Aakash
+ BYJU'S

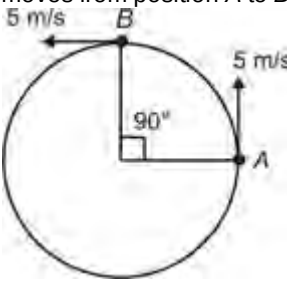**MM : 720**   Fortnightly Test Series 2023-24_RM(P1)-Test-02A   **Time : 200 Min.**

Topics Covered:
Physics: Motion in a Plane, Laws of Motion
Chemistry: Structure of Atom, Classification of Elements and Periodicity in Properties
Botany: Cell Cycle & Cell Division, The Living World
**Zoology:** Biomolecules

General Instructions :
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 completely fill the circle.
4. Rough work must not be done on the answer sheet.
5. Do not use white-fluid or any other rubbing material on answer sheet. No change in the answer once marked is allowed.
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 that Roll No. and Centre Code 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. There are two sections in each subject i.e., Section-A & Section-B. You have to attempt all 35 questions from Section-A & only 10 questions out of 15 from Section-B.

PHYSICS

SECTION-A

1. A projectile is thrown at an angle 60° with horizontal. At the topmost point of its path, projectile
(1) Has zero velocity
(2) Has acceleration g
(3) Has only vertical component of velocity
(4) Has acceleration $\frac{g}{2}$

2. A particle is moving with a speed of 5 m/s due north then takes a turn in 1 s and finally move with a speed of 5 m/s due east. Average acceleration of the particle during the turn is
(1) Zero
(2) 5 m/s^2, north-west
(3) $5\sqrt{2}$ m/s^2, south-east
(4) $5\sqrt{2}$ m/s^2, south-west

3. A stationary man observes that the rain is falling vertically downward. When he starts running with a speed of 8 km/h, he observes that the rain is falling at an angle of 45° with the vertical. The actual speed of the rain is
   (1) 4 km/h
   (2) $8\sqrt{2}$ km/h
   (3) 8 km/h
   (4) $4\sqrt{2}$ km/h

4. Relative velocity of a boat with respect to river is $2\hat{i} + 3\hat{j}$ and velocity of river with respect to ground is $3\hat{i} - 2\hat{j}$, then the velocity of boat with respect to ground is
   (1) $2\hat{i} + 4\hat{j}$
   (2) $-\hat{i} + 5\hat{j}$
   (3) $5\hat{i} + \hat{j}$
   (4) $\hat{i} - 5\hat{j}$

5. A projectile is projected with initial velocity $\left(8\hat{i} + 10\hat{j}\right)$ m/s. The time of flight of projectile is (Take $g = -10\hat{j}$ m/s^2)
   (1) 1 s
   (2) 2 s
   (3) 3 s
   (4) 4 s

6. A boy can throw a stone upto a maximum height of 10 m. The maximum horizontal distance upto which the boy can throw the same stone is
   (1) $20\sqrt{2}$ m
   (2) 10 m
   (3) $10\sqrt{2}$ m
   (4) 20 m

7. A man crosses a river of width 400 m flowing at 40 m/s in minimum time. If velocity of man in still water is 50 m/s, then the displacement of man while he reaches the opposite bank of the river is
   (1) 80 m
   (2) $8\sqrt{4}\,m$
   (3) $80\sqrt{41}\,m$
   (4) $10\sqrt{41}\,m$

8. The angular speed of a flywheel making 420 revolution per minute is nearly
   (1) 10 rad/s
   (2) 20 rad/s
   (3) 22 rad/s
   (4) 44 rad/s

9. In uniform circular motion particle moves with speed of 5 m/s, then the change in magnitude of velocity of particle, when it moves from position A to B (as shown) is

   (1) 10 m/s
   (2) Zero
   (3) 2.5 m/s
   (4) $5\sqrt{2}\,\mathrm{m/s}$

10. A body moves in $(x - y)$ plane, so that the displacement along the x and y axis are given by $x = 2t^3$ m and $y = 4t^2$ m. The speed of body at $t = 1$ s is
    (1) 14 m/s
    (2) 10 m/s
    (3) 24 m/s
    (4) 12 m/s

11. A stone is thrown at an angle of 53° with horizontal at a speed of 50 m/s from the top of a 20 m high building speed of the stone when it reach the ground will be ($g = 10$ m/s^2)
    (1) 75 m/s
    (2) 70 m/s
    (3) $10\sqrt{27}\,\mathrm{m/s}$
    (4) $10\sqrt{29}\,\mathrm{m/s}$

12. An object is projected with velocity $\vec{v}_0 = 15\hat{i} + 20\hat{j}$, considering x-axis along horizontal direction and y-axis along vertically upward direction. Its horizontal range is ($g = 10$ m/s^2)
    (1) 40 m
    (2) 50 m
    (3) 60 m
    (4) 80 m

13. The rowing speed of a man relative to water is 5 km/hr and speed of water is 3 km/hr. At what angle to the river flow should he head if he wants to reach a point on other bank directly opposite the starting point?
    (1) 60°
   (2) 90°
    (3) 127°
    (4) 120°

**14.** As shown in figure, find the tension T_2.
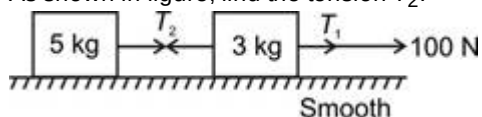
(1) 62.5 N

(2) 22.5 N

(3) 77.5 N

(4) Zero

15. If velocity of block B is 2 m/s downward as shown in the figure, then the speed of block A is
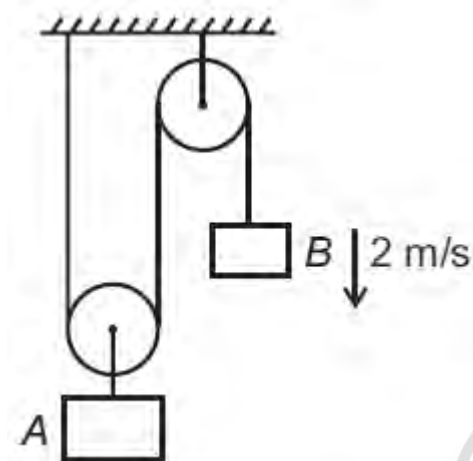

(1) 1 m/s

(2) 2 m/s

(3) 4 m/s

(4) 6 m/s

16. A ball of mass 0.5 kg, moving with velocity $(2\hat{i} + 2\hat{j})$ m/s, is caught by a fielder. If the ball comes to rest in 1.414 s, then the magnitude of average force applied on the ball is

(1) 2 N

(2) $\frac{1}{2}$ N

(3) 4 N

(4) 1 N

17. For the arrangement shown in figure, the magnitude of tension T in the string is [Coefficient of friction between block and surface is 0.8 and $g = 10$ ms^{-2}]


(1) 24 N

(2) 25.6 N

(3) 1.6 N

(4) Zero
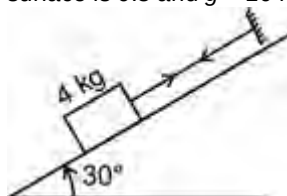
18. In the given figure, tension in string AB is
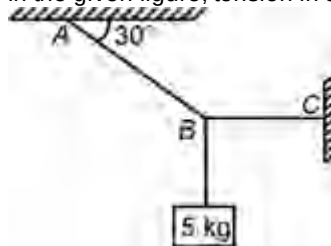
(1) 50 N

(2) 100 N

(3) $50\sqrt{3}\,N$

(4) $100\sqrt{3}\,N$

**19.** The reading of spring balance as shown in figure is [$g = 10$ m/s^2]
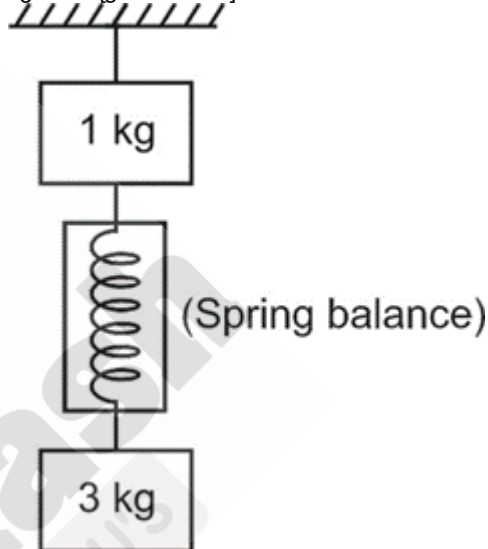
(1) 30 N

(2) 20 N

(3) 40 N

(4) 10 N

20. A block of mass m is suspended through a vertical spring of spring constant k as shown in the figure. If the block is pulled down by a distance $\frac{mg}{4k}$ from equilibrium position and released, then the initial acceleration of the block will be
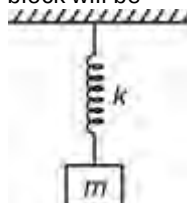
(1) $g/3$

(2) $g/4$

(3) $g/5$

(4) g

21. Force is an entity which, when applied on a body changes or tends to change a body's

(1) State of motion

(2) Direction of motion

(3) Shape

(4) All of these

22. A body of mass 2 kg is placed on a rough horizontal surface as shown in the figure. The force of friction between the body and surface is ($\mu = 0.2$)


(1) 4 N

(2) 6 N

(3) 8 N
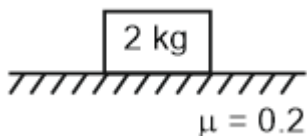
(4) Zero

23. A turn of radius 500 m is banked for vehicles going with optimum speed of 180 km/h. What is banking angle of this path?

(1) $\tan^{-1}(2)$

(2) $\tan^{-1}(1)$

(3) $\tan^{-1}(1/2)$

(4) $\tan^{-1}(0.33)$

**24.** What is maximum and minimum values of F such that block shown in diagram remains stationary?

(1) 20 N, 60 N

(2) 130 N, 30 N

(3) 60 N, 20 N

(4) 80 N, 0

25. A 4 kg block A is placed at the top of 8 kg block B which rest on smooth table. A just slips on B when a force of 20 N is applied on A. The maximum horizontal force F required to make both A and B move together.

(1) 36 N

(2) 5 N

(3) 40 N
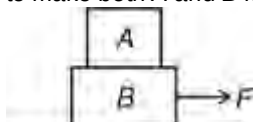
(4) 60 N

26. A body of mass m is moving on a circular track of radius R at constant speed as shown in figure. If normal reaction at C is N, then

(1) $N = mg$
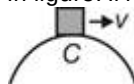
(2) $N = \dfrac{mv^2}{R} + mg$

(3) $N = \dfrac{mv^2}{R}$

(4) $N = mg - \dfrac{mv^2}{R}$

27. Two blocks of mass 4 kg and 6 kg are connected by a light string which is passing over a ideal pulley as shown in the figure. If coefficient of friction between the block and surface is 0.2 and system is released from rest than acceleration of the blocks will be ($g = 10$ m/s^2)

(1) 5.2 m/s^2

(2) 4.8 m/s^2

(3) 3 m/s^2
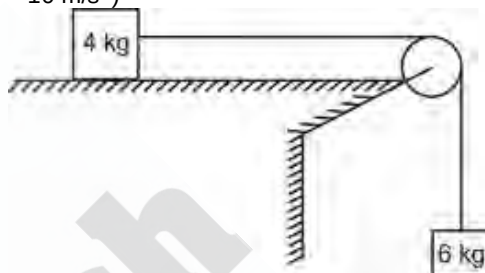
(4) 8 m/s^2

28. What is the maximum value of force F such that the block shown in figure does not move? ($g = 10$ m/s^2)

(1) 50 N

(2) 100 N

(3) 75 N

(4) 150 N

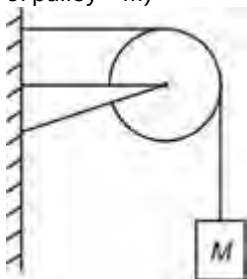29. A string of negligible mass going over a clamped pulley of mass m supports a block of mass M as shown in the figure. The force on the pulley by the clamp is given by (mass of pulley = m)

(1) Mg

(2) mg

(3) $\sqrt{2}Mg$

(4) $\sqrt{[(M+m)g]^2 + (Mg)^2}$

30. A rocket of total mass 4500 kg is set for vertical firing. The exhaust speed is 900 m/s with respect to the rocket. To give an initial upward acceleration of 20 m/s^2, the mass of gas ejected per second should be (g = 10 m/s^2)

(1) 50 kg/s

(2) 100 kg/s

(3) 150 kg/s

(4) 200 kg/s

31. The initial velocity of a ground to ground projectile is given by $\left(3\hat{i} + 4\hat{j}\right)\text{ms}^{-1}$, then its final velocity when it touch the ground will be

(1) $\left(4\hat{i} + 3\hat{j}\right)$ m/s

(2) $\left(-3\hat{i} + 4\hat{j}\right)$ m/s

(3) $\left(-3\hat{i} - 4\hat{j}\right)$ m/s

(4) $\left(3\hat{i} - 4\hat{j}\right)$ m/s

32. If $\vec{A} = \vec{B}$, then which of the following is incorrect?

(1) $\left|\vec{A}\right| = \left|\vec{B}\right|$

(2) $\hat{A} = \hat{B}$

(3) $\vec{A} + \vec{B} = \hat{A} + \hat{B}$

(4) $2\vec{A} = 2\vec{B}$

33. A vector A has magnitude of 20 m along east and vector B has magnitude of 20 m due 60° north of east. The magnitude of their resultant is

(1) 20 m

(2) 40 m

(3) 22 m

(4) $20\sqrt{3}$ m

34. Among given angles of projection, for same speed of projection, the range will be maximum for

(1) 20°

(2) 37°

(3) 46°

(4) 56°

35. A body of mass m rests on a horizontal floor. The coefficient of static friction between floor and body is μ. The minimum possible force that has to be applied to make the body move is

(1) μ mg

(2) $\left(\sqrt{\mu^2 + 1}\right) mg$

(3) $\dfrac{\mu\, mg}{\sqrt{\mu^2 + 1}}$

(4) $\dfrac{mg}{\sqrt{\mu^2 + 1}}$

SECTION-B

36. A particle is projected from ground with a speed 10 m/s at an angle 37° with horizontal. The average velocity of projectile during entire journey is

(1) 6 m/s

(2) Zero

(3) 8 m/s

(4) 10 m/s

37. A projectile is given an initial velocity of $\left(\hat{i} + 2\hat{j}\right)$ m/s where $\hat{i}$ is along the ground and $\hat{j}$ is along the vertical. The equation of trajectory of the particle is (g = 10 m/s^2)

(1) $y = x - 5x^2$

(2) $y = 2x - 5x^2$

(3) $4y = 2x - 5x^2$

(4) $3y = 4x - 25x^2$

38. A projectile is projected from ground with a speed of 20 m/s at an angle of 53° to horizontal. Its speed when it makes an angle of 37° to the horizontal will be

(1) 22 m/s

(2) 15 m/s

(3) 18 m/s

(4) 16 m/s

39. Two objects A and B are thrown with velocities $\vec{u}_A = 4\hat{i} + 5\hat{j}$ and $\vec{u}_B = \hat{i} + \hat{j}$ respectively from some point on horizontal ground. The magnitude of relative velocity of object B w.r.t. object A at any point will be

(1) 3 m s^{-1}

(2) 4 m s^{-1}

(3) 5 m s^{-1}

(4) 6 m s^{-1}

40. A body is moving in a circle of radius 80 m with a speed of 20 m s^{-1}. At some instant its speed is decreasing at a rate of 5 m s^{-2}. Angle made by its acceleration with its velocity at that instant is

(1) 30°

(2) 60°

(3) 135°

(4) 90°

41. The equation of a projectile is $y = 4x - 2x^2$. Its horizontal range is (All quantities are in SI units and y is vertically upwards)

(1) 8 m

(2) 4 m

(3) $\frac{1}{2}$ m

(4) 2 m

42. For a particle moving in x-y plane, the coordinates vary with time (t) as $x = 3t$ and $y = 4t + 4$. The equation of trajectory of the particle is

(1) $y = \frac{4}{3}x + 4$

(2) $y = 4x + 3$

(3) $y = 3x + 4$

(4) $y = \frac{3x}{4} + 4$

43. A rocket with lift mass 3500 kg is blasted upwards with an initial acceleration of 7.7 m/s^2, then initial thrust of blast is nearly [g = 9.8 m/s^2]

(1) 64×10^4 N

(2) 6.12×10^4 N

(3) 32.5×10^3 N

(4) 4.3×10^3 N

44. A block of mass 2 kg rest on a rough inclined plane making an angle 30° with the horizontal. If μ_s = 0.6, what is the frictional force on the block?

(1) 9.8 N

(2) 19.6 N

(3) 14.7 N

(4) 4.9 N

45. The maximum speed at which a car can turn a round curve of radius 30 m on a level road when coefficient of friction between tyres and road is 0.4, will be nearly

(1) 6 m/s

(2) 11 m/s

(3) 18 m/s

(4) 9 m/s

46. Inertia of a body is directly dependent on

(1) Its shape

(2) Its velocity

(3) Force acting

(4) Its mass

47. The resultant of two antiparallel forces is 12 N sum of their magnitudes is 20 N. Find magnitude of forces.

(1) 6 N, 6 N

(2) 2 N, 10 N

(3) 5 N, 7 N

(4) 4 N, 16 N

48. Blocks *A* and *B* are interconnected by a massless string and the system is accelerated upward with a constant acceleration 2 m/s^2 by pulling the block *A*. The tension in the string connecting *A* and *B* is (g = 10 m/s^2)
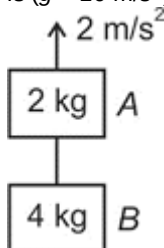
(1) 16 N

(2) 48 N

(3) 20 N

(4) 11 N

49. In the arrangement shown in the figure, the pulley has mass of 3 M. Ignore friction of pulley, what is force exerted by the supporting rope *AB* on the ceiling?
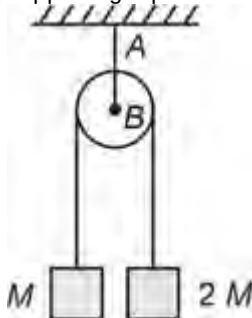
(1) 5 Mg

(2) 6 Mg

(3) 4.5 Mg

(4) $\frac{13}{3}$Mg

50. A body is sliding down an inclined plane having coefficient of friction 0.5. If the normal reaction is twice that of the resultant downward force along the incline. Find the angle between the inclined plane and the horizontal.

(1) 90°

(2) 30°

(3) 60°

(4) 45°

CHEMISTRY

SECTION-A

51. Identify the incorrect match

	Name		IUPAC Official Name
a.	Unnilbium	(i)	Nobelium
b.	Unnilquadium	(ii)	Rutherfordium
c.	Unnilseptium	(iii)	Bohrium
d.	Unnilennium	(iv)	Dubnium

(1) a, (i)

(2) b, (ii)

(3) c, (iii)

(4) d, (iv)

52. An element with atomic number 50 belongs to

(1) *s*-block

(2) *p*-block

(3) *d*-block

(4) *f*-block

53. Which of the following orders of ionic radii is correctly represented?
    (1) $P^{3-} > S^{2-} > Cl^-$
    (2) $Na^+ > F^- > O^{2-}$
    (3) $F^- > O^{2-} > Na^+$
    (4) $Al^{3+} > Mg^{2+} > N^{3-}$

54. Highest second ionisation energy is associated with which of the following electronic configuration?
    (1) $1s^2\ 2s^2\ 2p^6\ 3s^2$
    (2) $1s^2\ 2s^2\ 2p^6\ 3s^1$
    (3) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$
    (4) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$

55. Atomic number of element Uno is
    (1) 101
    (2) 106
    (3) 108
    (4) 109

56. Which of the following sets represents amphoteric compounds?
    (1) Na_2O, ZnO, BeO
    (2) BeO, ZnO, Al_2O_3
    (3) Al_2O_3, BeO, CaO
    (4) ZnO, CO_2, NO

57. Element of highest electronegativity is
    (1) Na
    (2) N
    (3) K
    (4) Rb

58. The correct order of negative electron gain enthalpy is
    (1) F > Cl > Br > I
    (2) Cl > Br > I > F
    (3) Cl > F > Br > I
    (4) Cl > Br > F > I

59. Eka – aluminium and Eka - silicon in Mendeleev's periodic table respectively are
    (1) Ga, Ta
    (2) Ga, Sn
    (3) Ge, Ga
    (4) Ga, Ge

60. Which represents the electronic configuration of the most electropositive element?
    (1) $[He]2s^1$
    (2) $[Xe]6s^1$
    (3) $[He]2s^2$
    (4) $[Xe]6s^2$

61. Which of the following pair can show diagonal relationship?
    (1) C and Si
    (2) Be and Mg
    (3) Be and Al
    (4) Li and Na

62. In the given bonds, which one is most ionic?
    (1) Cs–Cl
    (2) Al–Cl
    (3) C–Cl
    (4) H–Cl

63. Elements of which of the following sets has the strongest tendency to form anions?
    (1) N, O and F
    (2) Ga, In and Te
    (3) Na, Mg and Al
    (4) V, Cr and Mn

64. Representative element among the following is
    (1) Ce
    (2) Cr
    (3) Cd
    (4) Cs

65. Which of the following is an acidic oxide?
    (1) SiO_2
    (2) SnO
    (3) PbO_2
    (4) CO

66. Which among the following is not a metalloid?
    (1) Sb
    (2) As
    (3) In
    (4) Ge

67. Bohr's model is applicable to which ion?
    (1) $H^{\oplus}$
    (2) $He^{\oplus}$
    (3) $Li^{\oplus}$
    (4) $Na^{\oplus}$

68. The maximum number of orbitals that can be associated with the following quantum numbers is

n = 3, l = 1, m_l = 0

(1) 1

(2) 2

(3) 3

(4) 4

69. The number of radial nodes and angular nodes in 3p orbital respectively are

(1) 1 and 1

(2) 1 and 2

(3) 2 and 1

(4) 0 and 1

70. The orbital angular momentum of 3d electron is

(1) $\sqrt{2}\,\hbar$

(2) $\sqrt{6}\,\hbar$

(3) $\sqrt{5}\,\hbar$

(4) $\sqrt{3}\,\hbar$

71. The angular momentum of electron in 3rd orbit of H-atom is

(1) $\frac{h}{2\pi}$

(2) $\frac{h}{\pi}$

(3) $\frac{3h}{2\pi}$

(4) $\frac{5h}{2\pi}$

72. Maximum number of electrons present in p subshell is

(1) 2

(2) 6

(3) 10

(4) 5

73. Electromagnetic radiation having maximum frequency among the following is

(1) UV rays

(2) IR waves

(3) Radio waves

(4) X-rays

74. Incorrect set of quantum numbers is

   n l m s

(1) 4 2 +3 $-\frac{1}{2}$

(2) 4 2 +1 $-\frac{1}{2}$

(3) 5 4 −1 $+\frac{1}{2}$

(4) 5 3 +2 $+\frac{1}{2}$

(1) (1)

(2) (2)

(3) (3)

(4) (4)

75. The species which is isoelectronic with O_2 is

(1) CO^+

(2) NO^+

(3) C_2^{2-}

(4) N_2^{2-}

76. Among the following, choose the one which represents electronic configuration of Mn^{++}.

(1) $[Ar]\,4s^1 3d^5$

(2) $[Ar]\,4s^2 3d^5$

(3) $[Ar]\,4s^0 3d^5$

(4) $[Ar]\,4s^1 3d^6$

77. The d_{z^2} orbital has

(1) Two lobes along z-axis and a ring along yz-plane

(2) Two lobes and a ring along z-axis

(3) Two lobes along z-axis and a ring along xy-plane

(4) Two lobes along z-axis and two lobes along xy-plane

78. Assertion : Proton is ionised hydrogen atom.
Reason : α-particle is the unionized helium atom.

(1) Both Assertion & Reason are true and the reason is the correct explanation of the assertion

(2) Both Assertion & Reason are true but the reason is not the correct explanation of the assertion

(3) Assertion is true statement but Reason is false

(4) Both Assertion and Reason are false statements

79. If uncertainty in momentum is double of uncertainty in position then uncertainty in position will be

   (1) $\sqrt{\dfrac{h}{\pi}}$

   (2) $\dfrac{1}{2}\sqrt{\dfrac{h}{2\pi}}$

   (3) $\dfrac{h}{2\sqrt{2}\pi}$

   (4) $\sqrt{\dfrac{h}{2\pi}}$

80. A : Cu^+ has zero unpaired electron.
   R : In Cu, the electron is removed from 3d but not from 4s.

   (1) Both Assertion & Reason are true and the reason is the correct explanation of the assertion

   (2) Both Assertion & Reason are true but the reason is not the correct explanation of the assertion

   (3) Assertion is true statement but Reason is false

   (4) Both Assertion and Reason are false statements

81. Total number of exchange of electrons possible in f^6 is

   (1) 6

   (2) 10

   (3) 15

   (4) 21

82. The energy of one mole of photons having frequency 1.0×10^{14} Hz is nearly

   (1) 3×10^3 J

   (2) 5×10^6 J

   (3) 4×10^4 J

   (4) 4×10^3 J

83. What is the longest wavelength of Paschen series of Li^{2+} ion?

   (1) $\dfrac{36}{R}$

   (2) $\dfrac{16}{7R}$

   (3) $\dfrac{7R}{16}$

   (4) $\dfrac{4}{3R}$

84. Shape of an atomic orbital is determined by

   (1) Principal quantum number

   (2) Azimuthal quantum number

   (3) Magnetic orbital quantum number

   (4) Electron spin quantum number

85. A : de-Broglie's wavelength of sub-atomic particle is inversely proportional to its velocity.
   R : de-Broglie's equation explains the particle nature of electrons only.

   (1) Both Assertion & Reason are true and the reason is the correct explanation of the assertion

   (2) Both Assertion & Reason are true but the reason is not the correct explanation of the assertion

   (3) Assertion is true statement but Reason is false

   (4) Both Assertion and Reason are false statements

SECTION-B

86. Number of groups present in d-block is

   (1) 8

   (2) 10

   (3) 7

   (4) 5

87. The electronic configuration of an element is $1s^2 2s^2 2p^6 3s^2 3p^5$. Atomic number of the element present just below this element in the periodic table is

   (1) 36

   (2) 35

   (3) 33

   (4) 34

88. Electronegativity value of Cl on Pauling scale is same as that of
    (1) C
    (2) N
    (3) O
    (4) S

89. Match List I with List II.

a.	List I		List II
a.	Alkali metal	(i)	ns^2np^3
b.	Alkaline earth metal	(ii)	ns^1
c.	Transition metal	(iii)	$(n-1)d^{1-10}ns^{1-2}$
d.	Pnictogens	(iv)	ns^2

    Choose the correct option.
    (1) a(ii), b(iv), c(i), d(iii)
    (2) a(ii), b(iv), c(iii), d(i)
    (3) a(ii), b(iii), c(iv), d(i)
    (4) a(iv), b(iii), c(ii), d(i)

90. Assertion : Be^{2+} is isoelectronic with Li^+.
    Reason : Effective nuclear charge is same for both Be^{2+} and Li^+.
    (1) Both Assertion & Reason are true and the reason is the correct explanation of the assertion
    (2) Both Assertion & Reason are true but the reason is not the correct explanation of the assertion
    (3) Assertion is true statement but Reason is false
    (4) Both Assertion and Reason are false statements

91. Which of the following transitions will emit photon of maximum energy?
    (1) $6 \rightarrow 2$
    (2) $3 \rightarrow 2$
    (3) $4 \rightarrow 1$
    (4) $5 \rightarrow 1$

92. The total number of atomic orbitals in fourth energy level of an atom is
    (1) 4
    (2) 8
    (3) 16
    (4) 32

93. The radius of the second orbit of He^+ ion is
    (1) 52.9 pm
    (2) 105.8 pm
    (3) 26.45 pm
    (4) 125.4 pm

94. Maximum charge/mass ratio is of
    (1) neutron
    (2) electron
    (3) proton
    (4) α-particle

95. The wavelengths i.e. λ_1 and λ_2 of two radiations are 5000 Å and 2000 Å respectively. The relation between energies E_1 and E_2 of two radiations (for same number of photons) will be
    (1) $5E_1 = 2E_2$
    (2) $E_1 = E_2$
    (3) $E_1 = 2E_2$
    (4) $E_1 = 3E_3$

96. Isobar of $_8^{14}C$ is
    (1) $_8^{12}C$
    (2) $_8^{13}C$
    (3) $_8^{16}O$
    (4) $_7^{14}N$

97. In hydrogen atom, which energy level order is not correct?
    (1) $1s < 2p$
    (2) $2p > 2s$
    (3) $2p < 3s$
    (4) $1s < 3s$

98. The maximum number of $3p$ electrons having spin quantum value of $+\frac{1}{2}$ is/are
    (1) 1
    (2) 6
    (3) 3
    (4) 2

99. Number of protons and neutrons respectively in $_{26}^{56}Fe$ are
    (1) 56, 26
    (2) 26, 56
    (3) 30, 26
    (4) 26, 30

100. According to Planck's quantum theory, energy of a photon(E) is equal to
    (1) $h\nu^2$
    (2) $h^2\nu$
   (3) $h\nu$
    (4) $\frac{h}{\nu}$

BOTANY

SECTION-A

101. Separation of homologous chromosomes occurs in
(1) Anaphase II
(2) Metaphase I
(3) Anaphase I
(4) Metaphase II

102. In animals, centriole duplication occurs in
(1) S phase
(2) G_1 phase
(3) M phase
(4) G_2 phase

103. If the nucleus of a pollen grain contains 20 pg of DNA then what would have been DNA in its mother cell in G_2 phase?
(1) 40 pg
(2) 20 pg
(3) 80 pg
(4) 120 pg

104. In the 24 hour average cell cycle of human cell, the proper cell division lasts for only about
(1) An hour
(2) 190 minutes
(3) 20 minutes
(4) 3 hours

105. The diplotene phase begins with
(1) Dissolution of the synaptonemal complex
(2) Disappearance of nucleolus
(3) Occurrence of synapsis
(4) Formation of chiasmata

106. The stage of cell cycle in which splitting of centromere occurs is also characterised by
(1) Condensation of chromosomes
(2) Alignment of chromosomes at the equatorial plate
(3) Reappearance of nuclear envelope
(4) Movement of chromatids to the opposite poles

107. Syncytium formation is due to
(1) Failure of karyokinesis after cytokinesis
(2) Failure of cytokinesis after karyokinesis
(3) Failure of both karyokinesis and cytokinesis
(4) Occurrence of cytokinesis after karyokinesis

108. Daughter cells produced after meiosis II are genetically
(1) Identical to their parent cell
(2) Identical to each other
(3) Identical to each other as well as their parent cell
(4) Neither identical to each other nor to their parent cell

109. Condensation of chromatin material begins in
(1) Anaphase I
(2) Prophase
(3) Metaphase I
(4) Telophase

110. All of the given are significance of meiosis, **except**
(1) Formation of gametes
(2) Maintenance of chromosome number
(3) Introduction of variation
(4) Healing and regeneration

111. In an animal cell, interkinesis lacks
(1) Centriole duplication
(2) DNA replication
(3) RNA synthesis
(4) Protein synthesis

112. In the oocytes of some vertebrates, which of the following phase of prophase-I can lasts for months or years?
(1) Diakinesis
(2) Zygotene
(3) Diplotene
(4) Pachytene

113. What will be the number of chromosomes in S phase if the number of chromosomes in G_1 phase is 46?
    (1) 23
    (2) 92
    (3) 12
    (4) 46

114. During which phase of cell cycle, spindle fibres attach to kinetochore?
    (1) Anaphase
    (2) Metaphase
    (3) Telophase
    (4) Prophase

115. Select the **incorrect** option about G_0 phase
    (1) It is also called quiescent stage of the cell
    (2) Cells in this stage are metabolically inactive
    (3) Cells do not proliferate unless called on to do so
    (4) Cells exit G_1 phase to enter this phase

116. Mitosis is called equational division, **because**
    (1) It occurs in somatic cells
    (2) It occurs in meristematic tissues of plants
    (3) It produces two daughter cells that have same number of chromosomes as that present in the parent cell
    (4) It involves karyokinesis and cytokinesis

117. An yeast cell, can complete the cell-cycle in approximately
    (1) 90 seconds
    (2) 90 minutes
    (3) 45 minutes
    (4) 90 hours

118. What will be the amount of DNA in meiosis-II products, if pollen mother cell contains 40 pg DNA in G_1 phase?
    (1) 20 pg
    (2) 80 pg
    (3) 10 pg
    (4) 5 pg

119. Small disc shaped proteinaceous structure at the surface of the centromeres is
    (1) Called telomere
    (2) Called centrosome
    (3) A site for protein synthesis
    (4) A site for microtubule attachment

120. In final stage of prophase-I of meiosis-I
    (1) Chiasmata formation occurs
    (2) Crossing over occur
    (3) Recombinase enzyme gets fully activated
    (4) Terminalisation of chiasmata takes place

121. Synapsis
    (1) Occurs in leptotene
    (2) Is pairing of homologous chromosomes
    (3) Is initiated in diplotene
    (4) Is the process in which chiasmata dissolution occur

122. Synapsis occurs between
    (1) Two sister chromatids
    (2) Two homologous chromosomes
    (3) Two non-homologous chromosomes
    (4) A male and female gamete

123. What will be the amount of DNA in daughter cells produced by mitosis and meiosis respectively if quantity of DNA in its parent cell is 20 picogram in G_1- stage?
    (1) 20 pg, 10 pg
    (2) 20 pg, 20 pg
    (3) 10 pg, 5 pg
    (4) 10 pg, 20 pg

124. Recombination between homologous chromosomes is completed by the end of
    (1) Diplotene
    (2) Pachytene
    (3) Zygotene
    (4) Diakinesis

125. State true (T) or false (F) and choose the **correct** option.
    A. During G_2 phase, proteins are synthesised in preparation for mitosis while cell growth continues.
    B. The plants and animals can show mitotic division in both haploid and diplod cells.

	A	B
(1)	T	T
(2)	F	T
(3)	F	F
(4)	T	F

    (1) (1)
    (2) (2)
    (3) (3)
    (4) (4)

126. During mitosis, ER and nucleolus reappear in
(1) Early prophase
(2) Telophase
(3) Late prophase
(4) Metaphase

127. The given figure represents
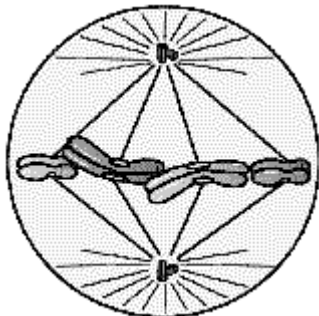
(1) Prophase
(2) Metaphase
(3) Anaphase
(4) Telophase

128. Order Polymoniales include
(1) Convolvulaceae and Anacardiaceae
(2) Convolvulaceae and Solanaceae
(3) Solanaceae and Poaceae
(4) Poaceae and Anacardiaceae

129. The word systematics is derived from a _____ word 'systema'.
(1) Greek
(2) English
(3) Roman
(4) Latin

130. Which among the following is **not** a defining feature?
(1) Metabolism
(2) Consciousness
(3) Intrinsic growth
(4) Reproduction

131. In taxonomic hierarchy
(1) Species serves as the basic and highest category
(2) Species serves as the basic and lowest category
(3) Division serves as the basic and highest category
(4) Kingdom serves as the basic and lowest category

132. Which of the following serves as quick referral system in taxonomical studies?
(1) Botanical gardens
(2) Herbarium
(3) Museum
(4) Zoological parks

133. Growth and reproduction are mutually exclusive events in
(1) Bacteria
(2) Diatoms
(3) *Amoeba*
(4) *Hydra*

134. ICBN stands for
(1) International Code for Bacterial Nomenclature
(2) Indian Code for Botanical Nomenclature
(3) International Code for Biological Nomenclature
(4) International Code for Botanical Nomenclature

135. Nomenclature is governed by certain universal rules. Choose the statement which is contrary to the rules
(1) Biological names are generally in Latin
(2) Name of the author appear before specific epithet
(3) The scientific name is underlined separately when hand written
(4) First word in a biological name represents the genus while the second component denotes the specific epithet

SECTION-B

136. Worker honey bees do **not** show
(1) Growth
(2) Reproduction
(3) Metabolism
(4) Consciousness

**137.** Indian Botanical Garden is located in
(1) Howrah
(2) Darjeeling
(3) Lucknow
(4) New Delhi

138. Each statement in the key is called
    (1) Couplet
    (2) Monograph
    (3) Lead
    (4) Manual

139. Binomial nomenclature was given by
    (1) Robert Hooke
    (2) Robert Brown
    (3) Carolus Linnaeus
    (4) Rudolf Virchow

140. According to binomial nomenclature, **correctly** printed scientific name of wheat is

    (1) *triticum Aestivum*
    (2) *Triticum* aestivum
    (3) *Triticum aestivum*
    (4) *Triticum Aestivum*

141. How many times DNA synthesis occur during the stages in a cell cycle?
    (1) zero
    (2) two
    (3) One
    (4) Three,

142. The best stage to observe acrocentric chromosome in J shape is
    (1) Metaphase
    (2) Anaphase
    (3) Prophase
    (4) Telophase

143. Duplication of semi-autonomous organelles occur in
    (1) G_1 and G_2 phase
    (2) G_2 and M-phase
    (3) G_1 phase
    (4) G_2 phase

144. The correct sequence of phases of the cell-cycle is
    (1) $G_2 \rightarrow S \rightarrow G_1 \rightarrow M$
    (2) $G_1 \rightarrow G_2 \rightarrow S \rightarrow M$
    (3) $G_1 \rightarrow M \rightarrow G_2 \rightarrow S$
    (4) $S \rightarrow G_2 \rightarrow M \rightarrow G_1$

145. During mitosis, mitotic spindle formation is completed in
    (1) Prophase
    (2) Metaphase
    (3) Telophase
    (4) Anaphase

146. How many tetrads are visible in human meiocyte?
    (1) 46
    (2) 23
    (3) 46 pairs
    (4) 23 pairs

147. Read the following statements and select the **correct** option.
    Statement A : Liquid endosperm of coconut is an example of syncytium.
    Statement B : Meiosis results in formation of haploid daughter cells which are identical to each other.
    (1) Only A is incorrect
    (2) Only B is incorrect
    (3) Both A and B are correct
    (4) Both A and B are incorrect

148. The metaphase II is similar to metaphase of mitosis in all aspects, **except**
    (1) Formation of single metaphasic plate
    (2) Microtubules from opposite poles attach to the kinetochore of two sister chromatids
    (3) Nucleolus and nuclear membrane do not appear
    (4) Occur in diploid cells only

149. The interval between mitosis and initiation of DNA replication is
    (1) G_0 phase
    (2) G_2 phase
    (3) S phase
    (4) G_1 phase

150. The phase of cell cycle which marks the end of cell division is
    (1) Telophase
    (2) Interkinesis
    (3) Cytokinesis
    (4) Karyokinesis

ZOOLOGY

SECTION-A

151. The exoskeleton of arthropods is a homopolymer of
(1) N-acetyl galactosamine
(2) N-acetyl glucosamine
(3) N-acetyl muramic acid
(4) Glucuronic acid

152. The molecular weight of lipids is
(1) More than 800 Da
(2) More than 10000 Da
(3) Less than 800 Da
(4) More than 8000 Da

153. Biomolecule named lecithin can be categorised as a/an
(1) Phosphoprotein
(2) Phospholipid
(3) Amino acid
(4) Fatty acid

154. Group of enzymes that catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds are called
(1) Oxidoreductases
(2) Transferases
(3) Lyases
(4) Hydrolases

155. The pitch of dsB-DNA would be
(1) 3.4 Å
(2) 0.34 Å
(3) 34 Å
(4) 34 nm

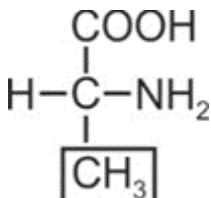**156.** Select the **odd** one from the following given graph.
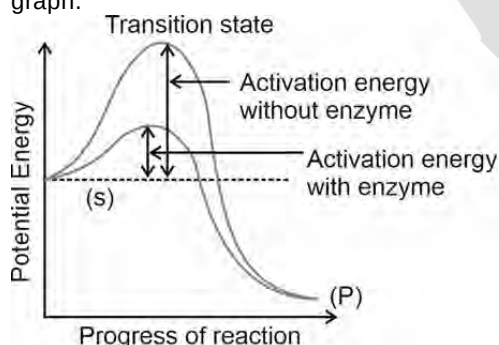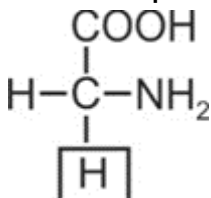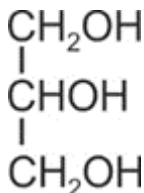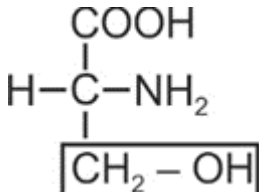
(1) In the presence of enzyme the activation energy is reduced
(2) Reduction in the activation energy leads to an enhanced speed of the reaction thereby converting substrate into products at a much faster rate
(3) When enzyme is absent, there is more amount of product formed
(4) When substrate binds to the active site of an enzyme, transition state structure is formed

157. 'Ramachandran Plot' is used to confirm the structure of category of biomolecules represented by
(1) Collagen
(2) Glycerol
(3) DNA
(4) Starch

158. Which of the following possesses helical structure?
(1) Starch
(2) Cellulose
(3) Glucose
(4) Chitin

159. Essential aromatic amino acid for humans is
(1) Lysine
(2) Phenylalanine
(3) Arachidonic acid
(4) Tyrosine

160. Read the following given statements and choose the correct option.
Statement-A: Change in substrate concentration regulates activity of enzymes.
Statement-B: Co-factor affects the catalytic activity of an enzyme.
(1) Both statements A and B are incorrect
(2) Both statements A and B are correct
(3) Only statement A is correct
(4) Only statement B is correct

161. All of the below given structures are of amino acids **except**

(1)

COOH
|
H−C−NH₂
|
[H]

(2)

CH₂OH
|
CHOH
|
CH₂OH

(3)

COOH
|
H−C−NH₂
|
[CH₂ − OH]

(4)

COOH
|
H−C−NH₂
|
[CH₃]

162. Select the **correct** match between column I and column II.

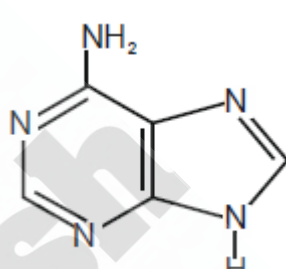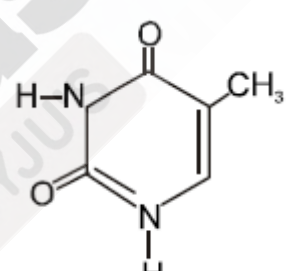| Column I		Column II
a. Cellulose	(i)	Storage homopolysaccharide
b. Chitin	(ii)	Structural homopolysaccharide
c. Inulin	(iii)	Branched polymer of glucose
d. Glycogen	(iv)	Exoskeleton of arthropods
	(v)	Cannot trap I₂ molecules

Choose the **correct** option.
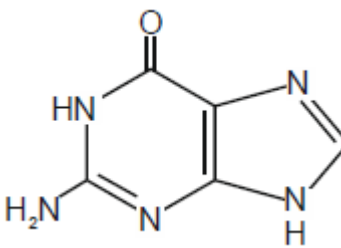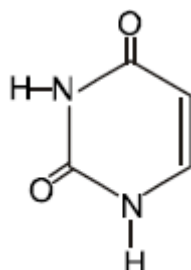
(1) a(v), b(iv), c(i), d(iii)

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

(3) a(v), b(iv), c(ii), d(i)

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

163. Choose the correct option in order to complete the analogy w.r.t secondary metabolites.
Pigment : Carotenoid : : Lectin : _____.

(1) Anthocyanin

(2) Concanavalin A

(3) Abrin

(4) Morphine

164. Among the following nitrogenous bases, select a purine that can form two hydrogen bonds with a pyrimidine.

(1)

(2)

(3)

(4)

165. If the total amount of cytosine and guanine in a dsDNA is 60%, the amount of adenine in this DNA will be

(1) 30%

(2) 20%

(3) 40%

(4) 50%

166. Select the correct statement in context of carboxypeptidase.

(1) Requires loosely held organic cofactor

(2) Requires tightly held organic cofactor

(3) Requires inorganic cofactor zinc for optimal activity

(4) Requires prosthetic group haem for optimal activity

167. How many of the given items listed in the box are heteropolymers with peptide bond as the linking bond between monomers?

Trypsin, RNA, Cellulose, Glycogen, Inulin, Collagen, Lecithin

(1) One
(2) Two
(3) Four
(4) Six

168. All of the following secondary metabolites are incorrectly categorised into different groups except
(1) Morphine–Alkaloid
(2) Curcumin–Lectin
(3) Ricin–Pigments
(4) Gums–Terpenoids

169. Select the **correct** match.

(1)	Bond between alanine and glycine in a protein chain	Ester bond
(2)	Bond between adenine and pentose sugar in DNA	Glycosidic bond
(3)	Bond between guanine and cytosine on antiparallel strands of DNA	Phosphodiester bond
(4)	Bond between glucose and glucose in starch molecule	Peptide bond

(1) (1)
(2) (2)
(3) (3)
(4) (4)

170. Read the following statements.
Statement A : In primary structure of a protein, the left end is represented by the first amino acid and the right end by the last amino acid.
Statement B : In a polysaccharide chain, the right end is called the reducing end and the left end is called the non-reducing end.
Choose the **correct** option.
(1) Both the statements are correct
(2) Both the statements are incorrect
(3) Statement A is correct but statement B is incorrect
(4) Statement A is incorrect but statement B is correct

171. The most abundant protein in the whole of biosphere, is
(1) RuBisCO
(2) Collagen
(3) Keratin
(4) Myoglobin

172. Consider the following statements
A. The protein portion of a holoenzyme is called apoenzyme.
B. Prosthetic groups are inorganic cofactors loosely bound to protein part of conjugated enzyme.
Select the **correct** option.
(1) Both A and B are true
(2) A is true but B is false
(3) Both A and B are false
(4) A is false but B is true

173. Zwitterionic form is one at which the monomeric form of proteins exists as electrically neutral moiety at a specific pH. This is **true** for
(1) Trihydroxypropane
(2) Amino acids
(3) DNA
(4) RNA

174. Which secondary metabolite is a toxin?
(1) Codeine
(2) Abrin
(3) Curcumin
(4) Vinblastin

175. Match column-I with column-II and choose the correct option.

	Column-I		Column-II
(a)	Arachidonic acid	(i)	Trihydroxypropane
(b)	Palmitic acid	(ii)	Unsaturated fatty acid
(c)	Glycerol	(iii)	Saturated fatty acid

    (a) (b) (c)
(1) (i)   (iii) (ii)
(2) (iii) (i)   (ii)
(3) (ii) (iii) (i)
(4) (ii) (i)   (iii)

(1) (1)
(2) (2)
(3) (3)
(4) (4)

176. Arachidonic acid has _____ carbon atoms including the carboxyl carbon. Choose the option that fills the blank **correctly** to complete the given statement.
(1) 19
(2) 20
(3) 21
(4) 22

177. Which among the following does not hold true for nucleic acids?
(1) A nucleic acid containing ribose sugar is called RNA.
(2) A nucleic acid containing 2-deoxyribose sugar is called DNA.
(3) They are polymer of nucleotides.
(4) A nucleotide has only two chemically distinct components, nitrogenous base and sugar.

178. A : Lipids though obtained in macromolecular fraction are not true macromolecules.
R : Lipids do not exceed molecular weight of 800 Da and are part of acid soluble fraction.
In the light of above statements, select the **correct** option.
(1) Both Assertion & Reason are true and the reason is the correct explanation of the assertion.
(2) Both Assertion & Reason are true but the reason is not the correct explanation of the assertion.
(3) Assertion is true statement but Reason is false.
(4) Both Assertion and Reason are false statements.

179. Select the **incorrect** statement w.r.t. catalytic action of enzyme
(1) The first step is binding of substrate to active site of enzyme
(2) The substrate always binds irreversibly with the enzyme and prevents the latter from breaking down its bonds
(3) The binding of substrate with enzyme leads to the formation of transient enzyme substrate complex
(4) After the product is formed, the free enzyme can bind to another molecule of substrate

180. Haemoglobin has four helical polypeptide chains, two α-chains and two β-chains. It is the example of
(1) Quaternary structure
(2) Tertiary structure
(3) Secondary structure
(4) Primary structure

181. Match the following and mark the correct option.

	R (Variable group)		Amino Acid
a.	Acidic	(i)	Valine
b.	Basic	(ii)	Glutamic acid
c.	Neutral	(iii)	Lysine

(1) a(i), b(ii), c(iii)
(2) a(ii), b(iii), c(i)
(3) a(iii), b(i), c(ii)
(4) a(ii), b(i), c(iii)

182. Select the incorrect statement w.r.t. lipids.
(1) Phospholipids have phosphorus and a phosphorylated organic compound in them
(2) Gingelly oil has higher melting point than fats
(3) Lecithin is an example of a phospholipid
(4) Phospholipids are found in cell membrane

183. Which is **not** common between sucrose and inulin?
(1) Both contain fructose
(2) Both are non-reducing sugars
(3) Both contain glycosidic linkages
(4) Both contain glucose

184. In the following diagram of glycogen, 'a', 'b' and 'c' are respectively
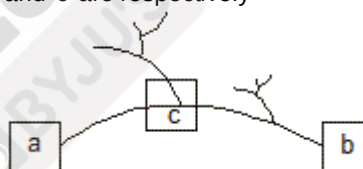
(1) Non-reducing end, Reducing end, α(1 → 6) glycosidic linkage
(2) Reducing end, non-reducing end, α(1 → 6) glycosidic linkage
(3) Reducing end, non-reducing end, α(1 → 4) glycosidic linkage
(4) Non-reducing end, Reducing end, α(1 → 4) glycosidic linkage

185. Michaelis constant (K_m) refers to substrate concentration at which the reaction reaches ____ of its maximum velocity.
Choose the option which fills the blank **correctly.**
(1) Three-fourth
(2) One-third
(3) One-fourth
(4) Half

SECTION-B

186. Monomeric unit is **not** available for
   (1) Proteins
   (2) Lipids
   (3) Polysaccharides
   (4) Nucleic acids

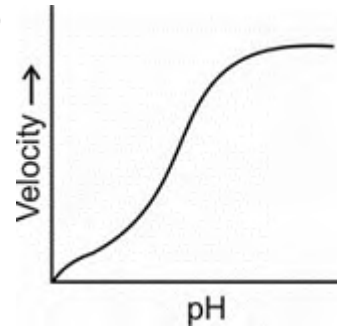**187.** Complete the analogy w.r.t. proteins and their functions.
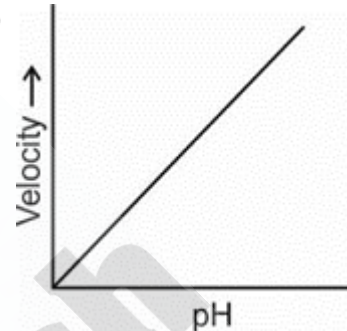   Trypsin : Enzyme : : GLUT-4 : _____
   (1) Fights infectious agents
   (2) Hormone
   (3) Enables glucose transport into cells
   (4) Forms intercellular ground substance

188. Which of the following graph represents **correctly** the effect of pH on the velocity of a typical enzymatic reaction?
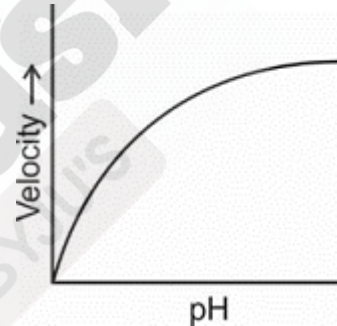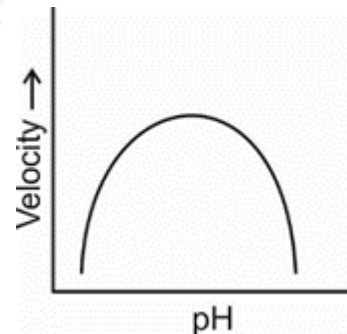
   (1)

   (2)

   (3)

   (4)

189. Select the correct option w.r.t. living state
   (1) Non-equilibrium unsteady state
   (2) Non-equilibrium steady-state to be able to perform work
   (3) Equilibrium steady-state
   (4) Non-equilibrium steady-state unable to perform work

190. Which of the following is **not** a polymer of glucose?
 (1) Starch
 (2) Inulin
 (3) Glycogen
 (4) Cellulose

191. Read the following statements (A) and (B) and select the correct option.
Statement (A): Glycerol is trihydroxy propane.
Statement (B): Lecithin is a phospholipid found in cell membranes of animals.
 (1) Statement (A) is incorrect while (B) is correct
 (2) Statement (A) is correct while (B) is incorrect
 (3) Both statements are correct
 (4) Both statements are incorrect

192. At high temperature, enzymes become __A__ while at low temperature enzymes remain in __B__ state. Select the **correct** option for A and B respectively.
 (1) Hyperactive, active
 (2) Inactivated, active
 (3) Denatured, inactive
 (4) Inactivated, hyperactive

193. Match the column I with column II and choose the **correct** answer with respect to elements present in earth crust.

	Column I		Column II
a.	Hydrogen	(i)	Very little
b.	Sulphur	(ii)	46.6%
c.	Nitrogen	(iii)	0.14%
d.	Oxygen	(iv)	0.03%
e.	Silicon	(v)	27.7%

 (1) a(iv), b(ii), c(iii), d(v,) e(i)
 (2) a(iii), b(iv), c(ii), d(i), e(v)
 (3) a(ii), b(iv), c(i), d(iii), e(v)
 (4) a(iii), b(iv), c(i), d(ii), e(v)

194. In competitive inhibition of succinic dehydrogenase which of the following inhibitor is used?
 (1) Malate
 (2) Sulpha drugs
 (3) Citrate
 (4) Malonate

195. Prosthetic group is usually
 (1) An organic cofactor firmly attached to apoenzyme
 (2) An inorganic cofactor transiently attached to apoenzyme
 (3) An organic cofactor loosely attached to apoenzyme
 (4) An inorganic cofactor loosely attached to apoenzyme

196. Read the given statements.
a. Ribozyme is a nucleic acid acting as an enzyme.
b. After catalysis, ES complex breaks to release free enzyme and substrate.
c. Deoxyribose sugar is present in DNA.
d. Inulin is a homopolymer of galactose.
How many statements are **wrong**?
 (1) One
 (2) Three
 (3) Two
 (4) Four

197. A cofactor is
 (1) Holoenzyme – Apoenzyme
 (2) Apoenzyme + Co-enzyme
 (3) Conjugated enzyme – Proenzyme
 (4) Proenzyme + Prosthetic group

198. _____ is the prosthetic group in peroxidase and catalase enzymes that catalyze the breakdown of hydrogen peroxide to water and oxygen.
Choose the option which fills the blank **correctly**.
 (1) Magnesium
 (2) Haem
 (3) Copper
 (4) Cobalt

199. The likely E. C. number for cytochrome c oxidase can be
 (1) 2.1.3.2
 (2) 4.5.2.1
 (3) 1.9.3.1
 (4) 5.3.2.4

200. Most abundant element in both Earth's crust and human body is
 (1) Hydrogen
 (2) Silicon
 (3) Oxygen
 (4) Nitrogen