2(C_{51}H_{98}O_6) + 145O_2 \rightarrow 102CO_2 + 98H_2O$ + Energy
The RQ in this case is
(A) 1 (B) 0.7
(C) 1.45 (D) 1.62

163. Read the given statements and select the correct option.
**Statement 1 :** Mitochondria are known as powerhouse of the cell.
**Statement 2 :** ATP synthesis occurs in mitochondria.
(A) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
(B) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
(C) Statement 1 is correct and statement 2 is incorrect.
(D) Both statement 1 and 2 are incorrect.

164. Last $e^-$ acceptor during ETS is
(A) $O_2$ (B) cyt a
(C) cyt $a_2$ (D) cty $a_3$

165. Which of the following statements regarding metabolic pathway is incorrect ?
(A) Many of the steps of glycolysis can run in reverse.
(B) Starch, sucrose or glycogen must be hydrolysed before it can enter the glycolysis.
(C) After fats are digested, glycerol enters glycolysis by forming DHAP
(D) After fat digestion, fatty acids can no longer participate in cellular respiration.

166. At the end of glycolysis, X is the net energy gain from one molecule of glucose *via* Y, but there is also energy stored in the form of Z. Identify X, Y and Z.

| | X | Y | Z |
|---|---|---|---|
| (A) | 1 ATP | Oxidative phosphorylation | $NADH + H^+$ |
| (B) | 2 ATPs | Oxidative phosphorylation | $NADH + H^+$ |
| (C) | 1 ATP | Substrate level phosphorylation | $FADH + H^+$ |
| (D) | 2ATPs | Substrate level phosphorylation | $NADH + H^+$ |

167. Consider the first reaction of TCA cycle.

$$\text{Acetyl CoA} + \text{OAA} + H_2O \xrightarrow[\text{synthase}]{\text{Citrate}} (A) + \text{CoA}$$

What is true about compound A ?
(A) First product of TCA cycle
(B) Tricarboxylic acid and six carbon compound
(C) It undergoes reorganisation in the presence of enzyme aconitase to form *cis*-aconitate
(D) All of these.

**Space for Rough Work**

168. Select the correct combinations of the respiratory substrates and their respective RQs.

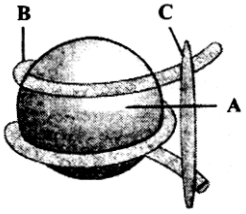
| | Organic acids | Fats | Succulents |
|---|---|---|---|
| (A) | 1.3 | 0.7 | Zero |
| (B) | Infinity | 0.7 | Zero |
| (C) | Zero | 1.3 | 0.7 |
| (D) | Zero | 0.7 | 1.3 |

169. Match Column-I with Column-II and select the correct option from the codes given below :

| | Column I | | Column II |
|---|---|---|---|
| (A) | R.Q. | (i) | Chemiosmotic ATP synthesis |
| (B) | Mitchel | (ii) | Muscle fatigue |
| (C) | Cytochromes | (iii) | Inner mitochondrial membrane |
| (D) | Lactic acid | (iv) | Alcoholic fermentation. |
| (E) | Yeast | (v) | Respirometer |

(A) A – (v), B – (i), C – (iii), D – (ii), E – (iv)
(B) A – (v), B – (i), C – (iii), D – (iv), E – (ii)
(C) A – (i), B – (v), C – (ii), D – (iii), E – (iv)
(D) A – (v), B – (ii), C – (iv), D – (iii), E – (i)

170. Refer the given figure of nucleosome and select the option that correctly identifies the parts A, B and C.



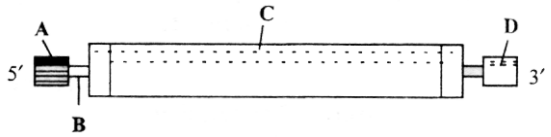

| | A | B | C |
|---|---|---|---|
| (A) | DNA | Histone octamer | $H_1$ histone |
| (B) | Histone octamer | $H_1$ histone | DNA |
| (C) | Histone octamer | DNA | $H_1$ histone |
| (D) | DNA | $H_1$ histone | Histone octamer |

171. Match Column-I with Column-II and select the correct option from the codes given below.

| | Column-I | | Column-II |
|---|---|---|---|
| (A) | Griffith | (i) | Lac operon |
| (B) | Hershey and Chase | (ii) | Semi-conservative DNA replication |
| (C) | Messelson and Stahl | (iii) | Transduction |
| (D) | Jacob and Monod. | (iv) | Transformation. |

(A) A – (iv), B – (iii), C – (ii), D – (i)
(B) A – (iii), B – (iv), C – (ii), D – (i)
(C) A – (iv), B – (ii), C – (iii), D – (i)
(D) A – (ii), B – (i), C – (iii), D – (iv)

172. Idenfity A, B, C and D in the given diagram of mRNA




| | A | B | C | D |
|---|---|---|---|---|
| (A) | Methylated cap | Initiation codon | Termination codon | Poly A tail |
| (B) | Poly A tail | Termination codon | Initiation codon | Methylated cap |
| (C) | Methylated cap | Non-coding region | Coding region | Poly A tail |
| (D) | Methylated cap | Coding region | Non-coding region | Poly A tail |

173. Histone proteins are
(A) basic, negatively charged
(B) basic, positively charged
(C) acidic positively charged
(D) acidic, negatively charged

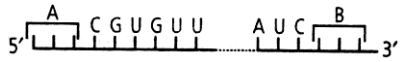
174. Refer the given sequence of steps and select the correct option

$$DNA \xrightarrow{(i)} hnRNA \xrightarrow{(ii)} mRNA \xrightarrow{(iii)} Proteins$$

| | (i) | (ii) | (iii) |
|---|---|---|---|
| (A) | Replication | Transcription | Translation |
| (B) | Replication | Processing | Translation |
| (C) | Transcription | Splicing | Translation |
| (D) | Transcription | Replication | Translation |

**Space for Rough Work**

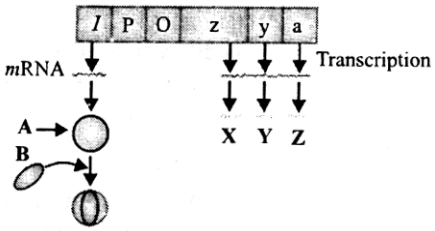
175. Refer the given mRNA segment




It can be translated completely into a polypeptide. Which of the following codons may correspond with A and B ?

(A) A–AUG, GUG; B–UAA, UAG or UGA
(B) A–UAA, UGA; B – AUG, GUG or UAG
(C) A–AUG, UGA; B–GUG, UAA or UGA
(D) A–AUG, GAG; B–UAA, UUU or UGA

176. The given figure shows *lac* operon and its functioning. Select the option which correctly labels A, B, X, Y and Z.




| | A | B | X | Y | Z |
|---|---|---|---|---|---|
| (A) | Repressor | Inducer | β-Galactosidase | Permease | Trans-acetylase |
| (B) | Repressor | Inducer | Permease | β-Galacto-sidase | Trans acetylase |
| (C) | Inducer | Repressor | β-Galactosidase | Permease | Trans-acetylase |
| (D) | Inducer | Repressor | β-Galactosidase | Trans-acetylase | Permease |

177. Match Column-I with Column-II and select the correct option from the codes given below :

| | Column-I (Codons) | | Column-II (Translated amino acid) |
|---|---|---|---|
| (A) | UUU | (i) | Serine |
| (B) | GGG | (ii) | Methionine |
| (C) | UCU | (iii) | Phenylalanine |
| (D) | CCC | (iv) | Glycine |
| (E) | AUG | (v) | Proline |

(A) A – (iii), B – (iv), C – (i), D – (v), E – (ii)
(B) A – (iii), B – (i), C – (iv), D – (v), E – (ii)
(C) A – (iii), B – (iv), C – (v), D – (i), E – (ii)
(D) A – (ii), B – (iv), C – (i), D – (v), E – (iii)

**Direction :** Read the sequence of nucleotides in the given segment of mRNA and the respective amino acid sequence in the polypeptide chain to answer the Q.Nos. 178 & 179.

*m*RNA $\xrightarrow{\text{AUGUUU AUG CCU GUU UCU UAA}}$

Polypeptide Met—Phe—Met—Pro—Val—Ser

178. Nucleotide sequence of the DNA strand from which this mRNA was transcribed is

(A) TAC AAA TAC GGA CAA AGA ATT
(B) AUG UUU AUG CCU GUU UCU UAA
(C) UAC AAA UAC GGA CAA AGA AUU
(D) ATG TTT ATG CCT GTT TCT TAA

179. Which codons respectively code for proline and valine amino acids in the given polypeptide chain, respectively?

(A) CCU and GUU (B) GUU and UCU
(C) UCU and UAA (D) GUU and CCU

180. Select the incorrect statement regarding DNA replication.

(A) Leading strand is formed in 5' –3' direction.
(B) Okazaki fragments are formed in 5' –3' direction.
(C) DNA polymerase catalyses polymerisation in 5'–3' direction.
(D) DNA polymerase catalyses polymerisation in 3'–5' direction.

❑ ❑ ❑

**Space for Rough Work**