23/04/2024

Phase-I
CODE-B

Aakash
Medical | IIT-JEE | Foundations

***Corporate Office*:** Aakash Tower, 8, Pusa Road, New Delhi-110005, Ph.011-47623456

FINAL TEST SERIES for NEET-2024

MM : 720 **Test -10** **Time : 3 Hrs. 20 Mins.**

Complete Syllabus of Class XI & XII

Instructions :

(i) 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 from Section-B out of 15.

(ii) Each question carries 4 marks. For every wrong response 1 mark shall be deducted from the total score. Unanswered / unattempted questions will be given no marks.

(iii) Use blue/black ballpoint pen only to darken the appropriate circle.

(iv) Mark should be dark and completely fill the circle.

(v) Dark only one circle for each entry.

(vi) Dark the circle in the space provided only.

(vii) Rough work must not be done on the Answer sheet and do not use white-fluid or any other rubbing material on the Answer sheet.

PHYSICS

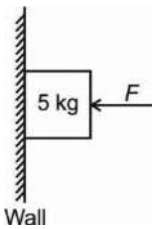
Choose the correct answer :

SECTION - A

1. Bohr's atomic model is applicable to
   (1) All atoms
   (2) Hydrogen atom only
   (3) All single electron species
   (4) Helium ion only

2. The angle between electric field and the equipotential surface is
   (1) 180° (2) 90°
   (3) 45° (4) 0°

3. If weight of block is 5 kg and coefficient of static friction is 0.5, then the minimum force required to keep the block at rest will be



   (1) 250 N (2) 500 N
   (3) 100 N (4) 50 N

4. Kinetic energy, potential energy and total mechanical energy of a body are equal to K, U and E respectively. Which option cannot be possible?
   (1) $E > K$ (2) $E < K$
   (3) $E > U$ (4) $E < U$

5. The voltage across the resistor, capacitor and inductor is 20 V each in a series LCR circuit. If the inductor is short circuited, then the voltage across the capacitor will be
   (1) $\frac{10}{\sqrt{2}}$ V (2) $10\sqrt{2}$ V
   (3) 10 V (4) 20 V

6. The surface energy of a liquid drop is E. If it is sprayed into 125 equal droplets, then its surface energy becomes
   (1) $5E$ (2) $10E$
   (3) $25E$ (4) $125E$

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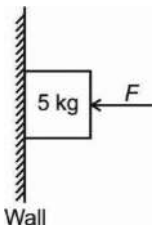

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7. A block is performing simple harmonic motion. When its displacements from the stable equilibrium position are 5 cm and 4 cm, the corresponding speeds are 8 cm/s and 10 cm/s. The time period of oscillation of the block is

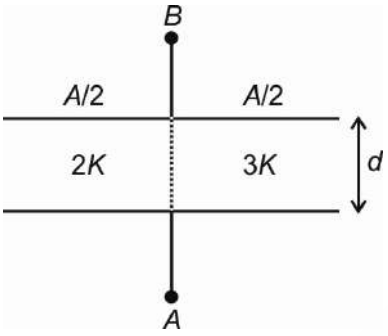
(1) 1.57 s

(2) 3.14 s

(3) 6.28 s

(4) 12.56 s

8. A parallel plate capacitor of area A, plate separation d and capacitance C is filled with two dielectric materials having dielectric constants $2K$ and $3K$ as shown in the figure.



Effective capacitance across the points A and B is

(1) $5K$ (2) $\frac{5}{2}KC$

(3) $\frac{2}{5}KC$ (4) $\frac{4}{7}KC$

9. A short dipole is at origin and directed towards positive x-axis. The electric field at a point $A(0, a, 0)$ is $\vec{E}$. The electric field at a point $B(a, 0, 0)$ will be

(1) $\vec{E}$ (2) $2\vec{E}$

(3) $-\frac{\vec{E}}{2}$ (4) $-2\vec{E}$

10. The time period of oscillation of a simple pendulum is $T = 2\pi\sqrt{\frac{L}{g}}$. The measured value of L is 10.0 cm with an instrument having least count 1 mm and time of 100 oscillations of the pendulum is measured to be 125 s using a stop watch of least count 1 second. The maximum percentage error in the determination of g is

(1) 1.4% (2) 2.6%

(3) 2% (4) 3%

11. In hydrogen atom, for which of the following transitions, photon with minimum wavelength is emitted?

(1) $n_f = 3, n_i = 5$

(2) $n_f = 2, n_i = 4$

(3) $n_f = 3, n_i = 4$

(4) $n_f = 4, n_i = 5$

12. If critical angle of a transparent crystal is 37°, then its polarizing angle will be

(1) $\tan^{-1}\left(\frac{5}{3}\right)$ (2) $\tan^{-1}\left(\frac{4}{3}\right)$

(3) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (4) $\tan^{-1}\left(\frac{3}{2}\right)$

13. The surface of a metal is illuminated with the light of wavelength 400 nm. The maximum kinetic energy of the ejected photoelectrons was found to be 1.68 eV. Work function of the metal is about

(1) 3.09 eV (2) 1.42 eV

(3) 4.73 eV (4) 0.68 eV

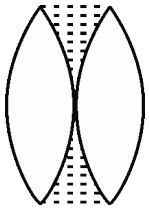
14. When $_{92}U^{237}$ nucleus is converted into $_{83}Bi^{209}$, x and y number of α and β^- particles are emitted respectively, then the values of x and y respectively are

(1) 5, 7 (2) 7, 6

(3) 7, 5 (4) 6, 7

Space for Rough Work

15. Two identical thin equiconvex lenses each of focal length 20 cm, made of material of refractive index 1.5 are placed coaxially in contact as shown. Now, the space between them is filled with a liquid of refractive index 1.5. The equivalent power of the arrangement will be



(1) +5 D (2) Zero

(3) +2.5 D (4) +0.5 D

16. A seconds pendulum is arranged in a lift. If the lift is moving down with an acceleration $\left(\frac{g}{2}\right)$, then its new time period will be

(1) $\sqrt{2}$ s (2) 2 s

(3) $2\sqrt{2}$ s (4) 1 s

17. A segment of wire vibrates with fundamental frequency 400 Hz under a tension of 8 kg weight. The tension at which the fundamental frequency of same wire becomes 800 Hz is

(1) 16 kg-weight (2) 32 kg-weight

(3) 12 kg-weight (4) 24 kg-weight

18. The pressure at the bottom of an open water tank is $3P_0$, where P_0 is atmospheric pressure. If water is drawn out until the water level decreases by $\frac{2}{3}$ times, then pressure at the bottom of the tank will be

(1) $\frac{7P_0}{3}$ (2) $\frac{3P_0}{2}$

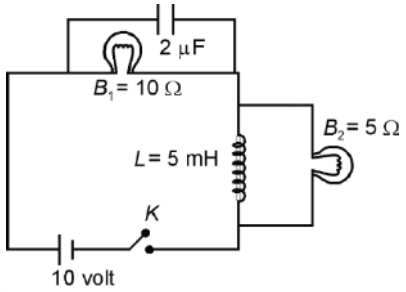
(3) $\frac{5P_0}{2}$ (4) $\frac{5P_0}{3}$

19. A particle of mass m is thrown from ground with velocity v making an angle 30° with vertical. The change in momentum of the particle during its entire journey has magnitude

(1) mv (2) $\frac{\sqrt{3}mv}{2}$

(3) $2mv$ (4) $\sqrt{3}mv$

20. In the given circuit, the power consumed by the bulb B_1 long time after the key K is closed will be (inductor is ideal)



(1) 5 W (2) 10 W

(3) 20 W (4) 40 W

21. The position – time graph of a particle is a straight line with a positive slope. This indicates

(1) The object is moving with constant acceleration

(2) The object is moving with zero acceleration

(3) The object is moving with increasing acceleration

(4) The object is moving with decreasing acceleration

22. A block of mass 4 kg is in contact against the inner wall of a hollow cylindrical drum of radius 1.5 m. The walls of the drum are rough and the minimum angular velocity needed for the drum to keep the block stationary when it is rotated about vertical axis is equal to 10 rad/s, the value of friction coefficient is (g = 10 m/s^2)

(1) $\frac{1}{15}$ (2) $\frac{1}{10}$

(3) $\frac{2}{15}$ (4) $\frac{1}{4}$

Space for Rough Work

23. In a new system of units, the unit of mass is 10 kg, unit of length is 100 m and unit of time is 1000 s, then the value of $10\ \text{kg}\frac{\text{m}^2}{\text{s}^2}$ in this new system will be

(1) 10^2 (2) 10^3

(3) 10^4 (4) 10^{-2}

24. Collision takes place between two identical balls. The kinetic energy loss will be maximum for

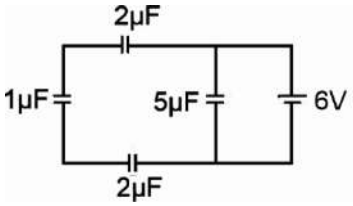
(1) Perfectly inelastic collision

(2) Perfectly elastic collision

(3) Partially inelastic collision

(4) Loss is same for all types of collisions

25. The charge on 1 μF capacitor in steady state will be



(1) 2 μC (2) $\frac{5}{2}$ μC

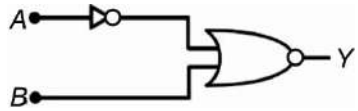
(3) 3 μC (4) Zero

26. The torque (in N m) about the origin when a force of $\left(2\hat{i}+3\hat{j}\right)$N acts on a point whose position vector is $\left(\hat{i}-\hat{j}+\hat{k}\right)$m is

(1) $3\hat{i}-2\hat{j}-5\hat{k}$ (2) $3\hat{i}-2\hat{j}+5\hat{k}$

(3) $-3\hat{i}-2\hat{j}+5\hat{k}$ (4) $-3\hat{i}+2\hat{j}+5\hat{k}$

27. For the following logic gate circuit, the truth table is



(1)

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

(2)

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	0

(3)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(4)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

28. **Assertion (A) :** To observe the photoelectric effect, a certain minimum frequency of light is needed which can be explained by particle nature of light.

Reason (R) : According to particle theory of light, energy of each photon is proportional to the wavelength of light.

(1) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**

(2) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A)**

(3) **(A)** is correct but **(R)** is not correct

(4) Both **(A)** and **(R)** are not correct

29. A swimmer swims with a speed of 6 m/s in still water. In a river of width $900\sqrt{3}$ m, water flows with speed of 3 m/s. If the swimmer swims in the river such that he reaches the other bank without drift, then the time taken by him to cross the river will be

(1) 2 minutes (2) 5 minutes

(3) 10 minutes (4) 12 minutes

30. The SI unit of volumetric strain is

(1) m^3 (2) m

(3) m^{-3} (4) No unit

31. Magnetic susceptibilities of three magnetic materials are 0.05, –0.01, and 599. The materials in the respective order are

(1) Paramagnetic, ferromagnetic, diamagnetic

(2) Paramagnetic, diamagnetic, ferromagnetic

(3) Diamagnetic, paramagnetic, ferromagnetic

(4) Diamagnetic, ferromagnetic, paramagnetic

Space for Rough Work

32. Position-time equation of a particle executing SHM is given by $y = A\sin(\omega t) + B\sin(2\omega t)$, where ω is 20π rad s^{-1}, then time period of the oscillation is

(1) 0.2 s (2) 0.1 s

(3) 0.05 s (4) 10 s

33. Consider the following statements:

Statement I : In a series LCR ac circuit, current always leads the source voltage.

Statement II : In a series LCR ac circuit, energy loss is zero when power factor is equal to one.

In the light of the above statements, choose the correct option.

(1) Both the statements I and II are correct

(2) Both the statements I and II are incorrect

(3) Statement I is correct and statement II is incorrect

(4) Statement I is incorrect and statement II is correct

34. A ray of light is incident on a thin prism with apex angle equal to 4°. If the refractive index of the material of prism is 1.5, then the angle of deviation of the light ray is

(1) 1° (2) 2°

(3) 1.5° (4) 4°

35. A car initially at rest starts moving on a straight road with uniform acceleration of 2 m/s^2. The ratio of distance covered in first 3 seconds to the distance covered in 3rd second by the car is

(1) $\frac{9}{5}$ (2) $\frac{5}{9}$

(3) $\frac{1}{3}$ (4) $\frac{4}{3}$

SECTION-B

36. A ball of mass m is projected with speed v_0 from ground at an angle 30º with horizontal. The instantaneous power delivered by the gravity to the ball at the highest point of its trajectory will be

(1) Zero (2) $\frac{\sqrt{3}mgv_0}{2}$

(3) $\frac{mgv_0}{2}$ (4) $-mgv_0$

37. Two positive ions, each carrying equal charge are separated by a distance 'd'. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge on an electron)

(1) $\frac{4\pi\varepsilon_0 Fd^2}{e^2}$ (2) $\sqrt{\frac{4\pi\varepsilon_0 Fe^2}{d^2}}$

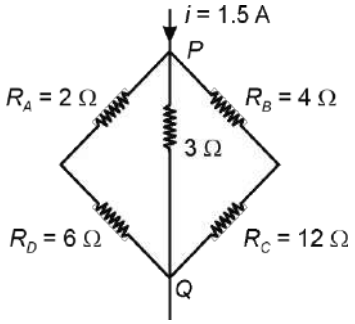
(3) $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$ (4) $\frac{\pi\varepsilon_0 Fd^2}{e^2}$

38. A block attached to a string describes a vertical circle of radius r. If block has a velocity $\sqrt{3rg}$ at the highest point, then ratio of maximum and minimum tension in the string is

(1) 3 (2) 2

(3) 4 (4) 1

39. Potential difference between the points P and Q in the electric circuit shown in the figure below is



(1) Zero (2) 1.2 V

(3) 2.4 V (4) 2.88 V

Space for Rough Work

40. An alpha particle and a proton are both accelerated by same potential difference, made to enter into a transverse uniform magnetic field. Then inside the magnetic field,
(1) Path of proton will be more curved
(2) Path of alpha particle will be more curved
(3) Path of both the particles will be equally curved
(4) Insufficient information

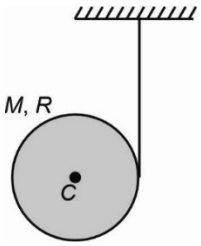
41. What is the velocity '*v*' of a metallic ball of radius '*r*' falling in a tank of liquid at the instant when its acceleration is one half that of a freely falling body? (The densities of metal and liquid are ρ and σ respectively, and viscosity of the liquid is η).

(1) $\frac{r^2 g}{9\eta}(\rho - 2\sigma)$ (2) $\frac{r^2 g}{\eta}(2\rho - \sigma)$

(3) $\frac{r^2 g}{9\eta}(\rho - \sigma)$ (4) $\frac{2r^2 g}{9\eta}(\rho - \sigma)$

42. In the phenomenon of electromagnetic induction, current in a coil can be induced by varying
(1) Magnetic field
(2) Area of coil
(3) Angle between magnetic field and coil
(4) All of the above

43. As shown in the figure, a uniform solid cylinder of mass *M* and radius *R* is hung with a massless string wrapped around it. If there is no slipping between string and cylinder, then the angular acceleration of the falling cylinder will be



(1) $\frac{g}{3R}$ (2) $\frac{3g}{2R}$

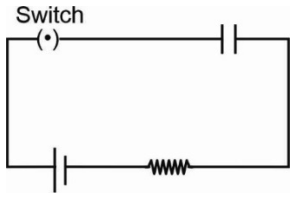
(3) $\frac{4g}{3R}$ (4) $\frac{2g}{3R}$

44. Consider a uniform solid sphere of mass 10 kg and radius 4 m. *G* represents the universal gravitational constant and *r* is the distance from the centre of sphere. Using the above information, match the columns and mark the correct option. All the entries in column II are in SI units.

	Column-I		**Column-II**
(A)	Gravitational field at r = 5 m	(P)	$-\frac{5G}{16}$
(B)	Gravitational field at r = 2 m	(Q)	$-2G$
(C)	Gravitational potential at r = 5 m	(R)	$-\frac{15}{4}G$
(D)	Gravitational potential at centre	(S)	$-\frac{2G}{5}$

(1) A-(S), B-(Q), C-(R), D-(P)
(2) A-(Q), B-(S), C-(P), D-(R)
(3) A-(Q), B-(P), C-(R), D-(S)
(4) A-(S), B-(P), C-(Q), D-(R)

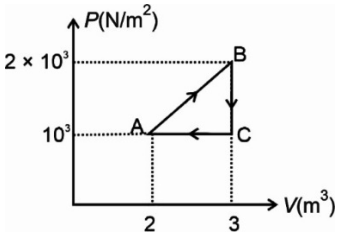
45. A capacitor is connected with a battery and a resistance as shown. If the switch is closed at t = 0, then



(1) Minimum current will flow in the circuit at t = 0
(2) Maximum current will flow in the circuit at t = 0
(3) Constant current will flow in the circuit from t = 0 to $t = \infty$
(4) Both (2) and (3)

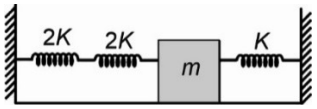
Space for Rough Work

46. For the given cyclic process as shown in pressure – volume graph, the net heat supplied to the system is



(1) Zero (2) 200 J
(3) 500 J (4) 750 J

47. A block of mass *m* is attached with springs as shown. If it is slightly disturbed from its equilibrium position, then the time period of oscillation will be



(1) $2\pi\sqrt{\frac{m}{4K}}$ (2) $2\pi\sqrt{\frac{m}{K}}$
(3) $2\pi\sqrt{\frac{m}{2K}}$ (4) $2\pi\sqrt{\frac{2m}{K}}$

48. An α-particle at rest experiences an electro-magnetic force. If *E* represents electric field and *B* represents magnetic field, then
(1) Both *B* and *E* must be present
(2) *E* must be present, *B* may be present
(3) *B* must be present, *E* may not be present
(4) All of the above

49. Kirchhoff's first law or the junction law is based on conservation of
(1) Mass
(2) Charge
(3) Energy
(4) Linear momentum

50. An inductor of inductance 2 H is connected in a circuit. At an instant, if the current through it is increasing at a rate of 3 A/s, then the potential difference across the inductor is
(1) Zero
(2) 6 V
(3) 3 V
(4) 1 V

CHEMISTRY

SECTION - A

51. Consider the following statements:

Statement I: For a reversible reaction, if $Q_c < K_c$, net reaction goes in the forward direction.

Statement II: If ΔG is negative, then the reaction is spontaneous and proceeds in the backward direction for a reversible reaction.

In the light of above two statements, select the correct option.
(1) Statement I is true and statement II is false
(2) Statement I is false and statement II is true
(3) Both statement I and statement II are true
(4) Both statement I and statement II are false

52. Consider the following reactions:
a. $CaO + C \rightarrow [A] + CO$
b. $[A] + H_2O \rightarrow Ca(OH)_2 + [B]$
In the above reaction sequence, product [B] is
(1) CH_4 (2) C_2H_2
(3) CaC_2 (4) C_2H_4

53. The pH of 0.01 M $Ba(OH)_2$ (aq) solution will be
(1) 10
(2) 12.3
(3) 13.3
(4) 10.3

Space for Rough Work

54. Consider the following statements:

Statement I: Crystal field stabilisation energy for high spin d^5 octahedral complex is zero.

Statement II: $[Fe(CN)_6]^{4-}$ is a high spin complex with zero value of crystal field stabilisation energy.

In the light of above statements, choose the correct option.

(1) Both statement I and statement II are correct

(2) Both statement I and statement II are incorrect

(3) Statement I is correct and statement II is incorrect

(4) Statement II is correct and statement I is incorrect

55. Which oxide among the following cannot act as a reducing agent?

(1) ClO_2 (2) CO_2

(3) NO_2 (4) SO_2

56. In which of the following species S–S bond is present?

(1) $S_4O_6^{2-}$ (2) $S_2O_7^{2-}$

(3) $S_2O_8^{2-}$ (4) S_3O_9

57. During nitrogen estimation of an organic compound by Kjeldahl's method, the ammonia evolved by 0.6 g of compound neutralized by 10 ml of 1 M H_2SO_4. Percentage of nitrogen present in the compound is

(1) 23.33 (2) 46.67

(3) 70 (4) 83.33

58. Incorrect statement about amylopectin is

(1) It is a polysaccharide

(2) It constitutes about 80–85% of starch

(3) It is insoluble in water

(4) It has branching of glycosidic linkage by $C_1 - C_3$

59. For a cell reaction, to be spontaneous, necessary condition is/are

(i) $\Delta G < 0$

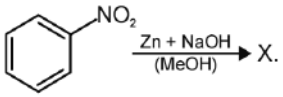
(ii) $\Delta S_{Total} < 0$

(iii) $E_{cell} > 0$

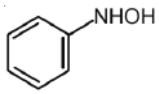
(1) (i) and (ii) only (2) (i), (ii) and (iii)

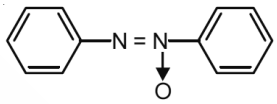
(3) (i) and (iii) only (4) (ii) and (iii) only

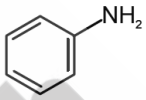
60. Consider the given reaction.

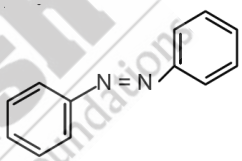


Identify X.

(1) 

(2) 

(3) 

(4) 

61. A 2 ampere current is passed through a solution of zinc sulphate for 20 minutes. The amount of zinc deposited at the cathode is

(1) 0.406 g (2) 0.812 g

(3) 0.316 g (4) 1.624 g

62. If mole fraction of NaOH in its aqueous solution is 0.2 then molality of the solution is

(1) 13.89 m (2) 6.94 m

(3) 10 m (4) 10.5 m

63. The order of melting point is

(1) Cr > Mn > Fe (2) Cr > Fe > Mn

(3) Mn > Cr > Fe (4) Fe > Mn > Cr

Space for Rough Work

64. Match **column I** with **column II** and choose the correct option.

	Column I (Compound)		Column II (Oxidation state of underlined element)
(a)	$\underline{Cr}O_5$	(i)	+ 3
(b)	$\underline{V}O_3^-$	(ii)	+ 7
(c)	$\underline{Mn}O_4^-$	(iii)	+ 5
(d)	$\underline{Fe}F_6^{3-}$	(iv)	+ 6

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

65. Given below are two statements.

Statement I: Aluminium is more electropositive than gallium.

Statement II: Gallium has the lowest melting point among the elements of group 13.

In the light of above statements, choose the **correct** option among the following.

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

66. For which of the following given reactions $\Delta H > \Delta U$?

(1) $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$
(2) $Ni(s) + 4CO(g) \rightarrow Ni(CO)_4(g)$
(3) $N_2(g) + O_2(g) \rightarrow 2NO(g)$
(4) $2NO_2(g) \rightarrow N_2O_4(g)$

67. Salt which undergoes anionic hydrolysis is

(1) NaCl (2) NH_4Cl
(3) $(NH_4)_2SO_4$ (4) CH_3COONa

68. Identify the non-redox reaction.

I. $2KClO_3(s) \xrightarrow{\Delta} 2KCl(s) + 3O_2(g)$
II. $NaOH + HCl \longrightarrow NaCl + H_2O$
III. $2H_2O_2 \longrightarrow 2H_2O + O_2$

(1) Only II (2) Only I & III
(3) Only I & II (4) Only II & III

69. Which of the following is inorganic graphite?

(1) $(BN)_x$ (2) $B_3N_3H_6$
(3) $(NO)_x$ (4) $(BNH)_x$

70. Correct order against indicated property is

(1) HCl > HBr > HI (Reducing power)
(2) HClO > $HClO_2$ > $HClO_3$ (Acidic strength)
(3) $I_2 < Br_2 < Cl_2 < F_2$ (Oxidising power)
(4) $NH_3 < PH_3 < AsH_3$ (Basic strength)

71. Van't Hoff factor of a triprotic acid H_3A having degree of dissociation 40% is

(1) 1.2 (2) 2.2
(3) 3.2 (4) 4.0

72. On electrolysis of aq. NaCl, products obtained at cathode and anode respectively are

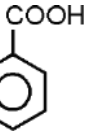
(1) H_2 and O_2 (2) Cl_2 and O_2
(3) H_2 and Cl_2 (4) Cl_2 and H_2

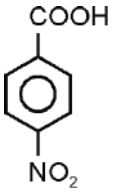
73. Half-life period of 1^{st} order reaction is equal to (k = rate constant of the reaction)

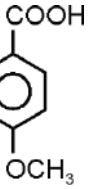
(1) $\frac{1}{k}$ (2) $\frac{0.693}{k}$
(3) 0.693k (4) $\frac{k}{0.693}$

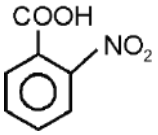
Space for Rough Work

74. Which among the following has highest pK_a?

(1) 

(2) 

(3) 

(4) 

75. Given below are two statements one is labelled as Assertion (A) and other is labelled as Reason (R).

Assertion (A): Heavier elements of group 14 do not form $p\pi - p\pi$ bonds.

Reason (R): Atomic orbitals of heavier elements of group-14 are too large and diffuse to have effective overlapping.

In the light of above statements, choose the correct option.

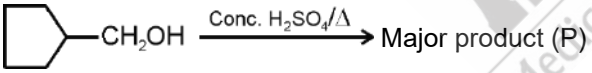
(1) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(2) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

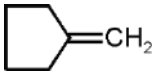
(3) (A) is correct and (R) is incorrect

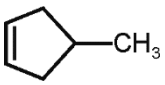
(4) Both (A) and (R) are incorrect

76. Consider the given reaction:



Product (P) is

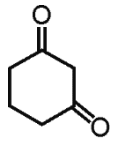
(1) 

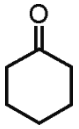
(2) 

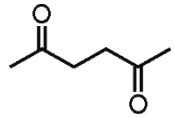
(3)

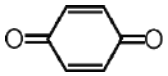
(4)

77. In the presence of $Na_2Cr_2O_7/H^+$, phenol is oxidised to

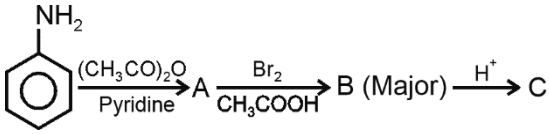
(1) 

(2) 

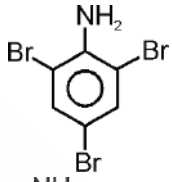
(3) 

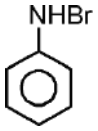
(4) 

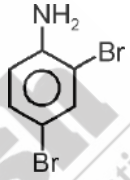
78. In the following reaction sequence

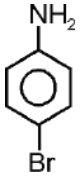


Product C is

(1) 

(2) 

(3) 

(4) 

79. Element of highest second ionization energy among the following is

(1) Li (2) Be

(3) B (4) C

80. Given below are two statements.

Statement I: Melting point of HF is greater than HCl.

Statement II: HF is a stronger acid than HCl.

In the light of above statements, choose the correct option.

(1) Statement I is incorrect but statement II is correct

(2) Statement I is correct but statement II is incorrect

(3) Both statement I and statement II are correct

(4) Both statement I and statement II are incorrect

Space for Rough Work

81. Longest bond length is present in

(1) C – N

(2) C = O

(3) C = C

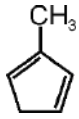
(4) C ≡ N

82. Which among the following has highest dipole moment?

(1) HF (2) HCl

(3) HBr (4) HI

83. Products obtained on reductive ozonolysis of



are

(1) $CHOCH_2CHO + CH_3CHO$

(2) $CHOCH_2CHO + CH_3COCH_3$

(3) $CH_3COCHO + CHOCH_2CHO$

(4) $CH_3COCHO + CH_3COCH_3$

84. Oxide which is not acidic is

(1) CO (2) CO_2

(3) GeO_2 (4) SiO_2

85. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A): In acid-base titration, phenolphthalein is used as an indicator.

Reason (R): Phenolphthalein is pink coloured in acidic medium while colourless in basic medium.

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

(1) Both (A) and (R) are true and (R) is the correct explanation of (A)

(2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

(3) (A) is true but (R) is false

(4) (A) is false but (R) is true

SECTION - B

86. The maximum number of isomeric ethers with the molecular formula $C_4H_{10}O$ is

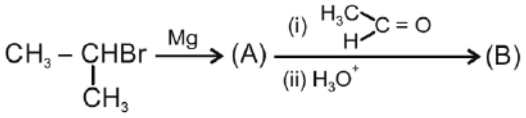
(1) 2

(2) 3

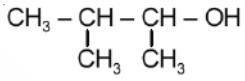
(3) 4

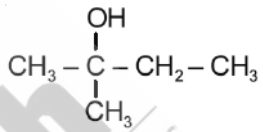
(4) 5

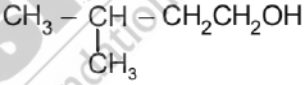
87. In the following reaction sequence

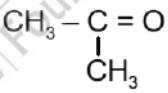


The product (B) is

(1) 

(2) 

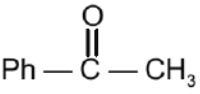
(3) 

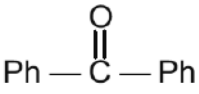
(4) 

88. Iodoform test is not given by

(1) CH_3COCH_3

(2) C_2H_5OH

(3) 

(4) 

Space for Rough Work

89. Match **column I** with **column II** and choose the correct option.

	Column I (Atomic orbital)		Column II (Set of quantum numbers)
(a)	4*d*	(i)	n = 4, l = 0, m_l = 0
(b)	4*p*	(ii)	n = 4, l = 1, m_l = –1
(c)	4*s*	(iii)	n = 4, l = 2, m_l = +1
(d)	4*f*	(iv)	n = 4, l = 3, m_l = 0

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

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

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

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

90. Correct order of basic strength is

(1) $CH_3NH_2 > PhNH_2 > PhCONH_2$

(2) $CH_3NH_2 > PhCONH_2 > PhNH_2$

(3) $PhNH_2 > CH_3NH_2 > PhCONH_2$

(4) $PhNH_2 > PhCONH_2 > CH_3NH_2$

91. Number of degenerate orbitals in second excited state of He^+ ion is

(1) 1 (2) 3

(3) 5 (4) 9

92. Complex which will show geometrical isomerism is

(1) $[Fe(H_2O)_6]Cl_3$ (2) $[Co(NH_3)_4Cl_2]Cl$

(3) $K_2[PtCl_4]$ (4) $[Co(en)_3]Cl_3$

93. A cation of group V gives brick red colour to the flame. It is precipitated as its carbonate on treatment with $(NH_4)_2CO_3$ in the presence of NH_4OH. When this precipitate is dissolved in acetic acid and treated with ammonium oxalate then white precipitate is formed. The cation is

(1) Ca^{2+} (2) Ba^{2+}

(3) Mg^{2+} (4) Sr^{2+}

94. If mole fraction of NaOH in aqueous solution is 0.1 and total mole of solution is 1 then mass of solvent present in solution will be

(1) 1.62 g

(2) 16.2 g

(3) 0.81 g

(4) 8.1 g

95. Radius of third excited state of He^+ ion is

(1) 0.529 Å

(2) 0.529 × 4 Å

(3) 0.529 × 2 Å

(4) 0.529 × 8 Å

96. Solubility of $Al(OH)_3$ in the presence of 0.2 M NaOH is [$K_{sp}(Al(OH)_3) = 4 \times 10^{-34}$]

(1) 4×10^{-34}

(2) 5×10^{-34}

(3) 5×10^{-32}

(4) 5×10^{-30}

97. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A): o-nitrophenol and p-nitrophenol are separated by steam distillation.

Reason (R): p-nitrophenol is steam volatile.

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

(1) Both (A) & (R) are true and (R) is the correct explanation of (A)

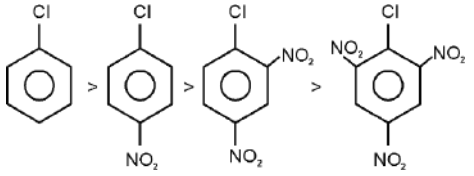
(2) Both (A) & (R) are true but (R) is not the correct explanation of (A)

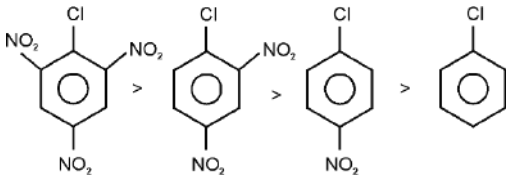
(3) (A) is true but (R) is false

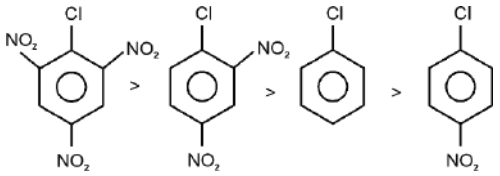
(4) Both (A) and (R) are false

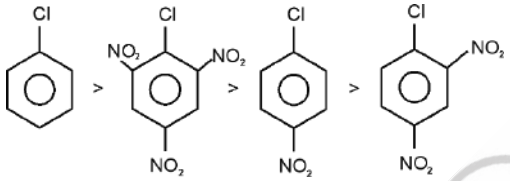
Space for Rough Work

98. Correct order of nucleophilic substitution reaction in the following is

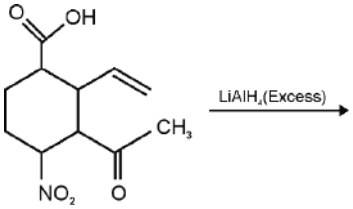
(1) 

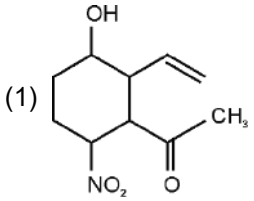
(2) 

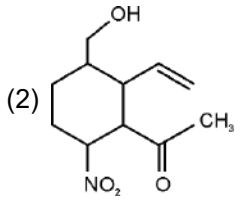
(3) 

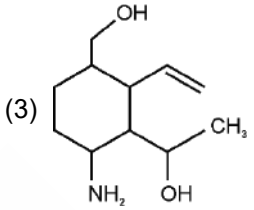
(4) 

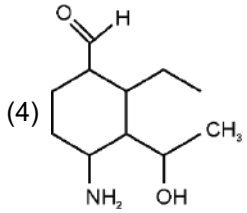
99. Major product obtained in the given reaction is



(1) 

(2) 

(3) 

(4) 

100. pH of 0.2 M aqueous sodium acetate solution will be (pK_a of CH_3COOH = 4.75)

(1) 7.5 (2) 8.5

(3) 9.0 (4) 10.5

BOTANY

SECTION - A

101. Metabolic reactions occur in

(1) Only those living organisms that have well defined nucleus

(2) Non-living objects only

(3) *In-vitro* conditions only

(4) Living organisms and some of those reactions can be made to occur in cell-free systems

102. Spores in consumer-decomposer protists are

(1) Formed during unfavourable conditions

(2) Without cell wall

(3) Dispersed with the help of flagella

(4) Formed inside plasmodium

103. Read the following statements and mark them as **true** (**T**) or **false** (**F**)

(A) Artificial system of classification grouped all the closely related species together

(B) Numbers and codes are assigned only to few observable characters in numerical taxonomy

(C) Chemotaxonomy is based on chemical constituents of the plants

(D) Cytotaxonomy is based on information like chromosome number, structure and behaviour

(1) (A)(T), (B)(T), (C)(F), (D)(T)

(2) (A)(T), (B)(F), (C)(T), (D)(T)

(3) (A)(F), (B)(F), (C)(T), (D)(T)

(4) (A)(T), (B)(T), (C)(T), (D)(F)

Space for Rough Work

104. How many of the following features are associated with the family whose member is okra?

(a) Actinomorphic flower

(b) Presence of epicalyx

(c) Dithecous anther

(d) Endospermic seed

(e) Twisted aestivation of calyx

(1) 3 (2) 4

(3) 5 (4) 2

105. A stele is constituted by all, **except**

(1) Hypodermis

(2) Pericycle

(3) Pith

(4) Vascular bundle

106. Which of the given statements is **incorrect** w.r.t. plastids?

(1) Chloroplast is a semi-autonomous cell organelle

(2) Majority of the chloroplasts of the green plants are found in mesophyll cells of the leaves

(3) Outer chloroplast membrane is relatively less permeable than inner membrane

(4) Amyloplasts store starch

107. A bisexual flowering plant produces 16 genetically different type of gametes. How many different zygotic genotypes are possible by selfing this plant?

(1) 16 (2) 81

(3) 8 (4) 16 × 8

108. How many generations of mitosis are required for producing 64 cells from a single cell?

(1) 63 (2) 7

(3) 6 (4) 32

109. Read the following statements and choose the **correct** option.

Statement A: C_4 plants show double carboxylation.

Statement B: C_4 plants have PEPcase enzyme in bundle sheath cells to fix CO_2.

(1) Only statement (A) is correct

(2) Only statement (B) is correct

(3) Both the statements (A) and (B) are correct

(4) Both the statements (A) and (B) are incorrect

110. What is the net gain of ATP if one molecule of glucose undergoes alcoholic or lactic acid fermentation?

(1) 38 ATP

(2) 36 ATP

(3) 4 ATP

(4) 2 ATP

111. Match the following columns and select the **correct** option w.r.t. components of chloroplast.

	Column I		**Column II**
a.	Thylakoids	(i)	Contains 70S ribosomes
b.	Stroma lamellae	(ii)	Flattened membranous sacs
c.	Stroma	(iii)	Stack of arranged sacs
d.	Granum	(iv)	Flat unstacked membranous tubules

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

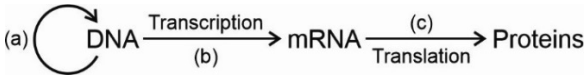
(2) a(iv), b(ii), c(i), d(iii)

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

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

Space for Rough Work

112. In the given flow chart of central dogma, select the **correct** option w.r.t. enzymes involved in the steps.



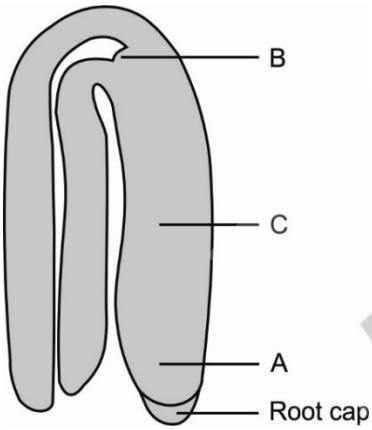
(1) (a) DNA polymerase
(b) RNA polymerase
(c) Peptidyl transferase

(2) (a) RNA polymerase
(b) Reverse transcriptase
(c) DNA polymerase

(3) (a) DNA dependent DNA polymerase
(b) RNA dependent DNA polymerase
(c) Peptidyl transferase

(4) (a) RNA dependent RNA polymerase
(b) DNA ligase
(c) DNA polymerase

113. The given below figure is a typical dicot embryo. What do A, B and C respectively represent?



	A	B	C
(1)	Radicle	Plumule	Cotyledon
(2)	Hypocotyl	Cotyledon	Plumule
(3)	Radicle	Plumule	Hypocotyl
(4)	Plumule	Radicle	Cotyledon

114. Select the **incorrect** statement about dinoflagellates.
(1) Their cell wall has lipids rich layer called pellicle
(2) Most of them have two flagella
(3) They are photosynthetic
(4) They are single celled eukaryotes

115. Tendrils of watermelon are modified
(1) Axillary buds
(2) Adventitious roots
(3) Scaly leaves
(4) Petiole

116. Phylloclade of *Opuntia* is
(1) Tubular leaf base
(2) Flattened petiole
(3) Modified stem
(4) Photosynthetic root

117. Choose the **incorrect** match.
(1) *Pinus* – Monoecious
(2) *Selaginella* – Heterosporous
(3) *Marchantia* – Dominant sporophytic stage
(4) *Eucalyptus* – Shows double fertilisation

118. Choose the **odd** one w.r.t. roles of rough endoplasmic reticulum.
(1) It provides precursor of enzyme for the formation of lysosome in Golgi complex
(2) It is involved in protein synthesis
(3) It gives rise to smooth endoplasmic reticulum
(4) It is primarily involved in lipid synthesis

119. Transcription in prokaryotes differs from that of eukaryotes as the former
(1) Takes place in nucleoplasm
(2) Includes post-transcriptional modifications
(3) Involves only one type of RNA polymerase
(4) Considers both DNA strands as template

Space for Rough Work

120. Incomplete dominance is exemplified by
(1) Flower colour in *Pisum sativum*
(2) ABO blood group in humans
(3) Flower colour in *Antirrhinum majus*
(4) Seed colour in *Pisum sativum*

121. In plants, all of the followings are naturally occurring hormone, **except**
(1) Zeatin (2) Kinetin
(3) IAA (4) IBA

122. Which of the following is an adaptation to ensure cross-pollination?
(1) Bisexuality
(2) Homogamy
(3) Bud-pollination
(4) Dichogamy

123. The probability of the progeny having AaBbccDd genotype from the cross between the parents AaBbCcDd and AaBbCcDd is
(1) $\frac{1}{2}$ (2) $\frac{1}{32}$
(3) $\frac{1}{16}$ (4) $\frac{1}{256}$

124. Read the following statements of assertion (A) and reason (R) and select the **correct** option.
Assertion (A): Transcription and translation are energetically very expensive processes, these have to be tightly regulated.
Reason (R): Regulation of translation is the primary step for regulation of gene expression.
(1) Both (A) and (R) are true and (R) is the correct explanation of (A)
(2) Both (A) and (R) are true and (R) is not the correct explanation of (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

125. The phenomenon which occur in cytoplasm of eukaryotic cells is
(1) Splicing of hnRNA
(2) Tailing of hnRNA
(3) Capping of hnRNA
(4) Aminoacylation of tRNA

126. Select the **odd** one w.r.t. commercial product from bacteria.
(1) Citric acid (2) Butyric acid
(3) Lactic acid (4) Acetic acid

127. The number of deaths in the population during a given period is
(1) Natality (2) Immigration
(3) Mortality (4) Emigration

128. Which of the following is **not** a functional aspect of an ecosystem?
(1) Nutrient cycling
(2) Species composition
(3) Productivity
(4) Decomposition

129. According to 'Rivet popper hypothesis', rivets on the wings are considered as
(1) Ecosystem (2) Extinct species
(3) Key species (4) Alien species

130. A pea plant heterozygous for both seed shape and seed colour was selfed and total 400 seeds were collected. What would be the total number of seeds having only recessive genes for both the characters?
(1) 25 (2) 30
(3) 10 (4) 60

131. The progenies of a test cross can be analysed to predict
(1) The phenotype of the test organism
(2) The genotype of the test organism
(3) The probability of all possible genotypes of offspring in a dihybrid cross
(4) The total number of progenies produced during a cross

Space for Rough Work

132. Choose the **wrong** statement regarding pollination.
(1) Pollen grains coming in contact with stigma is a chance factor in both wind and water pollination
(2) Pollination by water is quite rare in flowering plants
(3) The pollen grains are non-sticky in anemophilous flowers
(4) Flowers that attract flies and beetles are always odourless

133. Which of the following contributes to the formation of primary plant body but does not participate in secondary growth in dicots?
(1) Intrafascicular cambium
(2) Interfascicular cambium
(3) Phellogen
(4) Intercalary meristem

134. What will be the amount of DNA in meiocyte at its G_2 stage if its meiotic product has 10 pg DNA?
(1) 20 pg (2) 10 pg
(3) 40 pg (4) 80 pg

135. In which of the following phases of karyokinesis, morphology of chromosomes is most easily studied?
(1) Meiotic prophase I (2) Mitotic metaphase
(3) Mitotic prophase (4) Mitotic telophase

SECTION-B

136. The asexual spores common to both ascomycetes and deuteromycetes are
(1) Zoospores (2) Conidia
(3) Sporangiospores (4) Planospores

137. *Volvox* shows the type of life cycle pattern which
(1) Do not have free-living photosynthetic stage
(2) Have only zygote as sporophytic generation
(3) Is exhibited by all algae
(4) Have main plant body as free-living sporophytes

138. The medicinal plant of family Brassicaceae is
(1) *Nasturtium* (2) Ashwagandha
(3) *Aloe* (4) *Asparagus*

139. Read the following statements of assertion (A) and reason (R) and select the **correct** option.
Assertion (A): In the dicot root, the vascular cambium is completely secondary in origin.
Reason (R): In dicot roots, vascular cambium originates by the cells of conjoint open vascular bundles.
(1) Both (A) and (R) are true and (R) is correct explanation of (A)
(2) Both (A) and (R) are true and (R) is not the correct explanation of (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

140. Checkpoint present at G_2/M transition during cell cycle is influenced by all of the following factors, **except**
(1) Cell size
(2) Chromosome attachment to spindle
(3) DNA damage
(4) DNA replication

141. Select the **incorrect** statement w.r.t. glycolysis.
(1) Glycolysis takes place in cytoplasm
(2) It occurs both in aerobes and anaerobes
(3) There is no use of energy in the whole process
(4) Pyruvic acid is the end product of it

142. Which of the following shows 9 + 0 arrangement of microtubules giving a cartwheel like appearance?
(1) Centriole
(2) Cilia
(3) Eukaryotic flagella
(4) Fimbriae

Space for Rough Work

143. Select the **incorrect** statement w.r.t. VNTRs.
(1) They show very high degree of polymorphism
(2) The copy number varies from chromosomes to chromosomes in an individual
(3) They are microsatellites
(4) Their size vary from 0.1 to 20 kb

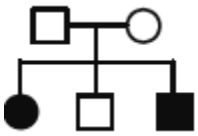
144. During transcription, the dsDNA helix is unwound by the enzyme
(1) Polynucleotide phosphorylase
(2) DNA gyrase
(3) RNA polymerase
(4) DNA polymerase

145. Alcoholic beverages produced without distillation of fermented broth are
(1) Wine and beer (2) Wine and whisky
(3) Whisky and rum (4) Brandy and rum

146. Choose the example of population interaction which shows competition.
(1) Clownfish living among sea anemone
(2) Epiphytes growing on mango trees
(3) *Balanus* living with *Chathamalus*
(4) Barnacles growing on the back of whale

147. In hydrarch succession, all belong to seral communities, **except**
(1) Amphibious plants
(2) Phytoplanktons
(3) Submerged plants
(4) Free-floating plants

148. In the following pedigree, the shaded symbols represent the affected individuals.



The given pedigree shows
(1) Autosomal dominant trait
(2) Autosomal recessive trait
(3) Sex linked dominant trait
(4) Sex linked recessive trait

149. Choose **odd** one w.r.t *in-situ* conservation of biodiversity.
(1) National parks (2) Wildlife sanctuaries
(3) Zoological parks (4) Biosphere reserves

150. Some plants require exposure of light less than critical photoperiod for flowering. These plants are called
(1) Short day plants (2) Long day plants
(3) Day-neutral plants (4) Perennial plant

ZOOLOGY

SECTION - A

151. Stanley Cohen and Herbert Boyer constructed the first recombinant DNA in which year?
(1) 1963 (2) 1972
(3) 1980 (4) 2000

152. The closest living relative of crocodiles among the following group of animals is
(1) Dinosaurs (2) Snakes
(3) Birds (4) Turtles

153. Excretory product of *Periplaneta* is
(1) Urea (2) Ammonia
(3) Uric acid (4) Guanine

154. Choose the **incorrect** statement w.r.t. members belonging to the class Osteichthyes.
(1) They are mostly viviparous and development is direct.
(2) They possess four pairs of gills that are covered by an operculum on each side.
(3) They are cold-blooded animals.
(4) They possess an air bladder which regulates buoyancy.

Space for Rough Work

155. How many birds given in the box below are flightless birds?

Pavo, Neophron, Aptenodytes, Struthio, Columba, Corvus

Select the correct option.

(1) Two (2) Four
(3) Three (4) Five

156. The enzymes that link together two substrate molecules belong to which class of enzymes?

(1) II (2) IV
(3) VI (4) V

157. Choose the **odd** one w.r.t. venereal diseases.

(1) Hepatitis-B (2) Genital herpes
(3) Genital warts (4) Haemophilia

158. Select the correct set of tissues which have fibroblasts and many collagen fibres that are present in rows between many parallel bundles of fibres in a regular pattern.

(1) Tendons and ligaments
(2) Bone and blood
(3) Cartilage and areolar tissue
(4) Skin and adipose tissue

159. How many of the below given structures present in frogs is/are not unpaired?

(a) Diencephalon
(b) Cerebral hemisphere
(c) Optic lobe
(d) Olfactory lobe
(e) Cloaca

Select the correct option.

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

160. During aestivation and hibernation, adult frogs perform

(1) Buccopharyngeal respiration
(2) Cutaneous respiration
(3) Pulmonary respiration
(4) Branchial respiration

161. Select the correct matching set w.r.t. phylum and its examples.

(1)	Porifera	*Spongilla, Hydra, Sycon*
(2)	Cnidaria	*Pennatula, Ctenoplana, Pleurobrachia*
(3)	Aschelminthes	*Wuchereria, Ascaris, Ancylostoma*
(4)	Mollusca	*Aplysia, Chaetopleura, Ophiura*

162. Complete the analogy and select the **correct** option.

Pigment : Carotenoid :: Alkaloid : _____

(1) Anthocyanin (2) Morphine
(3) Carotenoid (4) Concanavalin A

163. During joint diastole of human heart under normal conditions,

(1) Bicuspid and tricuspid valves are open
(2) Active filling of ventricles occur
(3) Semilunar valves are open
(4) Ventricles pump the blood away from heart

164. Match column I with column II and select the correct option w.r.t. humans

	Column I		**Column II**
a.	Eosinophils	(i)	Thrombocytes
b.	RBC	(ii)	Antigen 'A' on RBC surface
c.	'A' blood group	(iii)	Life span is of 120 days
d.	Platelets	(iv)	Resist infections

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

Space for Rough Work

165. Two hormones 'X' and 'Y' regulate the gene expression or chromosome function by the interaction of hormone-receptor complex with the genome. Both 'X' and 'Y' are different in chemical nature. Identify 'X' and 'Y' respectively and select the correct option.
(1) Tetraiodothyronine, estrogen
(2) Progesterone, PTH
(3) Glucagon, epinephrine
(4) Cortisol, adrenaline

166. Hashish is obtained from the extract of which plant?
(1) *Papaver somniferum*
(2) *Erythroxylum coca*
(3) *Atropa belladona*
(4) *Cannabis sativa*

167. Complete the analogy and select the correct option.
Renin : JG cells : : Vasopressin : _____
(1) Adenohypophysis (2) Hypothalamus
(3) Adrenal gland (4) Atria of heart

168. How many of the given statements is/are correct w.r.t. the functions of tubules?
(a) Collecting duct plays a role in the maintenance of pH and ionic balance of blood by the selective secretion of H^+ and K^+.
(b) Nearly all of the essential nutrients, 70-80% of electrolytes and water are reabsorbed by PCT.
(c) The ascending limb of loop of Henle is highly permeable to water.
(d) The descending limb of loop of Henle is completely permeable to electrolytes.
Select the correct option.
(1) Two (2) One
(3) Three (4) Four

169. At which of the following locations, Schwann cells are not present?
(1) Axon of myelinated nerve fibres of ANS
(2) Axon of unmyelinated nerve fibres of ANS
(3) Axon of myelinated nerve fibres of PNS
(4) Axon terminal of unmyelinated nerve fibres of ANS

170. Which of the following is related to the part of human hindbrain that is directly connected to the spinal cord?
(1) Contains a number of centres which control body temperature, urge for eating and drinking
(2) Involved in the regulation of sexual behaviour and expression of emotional reactions
(3) Contains centres which control respiration, cardiovascular reflexes and gastric secretions
(4) Possess very convoluted surface in order to provide the additional space for many more neurons

171. Enzymes catalyse biochemical reactions by
(1) Lowering the activation energy
(2) Increasing the activation energy
(3) Establishing stable bonds with the substrates
(4) Increasing the temperature

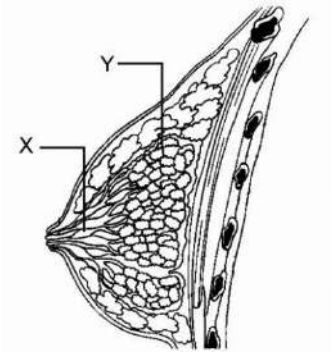
172. Select the incorrect statement w.r.t. reproductive cycle in female primates.
(1) The follicular phase is followed by the menstrual phase.
(2) The ovulatory phase is followed by the luteal phase.
(3) The secretion of gonadotropins (LH and FSH) increases gradually during the follicular phase.
(4) In the luteal phase, corpus luteum secretes large amounts of progesterone which is essential for maintenance of endometrium.

Space for Rough Work

173. Seminal plasma does not contain
(1) Enzyme (2) Sperm
(3) Ca^{+2} (4) Fructose

174. Succinate dehydrogenase is inhibited by _____ which closely resembles the substrate succinate in structure.
Select the option to fill in the blank correctly.
(1) Citrate (2) Acetate
(3) Malonate (4) Lactic acid

175. In 1963, two enzymes were isolated from *E. coli.*
Which statement is **correct** regarding these enzymes?
(1) These two enzymes were oxidoreductases.
(2) These two enzymes were transferases and polymerases respectively.
(3) One of them added methyl groups to the bacterial DNA, while the other cut the viral DNA.
(4) One of them was ligases and the other cut the DNA.

176.


Given above is a diagrammatic sectional view of female gland. Identify the labelled structures 'X' and 'Y' and select the correct option.

	'X'	**'Y'**
(1)	Mammary lobe	Lactiferous duct
(2)	Alveolus	Mammary lobe
(3)	Ampulla	Mammary alveolus
(4)	Fat	Areola

177. A chronic disorder in which alveolar walls are damaged due to excessive cigarette smoking is called
(1) Asthma
(2) Emphysema
(3) Pneumonia
(4) Occupational respiratory disorder

178. Complete the analogy and select the **correct** option.
Multicellular gland : Sebaceous gland :: Unicellular gland : _____.
(1) Mammary gland (2) Goblet cells
(3) Salivary gland (4) Sweat gland

179. Which of the following options is correctly matched?
(1) *Hippocampus* – 3-chambered heart
(2) *Rana* – 2-chambered heart
(3) *Crocodilus* – 4-chambered heart
(4) *Pavo* – 3-chambered heart

180. How many of the animals given in the box below have a segmented body, closed circulation and bilateral symmetry?

Octopus, Locusta, Nereis, Echinus Balanoglossus, Pheretima, Periplaneta, Antedon

Select the correct option.
(1) Four (2) Seven
(3) Two (4) Five

181. Transmission of HIV does not occur
(1) By hugging the infected person
(2) By transfusion of contaminated blood
(3) By sharing infected needles
(4) From infected mother to her foetus through placenta

Space for Rough Work

182. In an adult human, under normal physiological conditions, all of the given factors lead to dissociation of oxygen from oxyhaemoglobin, **except**
(1) High partial pressure of CO_2
(2) High temperature
(3) High H^+ concentration
(4) High pH

183. A bioreactor does **not** contain any
(1) Agitator system
(2) Oxygen delivery system
(3) Foam control system
(4) Gene regulation system

184. **Assertion (A):** Insulin cannot be orally administered to diabetic patients.
Reason (R): Insulin leads to a sudden decrease in blood sugar levels if given orally.
In the light of above statements, select the **correct** option.
(1) Both (A) and (R) are true and (R) is the correct explanation of (A)
(2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
(3) (A) is true, (R) is false
(4) (A) is false, (R) is true

185. Pre-historic men who are considered as the connecting link between men and apes and who hunted with stone weapons but essentially ate fruits were
(1) *Australopithecines*
(2) *Homo erectus*
(3) *Homo sapiens*
(4) *Dryopithecus*

SECTION - B

186. The gland named 'X' is a lobular structure located between lungs behind the sternum on the ventral side of aorta in humans. Select the correct statement w.r.t. 'X'.
(1) It secretes a steroidal hormone called thymosin.
(2) It gets degenerated in old individuals resulting in decreased production of thyroxine.
(3) Its hormone plays a major role in the glucose homeostasis.
(4) Its hormone plays a major role in differentiation of T-lymphocytes.

187. Which of the following is not an example of homologous structures?
(1) Thorns of *Bougainvillea* and tendrils of *Cucurbita*
(2) Flippers of penguins and dolphins
(3) Forelimbs of human and cheetah
(4) Vertebrate hearts or brains

188. In a population that is in Hardy-Weinberg equilibrium, the frequency of homozygous recessive genotype of eye colour is 0.09. Calculate the percentage of individuals homozygous for the dominant allele.
(1) 91% (2) 49%
(3) 64% (4) 24%

189. Read the following statements.
Statement A: MTP is considered relatively safe when body of foetus is covered with fine hair, their eyelids separate and eyelashes are formed.
Statement B: Nearly 0.45-0.50 million MTPs are performed in a year all over the world which accounts to $1/5^{th}$ of the total number of conceived pregnancies in a year.
Select the correct option.
(1) Both statements A and B are correct
(2) Both statements A and B are incorrect
(3) Only statement B is correct
(4) Only statement A is correct

Space for Rough Work

190. How many of the bones given in the box below are the part of axial skeleton in humans?

Frontal, Maxilla, Zygomatic, Ethmoid, Lacrimal, Temporal, Scapula

Select the correct option.

(1) Six (2) Five

(3) Three (4) Two

191. Supra-oesophageal ganglion of cockroach supplies nerves to _____ and _____. Select the correct option to fill in the blanks.

(1) Antennae, compound eyes

(2) Antennae, labium

(3) Compound eyes, tegmina

(4) Compound eyes, hypopharynx

192. Choose the incorrect statement w.r.t. *Pheretima*.

(1) Their nervous system is represented by ganglia arranged segmentwise on the dorsal paired nerve cord.

(2) Their blood cells are phagocytic in nature.

(3) They do not have eyes but do possess light and touch sensitive organs to distinguish the light intensities and to feel the vibrations in the ground.

(4) They are used as bait in game fishing.

193. Which ion increases the efficiency of rDNA entry in the bacterium during bacterial transformation?

(1) Na^+ (2) Ca^{2+}

(3) K^+ (4) Cl^-

194. Select the correct set of structures which are haploid in humans.

(1) Primary spermatocyte, secondary oocyte, spermatogonia

(2) Secondary oocyte, spermatid, spermatozoan

(3) Second polar body, secondary spermatocyte, primary oocyte

(4) First polar body, ovum, spermatogonium

195. Read the following statements.

Statement A: Stimulation of a muscle fibre by a motor neuron occurs at the neuromuscular junction.

Statement B: Lack of relaxation between successive stimuli in a sustained muscle contraction is known as tetanus.

Select the correct option.

(1) Both statements A and B are correct

(2) Both statements A and B are incorrect

(3) Only statement A is incorrect

(4) Only statement B is incorrect

196. Which of the following set of bones is involved in the formation of acetabulum of an adult human?

(1) Ileum, Ischium, Coccyx

(2) Ilium, Ischium, Pubis

(3) Ilium, Sacrum, Pubis

(4) Ileum, Ischium, Pubis

197. All of the following are included under the 'Reproductive and Child Health Care programmes', **except**

(1) Care of pregnant mothers

(2) Postnatal child care

(3) Importance of breastfeeding

(4) Promotion of unprotected sexual co-habitation

198. Select the **mismatch** w.r.t. enzyme used for isolation of DNA in RDT.

(1) Bacteria – Lysozyme

(2) Plant cell – Cellulase

(3) Animal cell – DNase

(4) Fungal cell – Chitinase

Space for Rough Work

199. Select the incorrect match.

(1)	Glomerulonephritis	–	Inflammation of glomeruli of kidney
(2)	Renal calculi	–	Stone or insoluble mass of crystallised salts formed within the kidneys
(3)	Uremia	–	Accumulation of urea in urine
(4)	Ketonuria	–	Presence of ketone bodies in urine

200. Select the correct option w.r.t. the standard ECG of a healthy human.

(1) The P-wave represents the electrical excitation of the ventricles.

(2) The QRS complex represents the repolarisation of ventricles.

(3) The T-wave represents the return of ventricles from excited to normal state.

(4) The end of the T-wave marks the end of ventricular diastole.

❑ ❑ ❑

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Space for Rough Work

7. A block is performing simple harmonic motion. When its displacements from the stable equilibrium position are 5 cm and 4 cm, the corresponding speeds are 8 cm/s and 10 cm/s. The time period of oscillation of the block is

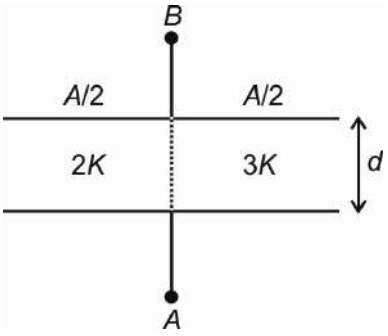
(1) 1.57 s

(2) 3.14 s

(3) 6.28 s

(4) 12.56 s

8. A parallel plate capacitor of area A, plate separation d and capacitance C is filled with two dielectric materials having dielectric constants $2K$ and $3K$ as shown in the figure.



Effective capacitance across the points A and B is

(1) $5K$ (2) $\frac{5}{2}KC$

(3) $\frac{2}{5}KC$ (4) $\frac{4}{7}KC$

9. A short dipole is at origin and directed towards positive x-axis. The electric field at a point $A(0, a, 0)$ is $\vec{E}$. The electric field at a point $B(a, 0, 0)$ will be

(1) $\vec{E}$ (2) $2\vec{E}$

(3) $-\frac{\vec{E}}{2}$ (4) $-2\vec{E}$

10. The time period of oscillation of a simple pendulum is $T = 2\pi\sqrt{\frac{L}{g}}$. The measured value of L is 10.0 cm with an instrument having least count 1 mm and time of 100 oscillations of the pendulum is measured to be 125 s using a stop watch of least count 1 second. The maximum percentage error in the determination of g is

(1) 1.4% (2) 2.6%

(3) 2% (4) 3%

11. In hydrogen atom, for which of the following transitions, photon with minimum wavelength is emitted?

(1) $n_f = 3, n_i = 5$

(2) $n_f = 2, n_i = 4$

(3) $n_f = 3, n_i = 4$

(4) $n_f = 4, n_i = 5$

12. If critical angle of a transparent crystal is 37°, then its polarizing angle will be

(1) $\tan^{-1}\left(\frac{5}{3}\right)$ (2) $\tan^{-1}\left(\frac{4}{3}\right)$

(3) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (4) $\tan^{-1}\left(\frac{3}{2}\right)$

13. The surface of a metal is illuminated with the light of wavelength 400 nm. The maximum kinetic energy of the ejected photoelectrons was found to be 1.68 eV. Work function of the metal is about

(1) 3.09 eV (2) 1.42 eV

(3) 4.73 eV (4) 0.68 eV

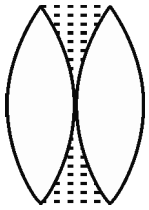
14. When $_{92}U^{237}$ nucleus is converted into $_{83}Bi^{209}$, x and y number of α and β^- particles are emitted respectively, then the values of x and y respectively are

(1) 5, 7 (2) 7, 6

(3) 7, 5 (4) 6, 7

Space for Rough Work

15. Two identical thin equiconvex lenses each of focal length 20 cm, made of material of refractive index 1.5 are placed coaxially in contact as shown. Now, the space between them is filled with a liquid of refractive index 1.5. The equivalent power of the arrangement will be



(1) +5 D (2) Zero

(3) +2.5 D (4) +0.5 D

16. A seconds pendulum is arranged in a lift. If the lift is moving down with an acceleration $\left(\frac{g}{2}\right)$, then its new time period will be

(1) $\sqrt{2}$ s (2) 2 s

(3) $2\sqrt{2}$ s (4) 1 s

17. A segment of wire vibrates with fundamental frequency 400 Hz under a tension of 8 kg weight. The tension at which the fundamental frequency of same wire becomes 800 Hz is

(1) 16 kg-weight (2) 32 kg-weight

(3) 12 kg-weight (4) 24 kg-weight

18. The pressure at the bottom of an open water tank is $3P_0$, where P_0 is atmospheric pressure. If water is drawn out until the water level decreases by $\frac{2}{3}$ times, then pressure at the bottom of the tank will be

(1) $\frac{7P_0}{3}$ (2) $\frac{3P_0}{2}$

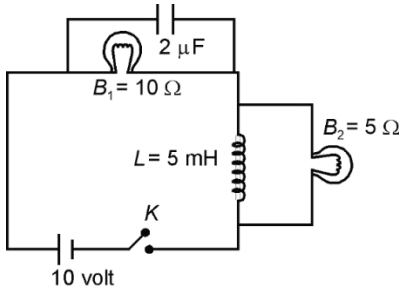
(3) $\frac{5P_0}{2}$ (4) $\frac{5P_0}{3}$

19. A particle of mass m is thrown from ground with velocity v making an angle 30° with vertical. The change in momentum of the particle during its entire journey has magnitude

(1) mv (2) $\frac{\sqrt{3}mv}{2}$

(3) $2mv$ (4) $\sqrt{3}mv$

20. In the given circuit, the power consumed by the bulb B_1 long time after the key K is closed will be (inductor is ideal)



(1) 5 W (2) 10 W

(3) 20 W (4) 40 W

21. The position – time graph of a particle is a straight line with a positive slope. This indicates

(1) The object is moving with constant acceleration

(2) The object is moving with zero acceleration

(3) The object is moving with increasing acceleration

(4) The object is moving with decreasing acceleration

22. A block of mass 4 kg is in contact against the inner wall of a hollow cylindrical drum of radius 1.5 m. The walls of the drum are rough and the minimum angular velocity needed for the drum to keep the block stationary when it is rotated about vertical axis is equal to 10 rad/s, the value of friction coefficient is (g = 10 m/s^2)

(1) $\frac{1}{15}$ (2) $\frac{1}{10}$

(3) $\frac{2}{15}$ (4) $\frac{1}{4}$

Space for Rough Work

23. In a new system of units, the unit of mass is 10 kg, unit of length is 100 m and unit of time is 1000 s, then the value of $10\ \text{kg}\frac{\text{m}^2}{\text{s}^2}$ in this new system will be

(1) 10^2 (2) 10^3

(3) 10^4 (4) 10^{-2}

24. Collision takes place between two identical balls. The kinetic energy loss will be maximum for

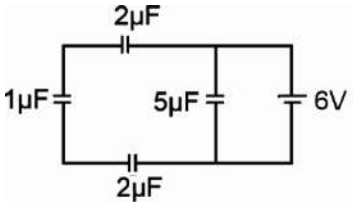
(1) Perfectly inelastic collision

(2) Perfectly elastic collision

(3) Partially inelastic collision

(4) Loss is same for all types of collisions

25. The charge on 1 μF capacitor in steady state will be



(1) 2 μC (2) $\frac{5}{2}$ μC

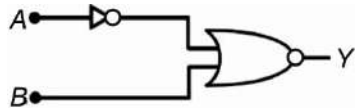
(3) 3 μC (4) Zero

26. The torque (in N m) about the origin when a force of $\left(2\hat{i}+3\hat{j}\right)$N acts on a point whose position vector is $\left(\hat{i}-\hat{j}+\hat{k}\right)$m is

(1) $3\hat{i}-2\hat{j}-5\hat{k}$ (2) $3\hat{i}-2\hat{j}+5\hat{k}$

(3) $-3\hat{i}-2\hat{j}+5\hat{k}$ (4) $-3\hat{i}+2\hat{j}+5\hat{k}$

27. For the following logic gate circuit, the truth table is



(1)

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

(2)

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	0

(3)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(4)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

28. **Assertion (A) :** To observe the photoelectric effect, a certain minimum frequency of light is needed which can be explained by particle nature of light.

Reason (R) : According to particle theory of light, energy of each photon is proportional to the wavelength of light.

(1) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**

(2) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A)**

(3) **(A)** is correct but **(R)** is not correct

(4) Both **(A)** and **(R)** are not correct

29. A swimmer swims with a speed of 6 m/s in still water. In a river of width $900\sqrt{3}$ m, water flows with speed of 3 m/s. If the swimmer swims in the river such that he reaches the other bank without drift, then the time taken by him to cross the river will be

(1) 2 minutes (2) 5 minutes

(3) 10 minutes (4) 12 minutes

30. The SI unit of volumetric strain is

(1) m^3 (2) m

(3) m^{-3} (4) No unit

31. Magnetic susceptibilities of three magnetic materials are 0.05, –0.01, and 599. The materials in the respective order are

(1) Paramagnetic, ferromagnetic, diamagnetic

(2) Paramagnetic, diamagnetic, ferromagnetic

(3) Diamagnetic, paramagnetic, ferromagnetic

(4) Diamagnetic, ferromagnetic, paramagnetic

Space for Rough Work

32. Position-time equation of a particle executing SHM is given by $y = A\sin(\omega t) + B\sin(2\omega t)$, where ω is 20π rad s^{-1}, then time period of the oscillation is

(1) 0.2 s (2) 0.1 s

(3) 0.05 s (4) 10 s

33. Consider the following statements:

Statement I : In a series LCR ac circuit, current always leads the source voltage.

Statement II : In a series LCR ac circuit, energy loss is zero when power factor is equal to one.

In the light of the above statements, choose the correct option.

(1) Both the statements I and II are correct

(2) Both the statements I and II are incorrect

(3) Statement I is correct and statement II is incorrect

(4) Statement I is incorrect and statement II is correct

34. A ray of light is incident on a thin prism with apex angle equal to 4°. If the refractive index of the material of prism is 1.5, then the angle of deviation of the light ray is

(1) 1° (2) 2°

(3) 1.5° (4) 4°

35. A car initially at rest starts moving on a straight road with uniform acceleration of 2 m/s^2. The ratio of distance covered in first 3 seconds to the distance covered in 3rd second by the car is

(1) $\frac{9}{5}$ (2) $\frac{5}{9}$

(3) $\frac{1}{3}$ (4) $\frac{4}{3}$

SECTION-B

36. A ball of mass m is projected with speed v_0 from ground at an angle 30º with horizontal. The instantaneous power delivered by the gravity to the ball at the highest point of its trajectory will be

(1) Zero (2) $\frac{\sqrt{3}mgv_0}{2}$

(3) $\frac{mgv_0}{2}$ (4) $-mgv_0$

37. Two positive ions, each carrying equal charge are separated by a distance 'd'. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge on an electron)

(1) $\frac{4\pi\varepsilon_0 Fd^2}{e^2}$ (2) $\sqrt{\frac{4\pi\varepsilon_0 Fe^2}{d^2}}$

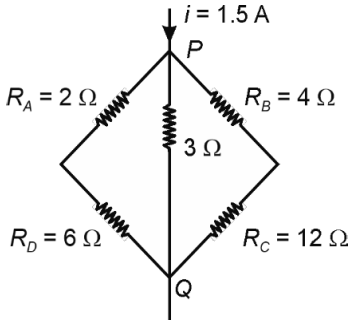
(3) $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$ (4) $\frac{\pi\varepsilon_0 Fd^2}{e^2}$

38. A block attached to a string describes a vertical circle of radius r. If block has a velocity $\sqrt{3rg}$ at the highest point, then ratio of maximum and minimum tension in the string is

(1) 3 (2) 2

(3) 4 (4) 1

39. Potential difference between the points P and Q in the electric circuit shown in the figure below is



(1) Zero (2) 1.2 V

(3) 2.4 V (4) 2.88 V

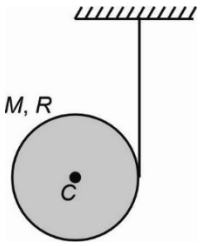
Space for Rough Work

40. An alpha particle and a proton are both accelerated by same potential difference, made to enter into a transverse uniform magnetic field. Then inside the magnetic field,
(1) Path of proton will be more curved
(2) Path of alpha particle will be more curved
(3) Path of both the particles will be equally curved
(4) Insufficient information

41. What is the velocity '*v*' of a metallic ball of radius '*r*' falling in a tank of liquid at the instant when its acceleration is one half that of a freely falling body? (The densities of metal and liquid are ρ and σ respectively, and viscosity of the liquid is η).
(1) $\frac{r^2 g}{9\eta}(\rho - 2\sigma)$ (2) $\frac{r^2 g}{\eta}(2\rho - \sigma)$
(3) $\frac{r^2 g}{9\eta}(\rho - \sigma)$ (4) $\frac{2r^2 g}{9\eta}(\rho - \sigma)$

42. In the phenomenon of electromagnetic induction, current in a coil can be induced by varying
(1) Magnetic field
(2) Area of coil
(3) Angle between magnetic field and coil
(4) All of the above

43. As shown in the figure, a uniform solid cylinder of mass *M* and radius *R* is hung with a massless string wrapped around it. If there is no slipping between string and cylinder, then the angular acceleration of the falling cylinder will be



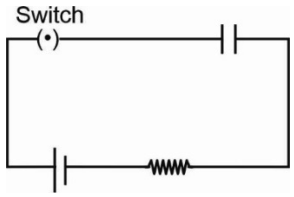
(1) $\frac{g}{3R}$ (2) $\frac{3g}{2R}$
(3) $\frac{4g}{3R}$ (4) $\frac{2g}{3R}$

44. Consider a uniform solid sphere of mass 10 kg and radius 4 m. *G* represents the universal gravitational constant and *r* is the distance from the centre of sphere. Using the above information, match the columns and mark the correct option. All the entries in column II are in SI units.

	Column-I		**Column-II**
(A)	Gravitational field at r = 5 m	(P)	$-\frac{5G}{16}$
(B)	Gravitational field at r = 2 m	(Q)	$-2G$
(C)	Gravitational potential at r = 5 m	(R)	$-\frac{15}{4}G$
(D)	Gravitational potential at centre	(S)	$-\frac{2G}{5}$

(1) A-(S), B-(Q), C-(R), D-(P)
(2) A-(Q), B-(S), C-(P), D-(R)
(3) A-(Q), B-(P), C-(R), D-(S)
(4) A-(S), B-(P), C-(Q), D-(R)

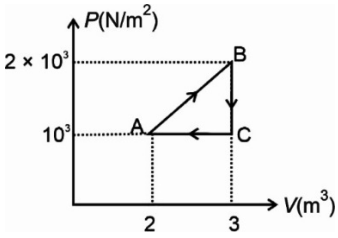
45. A capacitor is connected with a battery and a resistance as shown. If the switch is closed at t = 0, then



(1) Minimum current will flow in the circuit at t = 0
(2) Maximum current will flow in the circuit at t = 0
(3) Constant current will flow in the circuit from t = 0 to $t = \infty$
(4) Both (2) and (3)

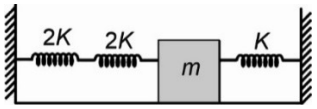
Space for Rough Work

46. For the given cyclic process as shown in pressure – volume graph, the net heat supplied to the system is



(1) Zero (2) 200 J
(3) 500 J (4) 750 J

47. A block of mass *m* is attached with springs as shown. If it is slightly disturbed from its equilibrium position, then the time period of oscillation will be



(1) $2\pi\sqrt{\frac{m}{4K}}$ (2) $2\pi\sqrt{\frac{m}{K}}$
(3) $2\pi\sqrt{\frac{m}{2K}}$ (4) $2\pi\sqrt{\frac{2m}{K}}$

48. An α-particle at rest experiences an electro-magnetic force. If *E* represents electric field and *B* represents magnetic field, then
(1) Both *B* and *E* must be present
(2) *E* must be present, *B* may be present
(3) *B* must be present, *E* may not be present
(4) All of the above

49. Kirchhoff's first law or the junction law is based on conservation of
(1) Mass
(2) Charge
(3) Energy
(4) Linear momentum

50. An inductor of inductance 2 H is connected in a circuit. At an instant, if the current through it is increasing at a rate of 3 A/s, then the potential difference across the inductor is
(1) Zero
(2) 6 V
(3) 3 V
(4) 1 V

CHEMISTRY

SECTION - A

51. Consider the following statements:

Statement I: For a reversible reaction, if $Q_c < K_c$, net reaction goes in the forward direction.

Statement II: If ΔG is negative, then the reaction is spontaneous and proceeds in the backward direction for a reversible reaction.

In the light of above two statements, select the correct option.
(1) Statement I is true and statement II is false
(2) Statement I is false and statement II is true
(3) Both statement I and statement II are true
(4) Both statement I and statement II are false

52. Consider the following reactions:
a. $CaO + C \rightarrow [A] + CO$
b. $[A] + H_2O \rightarrow Ca(OH)_2 + [B]$
In the above reaction sequence, product [B] is
(1) CH_4 (2) C_2H_2
(3) CaC_2 (4) C_2H_4

53. The pH of 0.01 M $Ba(OH)_2$ (aq) solution will be
(1) 10
(2) 12.3
(3) 13.3
(4) 10.3

Space for Rough Work

54. Consider the following statements:

Statement I: Crystal field stabilisation energy for high spin d^5 octahedral complex is zero.

Statement II: $[Fe(CN)_6]^{4-}$ is a high spin complex with zero value of crystal field stabilisation energy.

In the light of above statements, choose the correct option.

(1) Both statement I and statement II are correct

(2) Both statement I and statement II are incorrect

(3) Statement I is correct and statement II is incorrect

(4) Statement II is correct and statement I is incorrect

55. Which oxide among the following cannot act as a reducing agent?

(1) ClO_2 (2) CO_2

(3) NO_2 (4) SO_2

56. In which of the following species S–S bond is present?

(1) $S_4O_6^{2-}$ (2) $S_2O_7^{2-}$

(3) $S_2O_8^{2-}$ (4) S_3O_9

57. During nitrogen estimation of an organic compound by Kjeldahl's method, the ammonia evolved by 0.6 g of compound neutralized by 10 ml of 1 M H_2SO_4. Percentage of nitrogen present in the compound is

(1) 23.33 (2) 46.67

(3) 70 (4) 83.33

58. Incorrect statement about amylopectin is

(1) It is a polysaccharide

(2) It constitutes about 80–85% of starch

(3) It is insoluble in water

(4) It has branching of glycosidic linkage by $C_1 - C_3$

59. For a cell reaction, to be spontaneous, necessary condition is/are

(i) $\Delta G < 0$

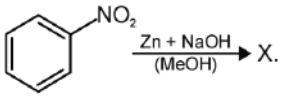
(ii) $\Delta S_{Total} < 0$

(iii) $E_{cell} > 0$

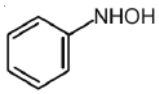
(1) (i) and (ii) only (2) (i), (ii) and (iii)

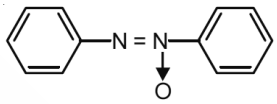
(3) (i) and (iii) only (4) (ii) and (iii) only

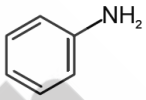
60. Consider the given reaction.

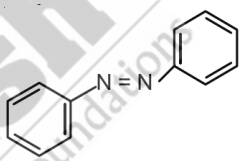


Identify X.

(1) 

(2) 

(3) 

(4) 

61. A 2 ampere current is passed through a solution of zinc sulphate for 20 minutes. The amount of zinc deposited at the cathode is

(1) 0.406 g (2) 0.812 g

(3) 0.316 g (4) 1.624 g

62. If mole fraction of NaOH in its aqueous solution is 0.2 then molality of the solution is

(1) 13.89 m (2) 6.94 m

(3) 10 m (4) 10.5 m

63. The order of melting point is

(1) Cr > Mn > Fe (2) Cr > Fe > Mn

(3) Mn > Cr > Fe (4) Fe > Mn > Cr

Space for Rough Work

64. Match **column I** with **column II** and choose the correct option.

	Column I (Compound)		Column II (Oxidation state of underlined element)
(a)	$\underline{Cr}O_5$	(i)	+ 3
(b)	$\underline{V}O_3^-$	(ii)	+ 7
(c)	$\underline{Mn}O_4^-$	(iii)	+ 5
(d)	$\underline{Fe}F_6^{3-}$	(iv)	+ 6

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

65. Given below are two statements.

Statement I: Aluminium is more electropositive than gallium.

Statement II: Gallium has the lowest melting point among the elements of group 13.

In the light of above statements, choose the **correct** option among the following.

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

66. For which of the following given reactions $\Delta H > \Delta U$?

(1) $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$
(2) $Ni(s) + 4CO(g) \rightarrow Ni(CO)_4(g)$
(3) $N_2(g) + O_2(g) \rightarrow 2NO(g)$
(4) $2NO_2(g) \rightarrow N_2O_4(g)$

67. Salt which undergoes anionic hydrolysis is

(1) NaCl (2) NH_4Cl
(3) $(NH_4)_2SO_4$ (4) CH_3COONa

68. Identify the non-redox reaction.

I. $2KClO_3(s) \xrightarrow{\Delta} 2KCl(s) + 3O_2(g)$
II. $NaOH + HCl \longrightarrow NaCl + H_2O$
III. $2H_2O_2 \longrightarrow 2H_2O + O_2$

(1) Only II (2) Only I & III
(3) Only I & II (4) Only II & III

69. Which of the following is inorganic graphite?

(1) $(BN)_x$ (2) $B_3N_3H_6$
(3) $(NO)_x$ (4) $(BNH)_x$

70. Correct order against indicated property is

(1) HCl > HBr > HI (Reducing power)
(2) HClO > $HClO_2$ > $HClO_3$ (Acidic strength)
(3) $I_2 < Br_2 < Cl_2 < F_2$ (Oxidising power)
(4) $NH_3 < PH_3 < AsH_3$ (Basic strength)

71. Van't Hoff factor of a triprotic acid H_3A having degree of dissociation 40% is

(1) 1.2 (2) 2.2
(3) 3.2 (4) 4.0

72. On electrolysis of aq. NaCl, products obtained at cathode and anode respectively are

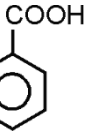
(1) H_2 and O_2 (2) Cl_2 and O_2
(3) H_2 and Cl_2 (4) Cl_2 and H_2

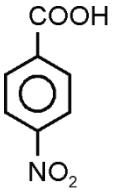
73. Half-life period of 1st order reaction is equal to (k = rate constant of the reaction)

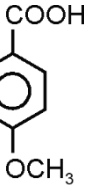
(1) $\frac{1}{k}$ (2) $\frac{0.693}{k}$
(3) 0.693k (4) $\frac{k}{0.693}$

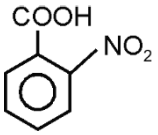
Space for Rough Work

74. Which among the following has highest pK_a?

(1) 

(2) 

(3) 

(4) 

75. Given below are two statements one is labelled as Assertion (A) and other is labelled as Reason (R).

Assertion (A): Heavier elements of group 14 do not form $p\pi - p\pi$ bonds.

Reason (R): Atomic orbitals of heavier elements of group-14 are too large and diffuse to have effective overlapping.

In the light of above statements, choose the correct option.

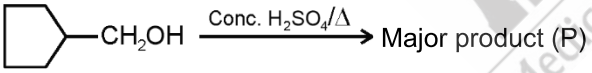
(1) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(2) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

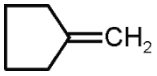
(3) (A) is correct and (R) is incorrect

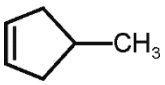
(4) Both (A) and (R) are incorrect

76. Consider the given reaction:



Product (P) is

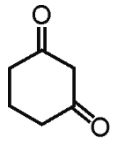
(1) 

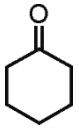
(2) 

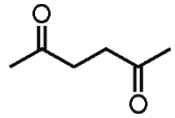
(3)

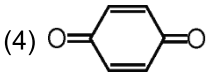
(4)

77. In the presence of $Na_2Cr_2O_7/H^+$, phenol is oxidised to

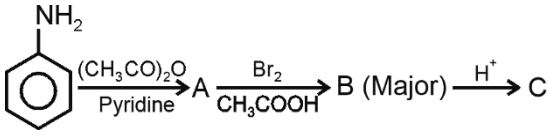
(1) 

(2) 

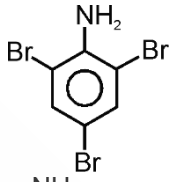
(3) 

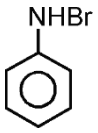
(4) 

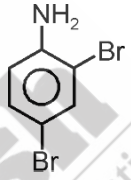
78. In the following reaction sequence

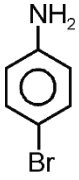


Product C is

(1) 

(2) 

(3) 

(4) 

79. Element of highest second ionization energy among the following is

(1) Li (2) Be

(3) B (4) C

80. Given below are two statements.

Statement I: Melting point of HF is greater than HCl.

Statement II: HF is a stronger acid than HCl.

In the light of above statements, choose the correct option.

(1) Statement I is incorrect but statement II is correct

(2) Statement I is correct but statement II is incorrect

(3) Both statement I and statement II are correct

(4) Both statement I and statement II are incorrect

Space for Rough Work

81. Longest bond length is present in

(1) C – N

(2) C = O

(3) C = C

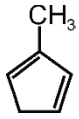
(4) C ≡ N

82. Which among the following has highest dipole moment?

(1) HF (2) HCl

(3) HBr (4) HI

83. Products obtained on reductive ozonolysis of



are

(1) $CHOCH_2CHO + CH_3CHO$

(2) $CHOCH_2CHO + CH_3COCH_3$

(3) $CH_3COCHO + CHOCH_2CHO$

(4) $CH_3COCHO + CH_3COCH_3$

84. Oxide which is not acidic is

(1) CO (2) CO_2

(3) GeO_2 (4) SiO_2

85. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A): In acid-base titration, phenolphthalein is used as an indicator.

Reason (R): Phenolphthalein is pink coloured in acidic medium while colourless in basic medium.

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

(1) Both (A) and (R) are true and (R) is the correct explanation of (A)

(2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

(3) (A) is true but (R) is false

(4) (A) is false but (R) is true

SECTION - B

86. The maximum number of isomeric ethers with the molecular formula $C_4H_{10}O$ is

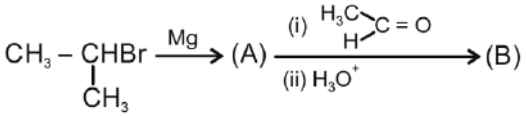
(1) 2

(2) 3

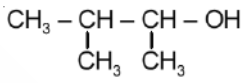
(3) 4

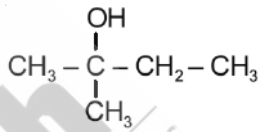
(4) 5

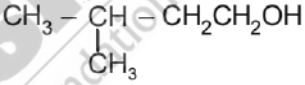
87. In the following reaction sequence

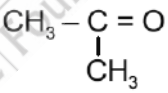


The product (B) is

(1) 

(2) 

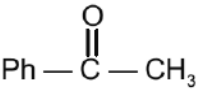
(3) 

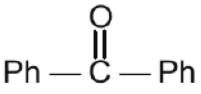
(4) 

88. Iodoform test is not given by

(1) CH_3COCH_3

(2) C_2H_5OH

(3) 

(4) 

Space for Rough Work

89. Match **column I** with **column II** and choose the correct option.

	Column I (Atomic orbital)		Column II (Set of quantum numbers)
(a)	4*d*	(i)	n = 4, l = 0, m_l = 0
(b)	4*p*	(ii)	n = 4, l = 1, m_l = –1
(c)	4*s*	(iii)	n = 4, l = 2, m_l = +1
(d)	4*f*	(iv)	n = 4, l = 3, m_l = 0

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

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

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

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

90. Correct order of basic strength is

(1) $CH_3NH_2 > PhNH_2 > PhCONH_2$

(2) $CH_3NH_2 > PhCONH_2 > PhNH_2$

(3) $PhNH_2 > CH_3NH_2 > PhCONH_2$

(4) $PhNH_2 > PhCONH_2 > CH_3NH_2$

91. Number of degenerate orbitals in second excited state of He^+ ion is

(1) 1 (2) 3

(3) 5 (4) 9

92. Complex which will show geometrical isomerism is

(1) $[Fe(H_2O)_6]Cl_3$ (2) $[Co(NH_3)_4Cl_2]Cl$

(3) $K_2[PtCl_4]$ (4) $[Co(en)_3]Cl_3$

93. A cation of group V gives brick red colour to the flame. It is precipitated as its carbonate on treatment with $(NH_4)_2CO_3$ in the presence of NH_4OH. When this precipitate is dissolved in acetic acid and treated with ammonium oxalate then white precipitate is formed. The cation is

(1) Ca^{2+} (2) Ba^{2+}

(3) Mg^{2+} (4) Sr^{2+}

94. If mole fraction of NaOH in aqueous solution is 0.1 and total mole of solution is 1 then mass of solvent present in solution will be

(1) 1.62 g

(2) 16.2 g

(3) 0.81 g

(4) 8.1 g

95. Radius of third excited state of He^+ ion is

(1) 0.529 Å

(2) 0.529 × 4 Å

(3) 0.529 × 2 Å

(4) 0.529 × 8 Å

96. Solubility of $Al(OH)_3$ in the presence of 0.2 M NaOH is [$K_{sp}(Al(OH)_3) = 4 \times 10^{-34}$]

(1) 4×10^{-34}

(2) 5×10^{-34}

(3) 5×10^{-32}

(4) 5×10^{-30}

97. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A): o-nitrophenol and p-nitrophenol are separated by steam distillation.

Reason (R): p-nitrophenol is steam volatile.

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

(1) Both (A) & (R) are true and (R) is the correct explanation of (A)

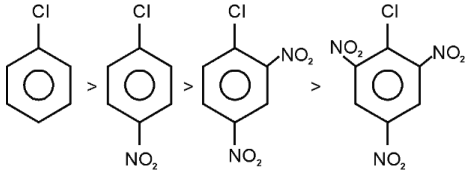
(2) Both (A) & (R) are true but (R) is not the correct explanation of (A)

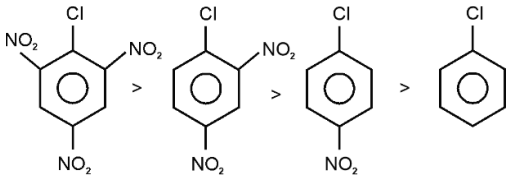
(3) (A) is true but (R) is false

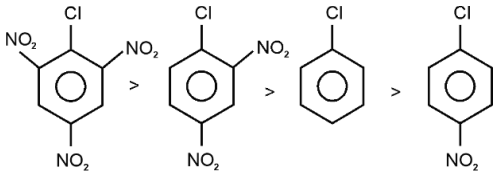
(4) Both (A) and (R) are false

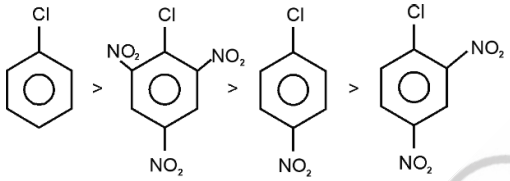
Space for Rough Work

98. Correct order of nucleophilic substitution reaction in the following is

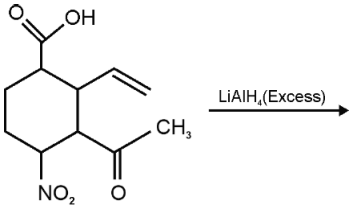
(1) 

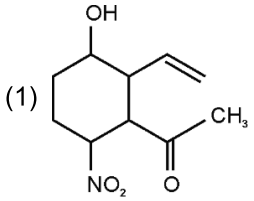
(2) 

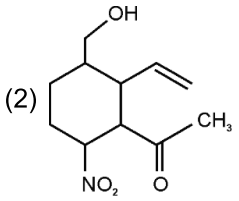
(3) 

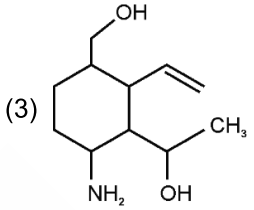
(4) 

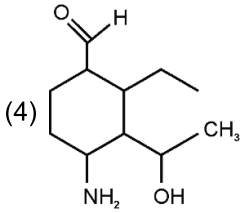
99. Major product obtained in the given reaction is



(1) 

(2) 

(3) 

(4) 

100. pH of 0.2 M aqueous sodium acetate solution will be (pK_a of CH_3COOH = 4.75)

(1) 7.5 (2) 8.5

(3) 9.0 (4) 10.5

BOTANY

SECTION - A

101. Metabolic reactions occur in

(1) Only those living organisms that have well defined nucleus

(2) Non-living objects only

(3) *In-vitro* conditions only

(4) Living organisms and some of those reactions can be made to occur in cell-free systems

102. Spores in consumer-decomposer protists are

(1) Formed during unfavourable conditions

(2) Without cell wall

(3) Dispersed with the help of flagella

(4) Formed inside plasmodium

103. Read the following statements and mark them as **true** (**T**) or **false** (**F**)

(A) Artificial system of classification grouped all the closely related species together

(B) Numbers and codes are assigned only to few observable characters in numerical taxonomy

(C) Chemotaxonomy is based on chemical constituents of the plants

(D) Cytotaxonomy is based on information like chromosome number, structure and behaviour

(1) (A)(T), (B)(T), (C)(F), (D)(T)

(2) (A)(T), (B)(F), (C)(T), (D)(T)

(3) (A)(F), (B)(F), (C)(T), (D)(T)

(4) (A)(T), (B)(T), (C)(T), (D)(F)

Space for Rough Work

104. How many of the following features are associated with the family whose member is okra?

(a) Actinomorphic flower

(b) Presence of epicalyx

(c) Dithecous anther

(d) Endospermic seed

(e) Twisted aestivation of calyx

(1) 3 (2) 4

(3) 5 (4) 2

105. A stele is constituted by all, **except**

(1) Hypodermis

(2) Pericycle

(3) Pith

(4) Vascular bundle

106. Which of the given statements is **incorrect** w.r.t. plastids?

(1) Chloroplast is a semi-autonomous cell organelle

(2) Majority of the chloroplasts of the green plants are found in mesophyll cells of the leaves

(3) Outer chloroplast membrane is relatively less permeable than inner membrane

(4) Amyloplasts store starch

107. A bisexual flowering plant produces 16 genetically different type of gametes. How many different zygotic genotypes are possible by selfing this plant?

(1) 16 (2) 81

(3) 8 (4) 16 × 8

108. How many generations of mitosis are required for producing 64 cells from a single cell?

(1) 63 (2) 7

(3) 6 (4) 32

109. Read the following statements and choose the **correct** option.

Statement A: C_4 plants show double carboxylation.

Statement B: C_4 plants have PEPcase enzyme in bundle sheath cells to fix CO_2.

(1) Only statement (A) is correct

(2) Only statement (B) is correct

(3) Both the statements (A) and (B) are correct

(4) Both the statements (A) and (B) are incorrect

110. What is the net gain of ATP if one molecule of glucose undergoes alcoholic or lactic acid fermentation?

(1) 38 ATP

(2) 36 ATP

(3) 4 ATP

(4) 2 ATP

111. Match the following columns and select the **correct** option w.r.t. components of chloroplast.

	Column I		**Column II**
a.	Thylakoids	(i)	Contains 70S ribosomes
b.	Stroma lamellae	(ii)	Flattened membranous sacs
c.	Stroma	(iii)	Stack of arranged sacs
d.	Granum	(iv)	Flat unstacked membranous tubules

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

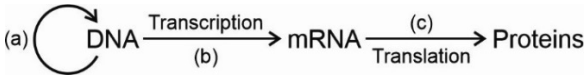
(2) a(iv), b(ii), c(i), d(iii)

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

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

Space for Rough Work

112. In the given flow chart of central dogma, select the **correct** option w.r.t. enzymes involved in the steps.



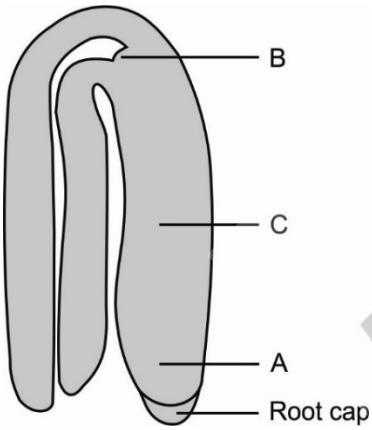
(1) (a) DNA polymerase
(b) RNA polymerase
(c) Peptidyl transferase

(2) (a) RNA polymerase
(b) Reverse transcriptase
(c) DNA polymerase

(3) (a) DNA dependent DNA polymerase
(b) RNA dependent DNA polymerase
(c) Peptidyl transferase

(4) (a) RNA dependent RNA polymerase
(b) DNA ligase
(c) DNA polymerase

113. The given below figure is a typical dicot embryo. What do A, B and C respectively represent?



	A	B	C
(1)	Radicle	Plumule	Cotyledon
(2)	Hypocotyl	Cotyledon	Plumule
(3)	Radicle	Plumule	Hypocotyl
(4)	Plumule	Radicle	Cotyledon

114. Select the **incorrect** statement about dinoflagellates.

(1) Their cell wall has lipids rich layer called pellicle
(2) Most of them have two flagella
(3) They are photosynthetic
(4) They are single celled eukaryotes

115. Tendrils of watermelon are modified

(1) Axillary buds
(2) Adventitious roots
(3) Scaly leaves
(4) Petiole

116. Phylloclade of *Opuntia* is

(1) Tubular leaf base
(2) Flattened petiole
(3) Modified stem
(4) Photosynthetic root

117. Choose the **incorrect** match.

(1) *Pinus* – Monoecious
(2) *Selaginella* – Heterosporous
(3) *Marchantia* – Dominant sporophytic stage
(4) *Eucalyptus* – Shows double fertilisation

118. Choose the **odd** one w.r.t. roles of rough endoplasmic reticulum.

(1) It provides precursor of enzyme for the formation of lysosome in Golgi complex
(2) It is involved in protein synthesis
(3) It gives rise to smooth endoplasmic reticulum
(4) It is primarily involved in lipid synthesis

119. Transcription in prokaryotes differs from that of eukaryotes as the former

(1) Takes place in nucleoplasm
(2) Includes post-transcriptional modifications
(3) Involves only one type of RNA polymerase
(4) Considers both DNA strands as template

Space for Rough Work

120. Incomplete dominance is exemplified by
(1) Flower colour in *Pisum sativum*
(2) ABO blood group in humans
(3) Flower colour in *Antirrhinum majus*
(4) Seed colour in *Pisum sativum*

121. In plants, all of the followings are naturally occurring hormone, **except**
(1) Zeatin (2) Kinetin
(3) IAA (4) IBA

122. Which of the following is an adaptation to ensure cross-pollination?
(1) Bisexuality
(2) Homogamy
(3) Bud-pollination
(4) Dichogamy

123. The probability of the progeny having AaBbccDd genotype from the cross between the parents AaBbCcDd and AaBbCcDd is
(1) $\frac{1}{2}$ (2) $\frac{1}{32}$
(3) $\frac{1}{16}$ (4) $\frac{1}{256}$

124. Read the following statements of assertion (A) and reason (R) and select the **correct** option.
Assertion (A): Transcription and translation are energetically very expensive processes, these have to be tightly regulated.
Reason (R): Regulation of translation is the primary step for regulation of gene expression.
(1) Both (A) and (R) are true and (R) is the correct explanation of (A)
(2) Both (A) and (R) are true and (R) is not the correct explanation of (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

125. The phenomenon which occur in cytoplasm of eukaryotic cells is
(1) Splicing of hnRNA
(2) Tailing of hnRNA
(3) Capping of hnRNA
(4) Aminoacylation of tRNA

126. Select the **odd** one w.r.t. commercial product from bacteria.
(1) Citric acid (2) Butyric acid
(3) Lactic acid (4) Acetic acid

127. The number of deaths in the population during a given period is
(1) Natality (2) Immigration
(3) Mortality (4) Emigration

128. Which of the following is **not** a functional aspect of an ecosystem?
(1) Nutrient cycling
(2) Species composition
(3) Productivity
(4) Decomposition

129. According to 'Rivet popper hypothesis', rivets on the wings are considered as
(1) Ecosystem (2) Extinct species
(3) Key species (4) Alien species

130. A pea plant heterozygous for both seed shape and seed colour was selfed and total 400 seeds were collected. What would be the total number of seeds having only recessive genes for both the characters?
(1) 25 (2) 30
(3) 10 (4) 60

131. The progenies of a test cross can be analysed to predict
(1) The phenotype of the test organism
(2) The genotype of the test organism
(3) The probability of all possible genotypes of offspring in a dihybrid cross
(4) The total number of progenies produced during a cross

Space for Rough Work

132. Choose the **wrong** statement regarding pollination.
(1) Pollen grains coming in contact with stigma is a chance factor in both wind and water pollination
(2) Pollination by water is quite rare in flowering plants
(3) The pollen grains are non-sticky in anemophilous flowers
(4) Flowers that attract flies and beetles are always odourless

133. Which of the following contributes to the formation of primary plant body but does not participate in secondary growth in dicots?
(1) Intrafascicular cambium
(2) Interfascicular cambium
(3) Phellogen
(4) Intercalary meristem

134. What will be the amount of DNA in meiocyte at its G_2 stage if its meiotic product has 10 pg DNA?
(1) 20 pg (2) 10 pg
(3) 40 pg (4) 80 pg

135. In which of the following phases of karyokinesis, morphology of chromosomes is most easily studied?
(1) Meiotic prophase I (2) Mitotic metaphase
(3) Mitotic prophase (4) Mitotic telophase

SECTION-B

136. The asexual spores common to both ascomycetes and deuteromycetes are
(1) Zoospores (2) Conidia
(3) Sporangiospores (4) Planospores

137. *Volvox* shows the type of life cycle pattern which
(1) Do not have free-living photosynthetic stage
(2) Have only zygote as sporophytic generation
(3) Is exhibited by all algae
(4) Have main plant body as free-living sporophytes

138. The medicinal plant of family Brassicaceae is
(1) *Nasturtium* (2) Ashwagandha
(3) *Aloe* (4) *Asparagus*

139. Read the following statements of assertion (A) and reason (R) and select the **correct** option.
Assertion (A): In the dicot root, the vascular cambium is completely secondary in origin.
Reason (R): In dicot roots, vascular cambium originates by the cells of conjoint open vascular bundles.
(1) Both (A) and (R) are true and (R) is correct explanation of (A)
(2) Both (A) and (R) are true and (R) is not the correct explanation of (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

140. Checkpoint present at G_2/M transition during cell cycle is influenced by all of the following factors, **except**
(1) Cell size
(2) Chromosome attachment to spindle
(3) DNA damage
(4) DNA replication

141. Select the **incorrect** statement w.r.t. glycolysis.
(1) Glycolysis takes place in cytoplasm
(2) It occurs both in aerobes and anaerobes
(3) There is no use of energy in the whole process
(4) Pyruvic acid is the end product of it

142. Which of the following shows 9 + 0 arrangement of microtubules giving a cartwheel like appearance?
(1) Centriole
(2) Cilia
(3) Eukaryotic flagella
(4) Fimbriae

Space for Rough Work

143. Select the **incorrect** statement w.r.t. VNTRs.
(1) They show very high degree of polymorphism
(2) The copy number varies from chromosomes to chromosomes in an individual
(3) They are microsatellites
(4) Their size vary from 0.1 to 20 kb

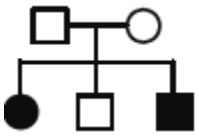
144. During transcription, the dsDNA helix is unwound by the enzyme
(1) Polynucleotide phosphorylase
(2) DNA gyrase
(3) RNA polymerase
(4) DNA polymerase

145. Alcoholic beverages produced without distillation of fermented broth are
(1) Wine and beer (2) Wine and whisky
(3) Whisky and rum (4) Brandy and rum

146. Choose the example of population interaction which shows competition.
(1) Clownfish living among sea anemone
(2) Epiphytes growing on mango trees
(3) *Balanus* living with *Chathamalus*
(4) Barnacles growing on the back of whale

147. In hydrarch succession, all belong to seral communities, **except**
(1) Amphibious plants
(2) Phytoplanktons
(3) Submerged plants
(4) Free-floating plants

148. In the following pedigree, the shaded symbols represent the affected individuals.



The given pedigree shows
(1) Autosomal dominant trait
(2) Autosomal recessive trait
(3) Sex linked dominant trait
(4) Sex linked recessive trait

149. Choose **odd** one w.r.t *in-situ* conservation of biodiversity.
(1) National parks (2) Wildlife sanctuaries
(3) Zoological parks (4) Biosphere reserves

150. Some plants require exposure of light less than critical photoperiod for flowering. These plants are called
(1) Short day plants (2) Long day plants
(3) Day-neutral plants (4) Perennial plant

ZOOLOGY

SECTION - A

151. Stanley Cohen and Herbert Boyer constructed the first recombinant DNA in which year?
(1) 1963 (2) 1972
(3) 1980 (4) 2000

152. The closest living relative of crocodiles among the following group of animals is
(1) Dinosaurs (2) Snakes
(3) Birds (4) Turtles

153. Excretory product of *Periplaneta* is
(1) Urea (2) Ammonia
(3) Uric acid (4) Guanine

154. Choose the **incorrect** statement w.r.t. members belonging to the class Osteichthyes.
(1) They are mostly viviparous and development is direct.
(2) They possess four pairs of gills that are covered by an operculum on each side.
(3) They are cold-blooded animals.
(4) They possess an air bladder which regulates buoyancy.

Space for Rough Work

155. How many birds given in the box below are flightless birds?

Pavo, Neophron, Aptenodytes, Struthio, Columba, Corvus

Select the correct option.

(1) Two (2) Four
(3) Three (4) Five

156. The enzymes that link together two substrate molecules belong to which class of enzymes?

(1) II (2) IV
(3) VI (4) V

157. Choose the **odd** one w.r.t. venereal diseases.

(1) Hepatitis-B (2) Genital herpes
(3) Genital warts (4) Haemophilia

158. Select the correct set of tissues which have fibroblasts and many collagen fibres that are present in rows between many parallel bundles of fibres in a regular pattern.

(1) Tendons and ligaments
(2) Bone and blood
(3) Cartilage and areolar tissue
(4) Skin and adipose tissue

159. How many of the below given structures present in frogs is/are not unpaired?

(a) Diencephalon
(b) Cerebral hemisphere
(c) Optic lobe
(d) Olfactory lobe
(e) Cloaca

Select the correct option.

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

160. During aestivation and hibernation, adult frogs perform

(1) Buccopharyngeal respiration
(2) Cutaneous respiration
(3) Pulmonary respiration
(4) Branchial respiration

161. Select the correct matching set w.r.t. phylum and its examples.

(1)	Porifera	*Spongilla, Hydra, Sycon*
(2)	Cnidaria	*Pennatula, Ctenoplana, Pleurobrachia*
(3)	Aschelminthes	*Wuchereria, Ascaris, Ancylostoma*
(4)	Mollusca	*Aplysia, Chaetopleura, Ophiura*

162. Complete the analogy and select the **correct** option.

Pigment : Carotenoid :: Alkaloid : _____

(1) Anthocyanin (2) Morphine
(3) Carotenoid (4) Concanavalin A

163. During joint diastole of human heart under normal conditions,

(1) Bicuspid and tricuspid valves are open
(2) Active filling of ventricles occur
(3) Semilunar valves are open
(4) Ventricles pump the blood away from heart

164. Match column I with column II and select the correct option w.r.t. humans

	Column I		**Column II**
a.	Eosinophils	(i)	Thrombocytes
b.	RBC	(ii)	Antigen 'A' on RBC surface
c.	'A' blood group	(iii)	Life span is of 120 days
d.	Platelets	(iv)	Resist infections

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

Space for Rough Work

165. Two hormones 'X' and 'Y' regulate the gene expression or chromosome function by the interaction of hormone-receptor complex with the genome. Both 'X' and 'Y' are different in chemical nature. Identify 'X' and 'Y' respectively and select the correct option.
(1) Tetraiodothyronine, estrogen
(2) Progesterone, PTH
(3) Glucagon, epinephrine
(4) Cortisol, adrenaline

166. Hashish is obtained from the extract of which plant?
(1) *Papaver somniferum*
(2) *Erythroxylum coca*
(3) *Atropa belladona*
(4) *Cannabis sativa*

167. Complete the analogy and select the correct option.
Renin : JG cells : : Vasopressin : _____
(1) Adenohypophysis (2) Hypothalamus
(3) Adrenal gland (4) Atria of heart

168. How many of the given statements is/are correct w.r.t. the functions of tubules?
(a) Collecting duct plays a role in the maintenance of pH and ionic balance of blood by the selective secretion of H^+ and K^+.
(b) Nearly all of the essential nutrients, 70-80% of electrolytes and water are reabsorbed by PCT.
(c) The ascending limb of loop of Henle is highly permeable to water.
(d) The descending limb of loop of Henle is completely permeable to electrolytes.
Select the correct option.
(1) Two (2) One
(3) Three (4) Four

169. At which of the following locations, Schwann cells are not present?
(1) Axon of myelinated nerve fibres of ANS
(2) Axon of unmyelinated nerve fibres of ANS
(3) Axon of myelinated nerve fibres of PNS
(4) Axon terminal of unmyelinated nerve fibres of ANS

170. Which of the following is related to the part of human hindbrain that is directly connected to the spinal cord?
(1) Contains a number of centres which control body temperature, urge for eating and drinking
(2) Involved in the regulation of sexual behaviour and expression of emotional reactions
(3) Contains centres which control respiration, cardiovascular reflexes and gastric secretions
(4) Possess very convoluted surface in order to provide the additional space for many more neurons

171. Enzymes catalyse biochemical reactions by
(1) Lowering the activation energy
(2) Increasing the activation energy
(3) Establishing stable bonds with the substrates
(4) Increasing the temperature

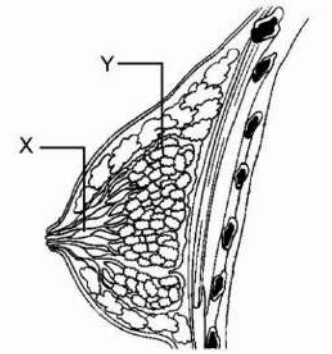
172. Select the incorrect statement w.r.t. reproductive cycle in female primates.
(1) The follicular phase is followed by the menstrual phase.
(2) The ovulatory phase is followed by the luteal phase.
(3) The secretion of gonadotropins (LH and FSH) increases gradually during the follicular phase.
(4) In the luteal phase, corpus luteum secretes large amounts of progesterone which is essential for maintenance of endometrium.

Space for Rough Work

173. Seminal plasma does not contain
(1) Enzyme (2) Sperm
(3) Ca^{+2} (4) Fructose

174. Succinate dehydrogenase is inhibited by _____ which closely resembles the substrate succinate in structure.
Select the option to fill in the blank correctly.
(1) Citrate (2) Acetate
(3) Malonate (4) Lactic acid

175. In 1963, two enzymes were isolated from *E. coli.* Which statement is **correct** regarding these enzymes?
(1) These two enzymes were oxidoreductases.
(2) These two enzymes were transferases and polymerases respectively.
(3) One of them added methyl groups to the bacterial DNA, while the other cut the viral DNA.
(4) One of them was ligases and the other cut the DNA.

176. 

Given above is a diagrammatic sectional view of female gland. Identify the labelled structures 'X' and 'Y' and select the correct option.

	'X'	**'Y'**
(1)	Mammary lobe	Lactiferous duct
(2)	Alveolus	Mammary lobe
(3)	Ampulla	Mammary alveolus
(4)	Fat	Areola

177. A chronic disorder in which alveolar walls are damaged due to excessive cigarette smoking is called
(1) Asthma
(2) Emphysema
(3) Pneumonia
(4) Occupational respiratory disorder

178. Complete the analogy and select the **correct** option.
Multicellular gland : Sebaceous gland :: Unicellular gland : _____.
(1) Mammary gland (2) Goblet cells
(3) Salivary gland (4) Sweat gland

179. Which of the following options is correctly matched?
(1) *Hippocampus* – 3-chambered heart
(2) *Rana* – 2-chambered heart
(3) *Crocodilus* – 4-chambered heart
(4) *Pavo* – 3-chambered heart

180. How many of the animals given in the box below have a segmented body, closed circulation and bilateral symmetry?

Octopus, Locusta, Nereis, Echinus Balanoglossus, Pheretima, Periplaneta, Antedon

Select the correct option.
(1) Four (2) Seven
(3) Two (4) Five

181. Transmission of HIV does not occur
(1) By hugging the infected person
(2) By transfusion of contaminated blood
(3) By sharing infected needles
(4) From infected mother to her foetus through placenta

Space for Rough Work

182. In an adult human, under normal physiological conditions, all of the given factors lead to dissociation of oxygen from oxyhaemoglobin, **except**
(1) High partial pressure of CO_2
(2) High temperature
(3) High H^+ concentration
(4) High pH

183. A bioreactor does **not** contain any
(1) Agitator system
(2) Oxygen delivery system
(3) Foam control system
(4) Gene regulation system

184. **Assertion (A):** Insulin cannot be orally administered to diabetic patients.
Reason (R): Insulin leads to a sudden decrease in blood sugar levels if given orally.
In the light of above statements, select the **correct** option.
(1) Both (A) and (R) are true and (R) is the correct explanation of (A)
(2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
(3) (A) is true, (R) is false
(4) (A) is false, (R) is true

185. Pre-historic men who are considered as the connecting link between men and apes and who hunted with stone weapons but essentially ate fruits were
(1) *Australopithecines*
(2) *Homo erectus*
(3) *Homo sapiens*
(4) *Dryopithecus*

SECTION - B

186. The gland named 'X' is a lobular structure located between lungs behind the sternum on the ventral side of aorta in humans. Select the correct statement w.r.t. 'X'.
(1) It secretes a steroidal hormone called thymosin.
(2) It gets degenerated in old individuals resulting in decreased production of thyroxine.
(3) Its hormone plays a major role in the glucose homeostasis.
(4) Its hormone plays a major role in differentiation of T-lymphocytes.

187. Which of the following is not an example of homologous structures?
(1) Thorns of *Bougainvillea* and tendrils of *Cucurbita*
(2) Flippers of penguins and dolphins
(3) Forelimbs of human and cheetah
(4) Vertebrate hearts or brains

188. In a population that is in Hardy-Weinberg equilibrium, the frequency of homozygous recessive genotype of eye colour is 0.09. Calculate the percentage of individuals homozygous for the dominant allele.
(1) 91% (2) 49%
(3) 64% (4) 24%

189. Read the following statements.
Statement A: MTP is considered relatively safe when body of foetus is covered with fine hair, their eyelids separate and eyelashes are formed.
Statement B: Nearly 0.45-0.50 million MTPs are performed in a year all over the world which accounts to $1/5^{th}$ of the total number of conceived pregnancies in a year.
Select the correct option.
(1) Both statements A and B are correct
(2) Both statements A and B are incorrect
(3) Only statement B is correct
(4) Only statement A is correct

Space for Rough Work

190. How many of the bones given in the box below are the part of axial skeleton in humans?

Frontal, Maxilla, Zygomatic, Ethmoid, Lacrimal, Temporal, Scapula

Select the correct option.

(1) Six (2) Five

(3) Three (4) Two

191. Supra-oesophageal ganglion of cockroach supplies nerves to _____ and _____. Select the correct option to fill in the blanks.

(1) Antennae, compound eyes

(2) Antennae, labium

(3) Compound eyes, tegmina

(4) Compound eyes, hypopharynx

192. Choose the incorrect statement w.r.t. *Pheretima*.

(1) Their nervous system is represented by ganglia arranged segmentwise on the dorsal paired nerve cord.

(2) Their blood cells are phagocytic in nature.

(3) They do not have eyes but do possess light and touch sensitive organs to distinguish the light intensities and to feel the vibrations in the ground.

(4) They are used as bait in game fishing.

193. Which ion increases the efficiency of rDNA entry in the bacterium during bacterial transformation?

(1) Na^+ (2) Ca^{2+}

(3) K^+ (4) Cl^-

194. Select the correct set of structures which are haploid in humans.

(1) Primary spermatocyte, secondary oocyte, spermatogonia

(2) Secondary oocyte, spermatid, spermatozoan

(3) Second polar body, secondary spermatocyte, primary oocyte

(4) First polar body, ovum, spermatogonium

195. Read the following statements.

Statement A: Stimulation of a muscle fibre by a motor neuron occurs at the neuromuscular junction.

Statement B: Lack of relaxation between successive stimuli in a sustained muscle contraction is known as tetanus.

Select the correct option.

(1) Both statements A and B are correct

(2) Both statements A and B are incorrect

(3) Only statement A is incorrect

(4) Only statement B is incorrect

196. Which of the following set of bones is involved in the formation of acetabulum of an adult human?

(1) Ileum, Ischium, Coccyx

(2) Ilium, Ischium, Pubis

(3) Ilium, Sacrum, Pubis

(4) Ileum, Ischium, Pubis

197. All of the following are included under the 'Reproductive and Child Health Care programmes', **except**

(1) Care of pregnant mothers

(2) Postnatal child care

(3) Importance of breastfeeding

(4) Promotion of unprotected sexual co-habitation

198. Select the **mismatch** w.r.t. enzyme used for isolation of DNA in RDT.

(1) Bacteria – Lysozyme

(2) Plant cell – Cellulase

(3) Animal cell – DNase

(4) Fungal cell – Chitinase

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199. Select the incorrect match.

(1)	Glomerulonephritis	–	Inflammation of glomeruli of kidney
(2)	Renal calculi	–	Stone or insoluble mass of crystallised salts formed within the kidneys
(3)	Uremia	–	Accumulation of urea in urine
(4)	Ketonuria	–	Presence of ketone bodies in urine

200. Select the correct option w.r.t. the standard ECG of a healthy human.

(1) The P-wave represents the electrical excitation of the ventricles.

(2) The QRS complex represents the repolarisation of ventricles.

(3) The T-wave represents the return of ventricles from excited to normal state.

(4) The end of the T-wave marks the end of ventricular diastole.

❑ ❑ ❑

Scan the QR Code for Detailed Video Solutions
(*Video will be available to access post 8 p.m. on 23th April, 2024 onwards)

Scan the QR Code to know "Should You Worry About Getting Enough Sleep or Leisure? | Tips from our NEET Toppers"

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Phase-I
CODE-B

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FINAL TEST SERIES for NEET-2024

MM : 720 **Test - 10** **Time : 3 Hrs. 20 Mins.**

Answers

1. (3)	41. (1)	81. (1)	121. (2)	161. (3)
2. (2)	42. (4)	82. (1)	122. (4)	162. (2)
3. (3)	43. (4)	83. (3)	123. (2)	163. (1)
4. (4)	44. (4)	84. (1)	124. (3)	164. (3)
5. (2)	45. (2)	85. (3)	125. (4)	165. (1)
6. (1)	46. (3)	86. (2)	126. (1)	166. (4)
7. (2)	47. (3)	87. (1)	127. (3)	167. (2)
8. (2)	48. (2)	88. (4)	128. (2)	168. (1)
9. (4)	49. (2)	89. (3)	129. (3)	169. (4)
10. (2)	50. (2)	90. (1)	130. (1)	170. (3)
11. (2)	51. (1)	91. (4)	131. (2)	171. (1)
12. (1)	52. (2)	92. (2)	132. (4)	172. (1)
13. (2)	53. (2)	93. (1)	133. (4)	173. (2)
14. (3)	54. (3)	94. (2)	134. (3)	174. (3)
15. (1)	55. (2)	95. (4)	135. (2)	175. (3)
16. (3)	56. (1)	96. (3)	136. (2)	176. (3)
17. (2)	57. (2)	97. (3)	137. (2)	177. (2)
18. (4)	58. (4)	98. (2)	138. (1)	178. (2)
19. (4)	59. (3)	99. (3)	139. (3)	179. (3)
20. (2)	60. (4)	100. (3)	140. (2)	180. (3)
21. (2)	61. (2)	101. (4)	141. (3)	181. (1)
22. (1)	62. (1)	102. (1)	142. (1)	182. (4)
23. (1)	63. (2)	103. (3)	143. (3)	183. (4)
24. (1)	64. (4)	104. (1)	144. (3)	184. (3)
25. (3)	65. (1)	105. (1)	145. (1)	185. (1)
26. (4)	66. (1)	106. (3)	146. (3)	186. (4)
27. (2)	67. (4)	107. (2)	147. (2)	187. (2)
28. (3)	68. (1)	108. (3)	148. (2)	188. (2)
29. (2)	69. (1)	109. (1)	149. (3)	189. (2)
30. (4)	70. (3)	110. (4)	150. (1)	190. (1)
31. (2)	71. (2)	111. (3)	151. (2)	191. (1)
32. (2)	72. (3)	112. (1)	152. (3)	192. (1)
33. (2)	73. (2)	113. (3)	153. (3)	193. (2)
34. (2)	74. (3)	114. (1)	154. (1)	194. (2)
35. (1)	75. (1)	115. (1)	155. (1)	195. (1)
36. (1)	76. (3)	116. (3)	156. (3)	196. (2)
37. (3)	77. (4)	117. (3)	157. (4)	197 (4)
38. (3)	78. (4)	118. (4)	158. (1)	198. (3)
39. (4)	79. (1)	119. (3)	159. (3)	199. (3)
40. (1)	80. (2)	120. (3)	160. (2)	200. (3)

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FINAL TEST SERIES for NEET-2024

MM : 720 **Test - 10** **Time : 3 Hrs. 20 Mins.**

Answers and Solutions

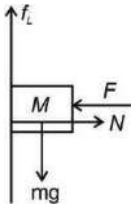
PHYSICS

SECTION - A

1. Answer (3)
Bohr's model is applicable for single electron species.

2. Answer (2)
Equipotential surface always makes 90° with electric field.

3. Answer (3)



$f_L = mg$

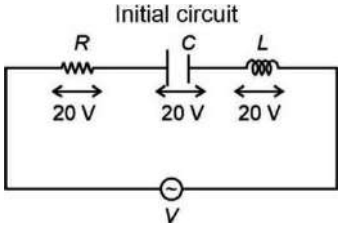
$\mu N = mg$

$\mu F = mg$

$$F = \frac{mg}{\mu} = \frac{5 \times 10}{0.5} = 100 \text{ N}$$

4. Answer (4)
$K + U = E$
$U = E - K$
Since, kinetic energy cannot be negative hence, total energy cannot be less than potential energy.

5. Answer (2)



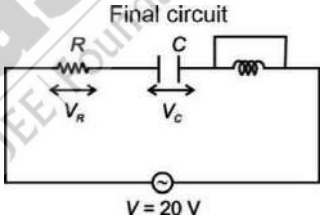
$$V^2 = V_R^2 + (V_L - V_C)^2$$

$$V^2 = (20)^2 + (20 - 20)^2$$

$V = 20$ V

$V_R = V_C = V_L$

$\therefore \quad R = X_C = X_L$



$$V^2 = V_R^2 + V_C^2$$

$\because \quad R = X_C$

$\Downarrow$

$V_R = V_C$

$$V^2 = V_C^2 + V_C^2$$

$$(20)^2 = 2V_C^2$$

$$V_C = \frac{20}{\sqrt{2}} = 10\sqrt{2} \text{ V}$$

6. Answer (1)

$$\frac{4}{3}\pi R^3 = 125 \times \frac{4}{3}\pi r^3$$

$$r = \frac{R}{5}$$

$E = T \times 4\pi R^2$

$$E_1 = T \times 125 \times 4\pi \left(\frac{R}{5}\right)^2$$

$= 5 \times E$

7. Answer (2)

$v = \omega\sqrt{A^2 - x^2}$

$8 = \omega\sqrt{A^2 - (5)^2}$

$\Rightarrow \quad \frac{64}{\omega^2} + 25 = A^2$ ...(i)

$10 = \omega\sqrt{A^2 - (4)^2}$

$\Rightarrow \quad \frac{100}{\omega^2} + 16 = A^2$ ...(ii)

From, (i) and (ii)

$\frac{64}{\omega^2} + 25 = \frac{100}{\omega^2} + 16$

$\frac{36}{\omega^2} = 9$

$\omega^2 = \frac{36}{9}$

$\omega = 2$ rad/s

$\because \quad \omega = \frac{2\pi}{T} = 2$

$T = \pi = 3.14$ s

8. Answer (2)

$C_1 = 2K\frac{C}{2} = KC$

$C_2 = 3K\frac{C}{2} = \frac{3}{2}KC$

Now $C_{eq} = C_1 + C_2$ (parallel combination)

$= KC + \frac{3KC}{2}$

$= \frac{5}{2}KC$

9. Answer (4)

Electric field at axial point

$\vec{E}_1 = \frac{2\vec{p}}{4\pi\varepsilon_0 r^3}$

Electric field at equatorial point

$\vec{E}_2 = \frac{-\vec{p}}{4\pi\varepsilon_0 r^3}$

10. Answer (2)

$T = 2\pi\sqrt{\frac{L}{g}} \quad \Rightarrow \quad T^2 = 4\pi^2\frac{L}{g}$

$\therefore \quad g = 4\pi^2\frac{L}{T^2} \quad \Rightarrow \frac{\Delta g}{g} = \frac{\Delta L}{L} + \frac{2\Delta T}{T}$ ...(i)

$\because \quad t = nT$

$\frac{\Delta T}{T} = \frac{\Delta t}{t} = \frac{1}{125}$

$\frac{\Delta L}{L} = \frac{0.1}{10}$

From (i)

$\frac{\Delta g}{g}\% = \left[\frac{0.1}{10} + 2\times\frac{1}{125}\right]\times 100$

$\frac{\Delta g}{g}\% = \left[\frac{0.1}{10} + \frac{2}{125}\right]\times 100$

$= 1\% + 1.6\% = 2.6\%$

11. Answer (2)

For $n_f = 2$, $n_i = 4$ transition, photon will be having least wavelength.

12. Answer (1)

$\sin i_c = \frac{1}{\mu}$

$\sin 37° = \frac{1}{\mu}$

$\mu = \frac{5}{3}$

$\tan i_p = \mu$

$i_p = \tan^{-1}\left(\frac{5}{3}\right)$

13. Answer (2)

$E = \frac{12400 \text{ eV}}{4000 \text{ Å}} = 3.1$ eV

$\phi_0 = E - K.E.$

$= (3.1 - 1.68)$ eV

$= 1.42$ eV

14. Answer (3)

$_{92}U^{237} \xrightarrow[\text{emissions}]{7\alpha\text{-particle}} {}_{78}Pt^{209} \xrightarrow[\text{emissions}]{5\beta^- \text{particle}} {}_{83}Bi^{209}$

15. Answer (1)

$\frac{1}{f_l} = (\mu - 1)\left(\frac{2}{R}\right)$

$\frac{1}{20} = \frac{0.5\times 2}{R}$

$R = 20$ cm

$\frac{1}{f'} = (1.5 - 1)\left(\frac{1}{-20} - \frac{1}{20}\right)$

$\frac{1}{f'} = (0.5)\times\left(\frac{-2}{20}\right) = \frac{-1}{20}$

Power of arrangement (P) $= \frac{1}{f} + \frac{1}{f'} + \frac{1}{f}$

$= \frac{1}{20} + \left(\frac{-1}{20}\right) + \frac{1}{20}$

$= \frac{1}{20}$

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16. Answer (3)

$$T = 2\pi\sqrt{\frac{l}{g}}$$

$$T_1 = 2\pi\sqrt{\frac{l}{g-\frac{g}{2}}}$$

$$T_1 = 2\pi\sqrt{\frac{2l}{g}}$$

$$\frac{T}{T_1} = \frac{1}{\sqrt{2}}$$

$$T_1 = 2\sqrt{2}\text{ s}$$

17. Answer (2)

$$f_1 = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

$$\frac{f_1}{f_2} = \sqrt{\frac{T_1}{T_2}}$$

$$\frac{400}{800} = \sqrt{\frac{80}{T_2}}$$

$$\frac{1}{4} = \frac{80}{T_2}$$

T_2 = 320 N

T_2 = 32 kg-weight

18. Answer (4)

$3P_0 = P_0 + \rho gh$

$\rho gh = 2P_0$

$$P_1 = \frac{\rho gh}{3} = \left(\frac{2P_0}{3}\right)$$

$$P_{net} = P_0 + \frac{2P_0}{3} = \frac{5P_0}{3}$$

19. Answer (4)

$$\vec{P}_i = mv\sin 60^\circ\hat{j} + mv\cos 60^\circ\hat{i}$$

$$= \frac{mv\sqrt{3}\hat{j}}{2} + \frac{mv}{2}\hat{i}$$

$$\vec{P}_f = -mv\sin 60^\circ\hat{j} + mv\cos 60^\circ\hat{i}$$

$$= -\frac{mv\sqrt{3}}{2}\hat{j} + \frac{mv}{2}\hat{i}$$

$$\Delta\vec{P} = \vec{P}_f - \vec{P}_i$$

$$\overline{\Delta P} = -mv\sqrt{3}\hat{j}$$

$$|\overline{\Delta P}| = mv\sqrt{3}$$

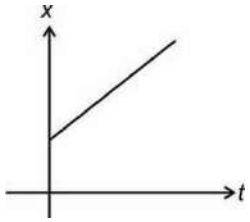
20. Answer (2)

After a long time, capacitor will be completely charged and will act as open wire while inductor will act as a resistance less wire.

$i = \frac{10}{10} = 1$ A $\therefore P = i^2R = 10$ W

21. Answer (2)

The given graph indicates that particle is moving with constant velocity and hence, zero acceleration



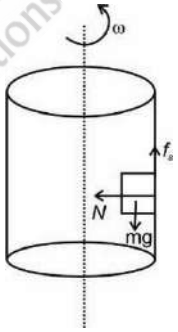
22. Answer (1)

For equilibrium:

$f_s = mg$ and ..(i)

$N = ma = mr\omega^2$

Minimum angular velocity will be needed when friction become maximum.



$$(f_s)_{max} = \mu N = mg$$

$$\mu mr\omega^2 = mg \Rightarrow \mu = \frac{g}{r\omega^2}$$

$$\mu = \frac{10}{1.5\times 10\times 10} = \frac{1}{15}$$

23. Answer (1)

Dimensional formula of $\text{kg}\frac{\text{m}^2}{\text{s}^2}$ is

$\left[\text{ML}^2\text{T}^{-2}\right]$

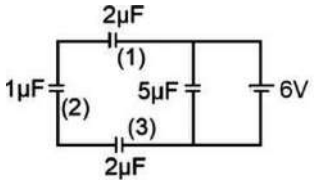
$$n_2 = n_1\left[\frac{\text{M}_1}{\text{M}_2}\right]^1\left[\frac{\text{L}_1}{\text{L}_2}\right]^2\left[\frac{\text{T}_1}{\text{T}_2}\right]^{-2}$$

$$n_2 = 10\left[\frac{1\text{ kg}}{10\text{ kg}}\right]^1\left[\frac{1\text{ m}}{100\text{ m}}\right]^2\left[\frac{1\text{ s}}{10^3\text{ s}}\right]^{-2}$$

$n_2 = 100$

24. Answer (1)
Maximum loss of kinetic energy happens when the collision is perfectly inelastic.

25. Answer (3)
Capacitors (1), (2) and (3) are in series with the battery.



$\therefore C_{eq} = \frac{1}{2}\mu F$

$Q = CV \Rightarrow Q = \frac{1}{2}\times 6$

$Q = 3\mu C$

26. Answer (4)

$\vec{\tau} = \vec{r}\times\vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 1 \\ 2 & 3 & 0 \end{vmatrix}$

$\vec{\tau} = \hat{i}(-3) - \hat{j}(-2) + \hat{k}(3+2)$

$\vec{\tau} = -3\hat{i} + 2\hat{j} + 5\hat{k}$

27. Answer (2)

$y = \overline{\overline{A} + B} = \overline{\overline{A}}\cdot\overline{B} = A\cdot\overline{B}$

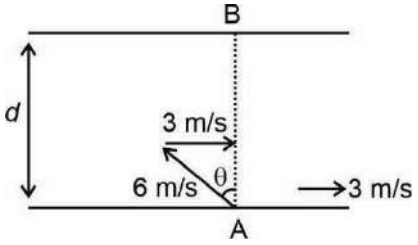
A	B	Y
0	0	0
0	1	0
1	0	1
1	1	0

28. Answer (3)
The existence of threshold frequency in photelectric effect can be explained by particle nature of light.

While $E = \frac{hc}{\lambda}$

$\therefore \quad E \propto \frac{1}{\lambda}$

29. Answer (2)



For zero drift : $6\sin\theta = 3 \Rightarrow \sin\theta = \frac{1}{2} \Rightarrow \theta = 30^\circ$

$\therefore$ Time to cross the river $= \frac{d}{6\cos 30^\circ}$

$t = \frac{900\sqrt{3}}{6\times\frac{\sqrt{3}}{2}} = 300$ seconds

30. Answer (4)

Volumetric strain $= \frac{\text{change in volume}}{\text{original volume}}$

Hence, volumetric strain has no unit.

31. Answer (2)
- Magnetic susceptibility of diamagnetic substance is negative
- Magnetic susceptibility of paramagnetic substance is small and positive.
- Magnetic susceptibility of ferromagnetic substance is large and positive.

32. Answer (2)
Given,

$y = A\sin(\omega t) + B\sin(2\omega t)$
$\quad\quad\downarrow \quad\quad\quad\quad \downarrow$

$T_1 = \frac{2\pi}{\omega} = T_0 \quad T_2 = \frac{2\pi}{2\omega} = \frac{T_0}{2}$

Clearly, the motion will repeat after T_0 time.

Hence, time period is $T_0 = \frac{2\pi}{20\pi} = \frac{1}{10}$ second

33. Answer (2)
In a series LCR ac circuit:
(a) Whether current will lead the voltage or not depends on the value of X_L and X_c
(b) Energy loss is maximum for $\cos\phi = 1$ but not zero.

34. Answer (2)
For thin prism:

$\delta = (\mu - 1)A \Rightarrow \delta = 0.5\times 4^\circ = 2^\circ$

35. Answer (1)
Given $u = 0$; a = 2 m/s^2

$s = ut + \frac{1}{2}at^2 \Rightarrow s = 0 + \frac{1}{2}\times 2\times 3^2 = 9$ m

Distance covered in n^{th} second:

$S_{n^{th}} = u + \frac{a}{2}(2n-1)$

$S_{3rd} = 0 + \frac{2}{2}(2\times 3 - 1) = 5$ m

$\therefore$ Ratio $= \frac{9}{5}$

SECTION-B

36. Answer (1)

Instantaneous power:

$P = \vec{F}.\vec{v} = Fv\cos\theta$

At highest point, θ will be 90°

$\therefore \quad P = Fv\cos 90° = 0$

37. Answer (3)

$q = ne$

$$F = \frac{1}{4\pi\varepsilon_0}\frac{n^2e^2}{d^2}$$

$$n^2 = \frac{4\pi\varepsilon_0 Fd^2}{e^2}$$

$$n = \sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$$

38. Answer (3)

By the circular dynamics at the highest point.

$$T_H + mg = \frac{mv^2}{r}$$

$$T_H + mg = \frac{m\left(\sqrt{3rg}\right)^2}{r}$$

$$T_H = 2mg$$

$\because \quad T_L - T_H = 6mg$

$$T_H\left[\frac{T_L}{T_H} - 1\right] = 6mg$$

$$\frac{T_L}{T_H} - 1 = \frac{6mg}{T_H} = \frac{6mg}{2mg}$$

$$\frac{T_L}{T_H} = 1 + 3 = 4$$

39. Answer (4)

$$\frac{1}{R} = \frac{1}{3} + \frac{1}{16} + \frac{1}{8}$$

$$\frac{1}{R} = \frac{16 + 3 + 6}{48} = \frac{25}{48} \Rightarrow R = \frac{48}{25}\Omega$$

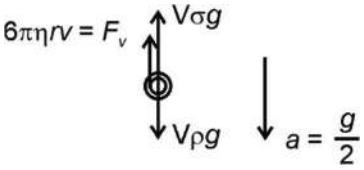
$$V_{PQ} = 1.5 \times \frac{48}{25} = \frac{14.4}{5} = 2.88 \text{ V}$$

40. Answer (1)

$$r = \frac{mv}{qB} = \frac{\sqrt{2mK}}{qB} = \frac{\sqrt{2mqV}}{qB}$$

$$r \propto \sqrt{\frac{m}{q}}$$

41. Answer (1)



$V\rho g - (F_v + V\sigma g) = ma$

$$\Rightarrow \frac{4}{3}\pi r^3\rho g - 6\pi\eta rv - \frac{4}{3}\pi r^3\sigma g = \frac{4}{3}\pi r^3\rho\left(\frac{g}{2}\right)$$

$$\Rightarrow 6\pi\eta rv = \frac{4}{3}\pi r^3 g(\rho - \sigma) - \frac{4}{3}\frac{\pi r^3\rho g}{2}$$

$$\Rightarrow 6\pi\eta rv = \frac{4}{3}\pi r^3 g\left(\rho - \sigma - \frac{\rho}{2}\right)$$

$$\Rightarrow 6\pi\eta rv = \frac{4}{3}\pi r^3 g\left(\frac{\rho - 2\sigma}{2}\right)$$

$$\Rightarrow v = \frac{2\pi r^2 g(\rho - 2\sigma)}{18\eta\pi}$$

$$\Rightarrow v = \frac{r^2 g(\rho - 2\sigma)}{9\eta}$$

42. Answer (4)

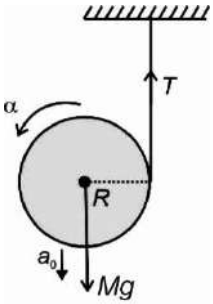
Magnetic flux, $\phi = \vec{B}.\vec{A} = BA\cos\theta$

and $\varepsilon = \frac{-d\phi}{dt} \Rightarrow \varepsilon = -\frac{d}{dt}(BA\cos\theta)$

Therefore, emf and current can be induced by varying B, A or θ.

43. Answer (4)

$$\tau_{net} = I\alpha \Rightarrow Mg \times R = \left(\frac{MR^2}{2} + MR^2\right)\alpha$$



$$MgR = \frac{3}{2}MR^2\alpha$$

$$\alpha = \frac{2g}{3R}$$

44. Answer (4)

Gravitational field outside the sphere:

$$E = \frac{GM}{r^2}$$

$$\therefore \quad E\,(r = 5) = \frac{G \times 10}{5 \times 5} = \frac{-2G}{5}$$

Gravitational field inside the sphere :

$$\mathrm{E} = \frac{-GMr}{R^3}$$

$$\therefore \quad E(r = 2) = \frac{-G \times 10 \times 2}{(4)^3} = \frac{-5\mathrm{G}}{16}$$

Gravitational potential outside the sphere,

$$V = \frac{-GM}{r}$$

$V(r = 5) = -2G$

Gravitational potential at centre of sphere,

$$V = \frac{-3}{2}\frac{GM}{R} = \frac{-3}{2}\frac{G(10)}{4}$$

$$V_0 = \frac{-15G}{4}$$

45. Answer (2)

At $t = 0$, maximum current will flow in the circuit and current will become zero eventually, when the capacitor is charged fully.

46. Answer (3)

For a cyclic process

$Q = w$

w = Area under P-V graph

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

$$= \frac{1}{2} \times 1 \times 10^3 = 500\,\mathrm{J}$$

$\therefore \quad Q = 500$ J

47. Answer (3)

Springs with force constants $2K$ and $2K$ are in series, therefore their equivalent will become $\frac{2K \times 2K}{2K + 2K} = K$.

Then, the combination is in parallel with other spring of force constant K.

$$K_{eq} = K + K = 2K$$

$$\therefore T = 2\pi\sqrt{\frac{m}{K_{eq}}} = 2\pi\sqrt{\frac{m}{2K}}$$

48. Answer (2)

To apply electromagnetic force on a charged particle at rest, electric field must be present.

49. Answer (2)

Kirchhoff's junction law is based on conservation of charge.

50. Answer (2)

$$\varepsilon = \frac{-Ldi}{dt} \Rightarrow \varepsilon = -2 \times 3 = -6\,\mathrm{V}$$

CHEMISTRY

SECTION - A

51. Answer (1)

If ΔG is negative, then the reaction is spontaneous and proceeds in the forward direction.

52. Answer (2)

a. $\underset{}{CaO} + C \longrightarrow \underset{[A]}{CaC_2} + CO$

b. $\underset{[A]}{CaC_2} + H_2O \longrightarrow Ca(OH)_2 + \underset{[B]}{C_2H_2}$

53. Answer (2)

$Ba(OH)_2 \rightarrow Ba^{+2} + 2OH^{\ominus}$

0.01 M ↓ ↓

0 0.01 M 2×0.01 M = 0.02 M

$pOH = -\log [OH^{\ominus}] = 1.69 \approx 1.7$

$pH = 14 - 1.7 = 12.3$

54. Answer (3)

CFSE = $[-0.4x + 0.6y]\Delta_0$

Where, x and y are number of electrons occupying t_{2g} and e_g orbitals respectively.

$d^5[\text{High spin}] = t_{2g}^3 e_g^2$

CFSE = {[–0.4 × 3] + [0.6 × 2]} = 0

$Fe^{2+} = 3d^6 4s^0$

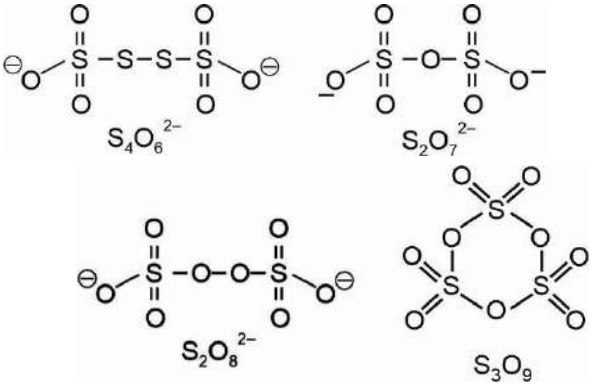
For $3d^6 \Rightarrow t_{2g}^6\ 4s^0$

$[Fe(CN)_6]^{4-}$ is a low spin complex

55. Answer (2)

In CO_2, oxidation state of carbon is +4, which is maximum oxidation state of carbon. So, CO_2 cannot act as reducing agent.

56. Answer (1)



57. Answer (2)

Meq. of NH_3 = meq. of H_2SO_4.

= 2×1×10 = 20 meq.

mol. of NH_3 = mol. of 'N' atom = 20×10^{-3} mol

weight of 'N' atom = $20 \times 10^{-3} \times 14$ g

$$\% \text{ of 'N' atom} = \frac{20\times10^{-3}\times14}{0.6}\times100$$

= 46.67%

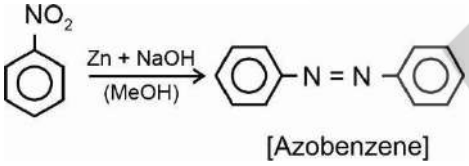
58. Answer (4)

In starch α-D-glucose units are held in which chain is formed by $C_1 - C_4$ glycosidic linkage whereas branching occurs by $C_1 - C_6$ glycosidic linkage.

59. Answer (3)

For spontaneous reactions $\Delta G < 0$ or $E_{cell} > 0$.

60. Answer (4)



[Azobenzene]

61. Answer (2)

$$\omega = \frac{MM \times It}{nF}$$

$$= \frac{65.3\times2\times20\times60}{2\times96500}$$

= 0.812 g

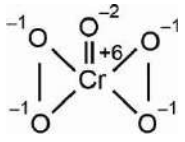
62. Answer (1)

$$\text{Molality} = \frac{X_{solute}\times1000}{X_{solvent}\times M_{solvent}} = \frac{0.2\times1000}{0.8\times18} = 13.89$$

63. Answer (2)

Cr > Fe > Mn [Melting point].

64. Answer (4)

(a) 

(b) VO_3^- → Oxidation state of V = + 5

(c) MnO_4^- → Oxidation state of Mn = + 7

(d) FeF_6^{3-} → Oxidation state of Fe = + 3

65. Answer (1)

Among all the elements of group 13, aluminium is most electropositive while gallium has the lowest melting point.

66. Answer (1)

- Use relation, $\Delta H = \Delta U + \Delta n_g RT$

$\Delta n_g = 1 + 1 - 1 = 1$ for the reaction

$PCl_5 \rightarrow PCl_3 + Cl_2$

67. Answer (4)

Salt containing anion of weak acid will give anionic hydrolysis

68. Answer (1)

Acid-Base neutralization is a non-redox reaction.

69. Answer (1)

$(BN)_x$ is a inorganic graphite.

$B_3N_3H_6$ is a inorganic Benzene.

70. Answer (3)

HCl < HBr < HI [Reducing power]

$HClO < HClO_2 < HClO_3$ [Acidic strength]

$NH_3 > PH_3 > AsH_3$ [Basic strength]

71. Answer (2)

$$H_3A \rightleftharpoons 3H^+ + A^{3-}$$

$i = 1 + (4 - 1) \times 0.4 = 1 + 3 \times 0.4 = 1 + 1.2$

= 2.2

72. Answer (3)

$NaCl(aq) \longrightarrow Na^+(aq) + Cl^-(aq)$

Cathode : $H_2O + e^- \longrightarrow \frac{1}{2}H_2(g) + OH^-(aq)$

Anode : $2Cl^-(aq) \longrightarrow Cl_2(g) + 2e^-$

73. Answer (2)

$$t_{1/2} = \frac{0.693}{k}$$

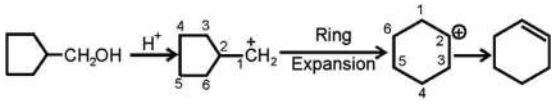
74. Answer (3)

Electron donating groups present at o/p position increases pK_a and decreases acidic character.

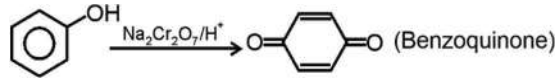
75. Answer (1)

Heavier elements of group-14 do not form $p\pi - p\pi$ bond because their atomic orbitals are too large and diffuse to have effective overlapping.

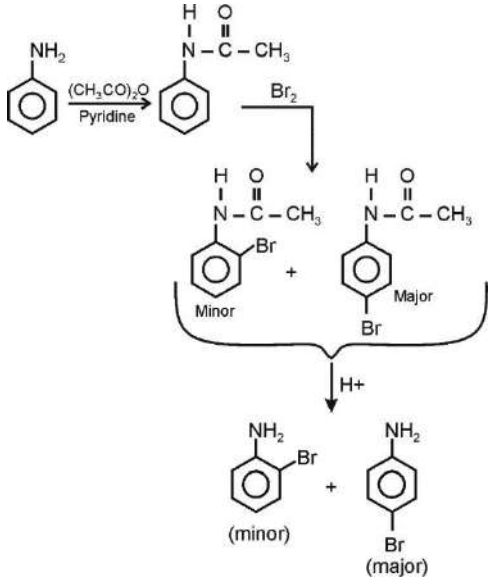
76. Answer (3)



77. Answer (4)



78. Answer (4)



79. Answer (1)

Li > B > C > Be (Order of IE_2)

80. Answer (2)

Because of lower dissociation enthalpy, HCl is stronger acid than HF.

81. Answer (1)

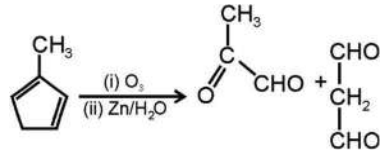
Bond length order: C – N > C = C > C = O > C ≡ N

(pm) (143) (133) (121) (116)

82. Answer (1)

HF > HCl > HBr > HI (order of dipole moment)

83. Answer (3)



84. Answer (1)

CO_2, SiO_2 and GeO_2 are acidic in nature.

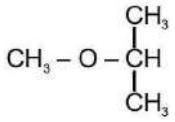
85. Answer (3)

Phenolphthalein is used as an acid base indicator as it is colourless in acidic medium while pink in basic medium.

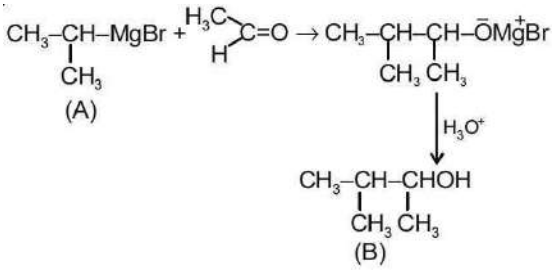
SECTION-B

86. Answer (2)

$C_2H_5 – O – C_2H_5$, $CH_3 – O – CH_2 – CH_2 – CH_3$



87. Answer (1)



88. Answer (4)

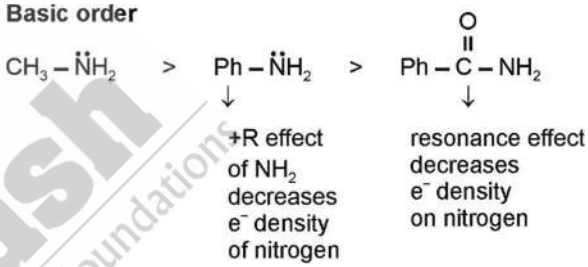
Ethanol and α-methylketones give iodoform test.

89. Answer (3)

Orbital	n	l	m_l(possible values)
4*d*	4	2	–2, –1, 0, +1, +2
4*p*	4	1	–1, 0, + 1
4*s*	4	0	0
4*f*	4	3	–3, –2, –1, 0, +1, +2, +3

90. Answer (1)

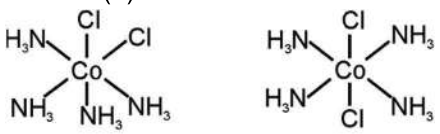
Basic order



91. Answer (4)

Number of degenerate orbitals in second excited state of $He^+ = n^2 = 3^2 = 9$.

92. Answer (2)



93. Answer (1)

$Ca^{2+} + CO_3^{2-} \rightarrow CaCO_3$

$CaCO_3 + 2CH_3COOH \rightarrow (CH_3COO)_2Ca + H_2O + CO_2$

$(CH_3COO)_2Ca + (NH_4)_2C_2O_4 \rightarrow (COO)_2Ca$ (white ppt) $+ 2CH_3COONH_4$

Ca^{2+} gives brick red colour to flame

94. Answer (2)

Mole fraction of solvent = 0.9 mol H_2O

Mass of solvent = 0.9 × 18 = 16.2 g

95. Answer (4)

$r_n = 0.529\left(\frac{n^2}{Z}\right)$ Å = $0.529\left(\frac{4^2}{2}\right)$ Å = 0.529 × 8 Å

96. Answer (3)

$NaOH \rightarrow Na^+ + OH^-$

0.2 M 0.2 M

$Al(OH)_3 \rightleftharpoons \underset{s}{Al^{3+}(aq)} + \underset{(s+0.2)\simeq 0.2}{3OH^-(aq)}$

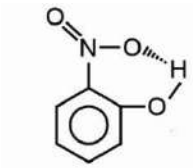
$K_{sp} = [Al^{3+}][OH^-]^3$

$4 \times 10^{-34} = [Al^{3+}][0.2]^3$

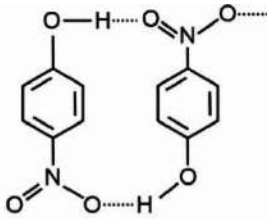
$[Al^{3+}] = \frac{4\times10^{-34}}{(0.2)^3} = 5 \times 10^{-32}$

97. Answer (3)

p-nitrophenol has higher boiling point than that of o-nitrophenol due to extensive intermolecular hydrogen bonding while o-nitrophenol has intramolecular hydrogen bonding and it is steam volatile.



o-nitrophenol
(steam volatile)



p-nitrophenol

98. Answer (2)

Electron withdrawing group makes aryl halides more susceptible to nucleophilic substitution.

99. Answer (3)

$LiAlH_4$ will reduce – ketones, carboxylic acid and $–NO_2$ group.

100. Answer (3)

Sodium acetate will undergo hydrolysis

$$pH = 7 + \frac{1}{2}[pK_a + \log C]$$

$$= 7 + \frac{1}{2}[4.75 + \log 0.2]$$

$$= 7 + \frac{1}{2}[4.75 - 0.7]$$

$$= 9.025$$

$pH \simeq 9$

BOTANY

SECTION - A

101. Answer (4)

Metabolic reactions occur in living being and some of them can be made to occur in cell-free systems.

102. Answer (1)

During unfavourable conditions, plasmodium differentiates in sporangia and forms fruiting bodies bearing spores at their tips.

103 Answer (3)

Artificial system of classification separated the closely related species. Numbers and codes are assigned to all the observable characters in numerical taxonomy.

104. Answer (1)

Okra belongs to family Malvaceae. In Malvaceae family actinomorphic flower, twisted aestivation of corolla and epicalyx is found. Monoadelphous stamens, monothecous anthers and endospermic seeds are found.

105. Answer (1)

Hypodermis is a part of ground tissue system and present outside the stele.

106. Answer (3)

Of the two membrane, the inner chloroplast membrane is relatively less permeable.

107. Answer (2)

Since, the parent produces 16 genetically different types of gametes, the number of hybrids would be $\sqrt{16} = 4$, then the total number of different genotypes of zygotes will be $3^4 = 81$.

108. Answer (3)

Number of generation (n) of mitosis for producing x cells = $2^{(n)}$

x = 64

$64 = 2^{(n)}$

n = 6

109. Answer (1)

C_4 plants show double carboxylation. In C_4 plants, PEPcase enzyme is found in mesophyll cells.

110. Answer (4)

In fermentation there is net gain of 2 ATP only.

111. Answer (3)

Thylakoids are flat membranous sacs which are arranged in stack known as granum.

Two grana are connected with the help of flat membranous tubules known as stroma lamellae.

Stroma contains 70S ribosomes.

112. Answer (1)

(a) DNA polymerase is involved in DNA replication.

(b) RNA polymerase is involved in transcription.

(c) Peptidyl transferase is involved in translation.

113. Answer (3)

In the given diagram

A represents radicle

B represents plumule

C represents hypocotyl

114. Answer (1)

Cell wall of dinoflagellate has stiff cellulosic plates on the outer surface.

115. Answer (1)

Tendrils of watermelon are modified axillary buds. They help plant to climb.

116. Answer (3)

Phylloclade of *Opuntia* is a modified flattened photosynthetic stem.

117. Answer (3)

Marchantia is a bryophyte (liverwort) having main plant body as dominant gametophyte.

118. Answer (4)

Lipid synthesis is performed by SER.

119. Answer (3)

Prokaryotes have only one type of RNA polymerase plant.

120. Answer (3)

Pink coloured flowers in F_1 generation represents incomplete dominance in *Antirrhinum majus* (snapdragon) or dog flower plant.

121. Answer (2)

Kinetin does not occur naturally in plants.

122. Answer (4)

Dichogamy promotes cross-pollination.

123. Answer (2)

Parent A AaBbCcDd

Parent B AaBbCcDd

Aa × Aa	Bb × Bb	Cc × Cc	Dd × Dd
AA Aa Aa aa	BB Bb Bb bb	CC Cc Cc cc	DD Dd Dd dd

Probability of the progeny having: AaBbccDd

$= \frac{2}{4} \times \frac{2}{4} \times \frac{1}{4} \times \frac{2}{4} = \frac{1}{32}$

124. Answer (3)

Regulation of transcription is the primary step for regulation of gene expression.

125. Answer (4)

Aminoacylation of tRNA occurs in cytoplasm of eukaryotic cells.

126. Answer (1)

Citric acid is produced by a fungus *Aspergillus niger*.

127. Answer (3)

Mortality is the number of deaths in the population during a given period.

128. Answer (2)

Species composition is the structural aspect of an ecosystem.

129. Answer (3)

According to Rivet popper hypothesis, rivets on the wings are considered as keystone species.

130. Answer (1)

The flowers that are pollinated by seed with both genes recessive is rryy $= \frac{1}{16} \times 400 = 25$ seeds.

131. Answer (2)

The progenies of test cross can be easily analysed to predict the genotype of test organism.

132. Answer (4)

The flowers that are pollinated by flies and beetles secrete foul odour to attract pollinators.

133. Answer (4)

Intercalary meristem helps in primary growth of plants.

134. Answer (3)

Meiotic products are haploid (C) *i.e.* 10 pg DNA. Parent cell (meiocyte) has 2C amount of DNA.

Parent cell at G_2 stage has 4C amount of DNA *i.e.*, 40 pg DNA.

135. Answer (2)

In metaphase, condensation of chromosomes is completed and their morphology is most easily studied.

SECTION – B

136. Answer (2)

Conidia are asexual spores that is common to both ascomycetes and deuteromycetes.

137. Answer (2)

Volvox shows haplontic life cycle in which sporophytic generation is represented only by the one-celled zygote.

138. Answer (1)

Nasturtium is the medicinal plant of family Brassicaceae.

139. Answer (3)

In roots, vascular cambium originates from the tissue located just below the phloem bundles and a portion of pericycle tissue, above the protoxylem forming a complete and continuous wavy ring.

140. Answer (2)

Check point present at metaphase-anaphase transition is influenced by chromosome attachment to spindle.

141. Answer (3)

During activation phase of glycolysis, two molecules of ATP are used.

142. Answer (1)

Centrioles show 9 + 0 arrangement of microtubules giving a cartwheel like appearance.

143. Answer (3)

VNTRs are minisatellites.

144. Answer (3)

During transcription, the dsDNA helix is unwound by the enzyme RNA polymerase.

145. Answer (1)

Whisky, brandy and rum are produced by distillation.

146. Answer (3)

Balanus dominates the intertidal area and excludes the smaller barnacle *Chathamalus* from that zone. They show competition.

Rest are examples of commensalism.

147. Answer (2)

Phytoplanktons form pioneer community of hydrarch succession.

148. Answer (2)

Since the parents are unaffected but their both daughter and son are affected, the trait would be autosomal recessive.

149. Answer (3)

Zoological parks are *ex-situ* conservation strategies of biodiversity.

150. Answer (1)

Short day plants flower when they are exposed to a photoperiod shorter than a critical period.

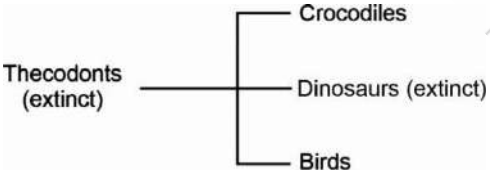
ZOOLOGY

SECTION - A

151. Answer (2)

The construction of the 1st rDNA emerged from the possibility of linking a gene encoding antibiotic resistance with a native plasmid of *Salmonella typhimurium.*

152. Answer (3)



153. Answer (3)

Periplaneta absorbs nitrogenous waste products and convert them into uric acid which is excreted out through the hindgut.

154. Answer (1)

Members of the class Osteichthyes are mostly oviparous and development is direct.

155. Answer (1)

Struthio, Apteryx and *Aptenodytes* are flightless birds.

156. Answer (3)

Ligases catalyse the linking together of two molecules. They belong to class VI of enzymes.

157. Answer (4)

Haemophilia is a genetic disorder and can be detected by the technique known as amniocentesis.

158. Answer (1)

In the dense regular connective tissue, the collagen fibres are present in rows between many parallel bundles of fibres. Tendons and ligaments are the examples of this type of tissue.

159. Answer (3)

Cerebral hemispheres, optic lobes and olfactory lobes are paired structures in frogs.

160. Answer (2)

During aestivation and hibernation in frogs, the gaseous exchange takes place through skin. Respiration through skin is known as cutaneous respiration.

161. Answer (3)

Hydra belongs to the phylum Cnidaria.

Ctenoplana and *Pleurobrachia* belong to the phylum Ctenophora.

Ophiura belongs to the phylum Echinodermata.

162. Answer (2)

Morphine is an alkaloid.

163. Answer (1)

In the cardiac cycle of humans, to begin with, all the four chambers of heart are in a relaxed state, *i.e.,* they are in joint diastole. As the tricuspid and bicuspid valves are open, blood from the pulmonary veins and vena cava flows into the left and the right ventricle respectively through the left and right atria. The semilunar valves are closed at this stage. The SAN now generates an action potential which stimulates both the atria to undergo a simultaneous contraction – the atrial systole.

164. Answer (3)

(1) Eosinophils – Resist infections
(2) RBC – Life span is of 120 days
(3) Platelets – Thrombocytes
(4) 'A' blood group – Antigen 'A' on RBCs surface

165. Answer (1)

Tetraiodothyronine and steroid hormones regulate the gene expression or chromosome function by the interaction of hormone – receptor complex with the genome.

166. Answer (4)

The flower tops, leaves and the resin of *Cannabis* plant are used in various combinations to produce marijuana, hashish, charas and ganja.

167. Answer (2)

Vasopressin/ADH is released from neurohypophysis or pars nervosa, but it is actually synthesised by the hypothalamus.

168. Answer (1)

The ascending limb of loop of Henle is impermeable to H_2O while descending limb of Henle's loop is almost impermeable to electrolytes.

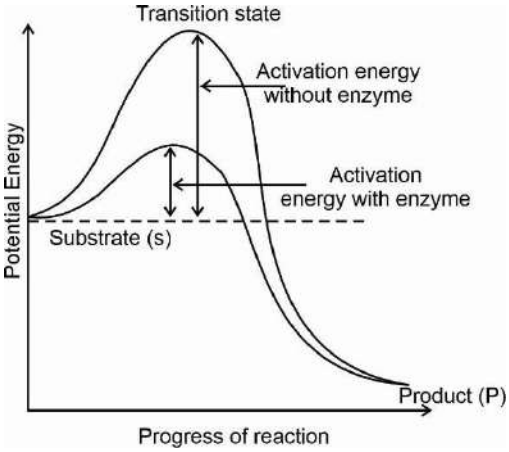
169. Answer (4)

The myelinated nerve fibres are enveloped with Schwann cells, which form a myelin sheath around the axon. The gaps between two adjacent myelin sheaths are called nodes of Ranvier. Myelinated nerve fibres are found in spinal and cranial nerves. Unmyelinated nerve fibre is enclosed by a Schwann cell that does not form a myelin sheath around the axon and is commonly found in ANS and somatic neural systems.

170. Answer (3)

In humans, the part of hindbrain which is connected to the spinal cord is medulla oblongata. The medulla contains centres which control respiration, cardiovascular reflexes and gastric secretions.

171. Answer (1)



Enzymes lower the activation energy as required for a particular reaction.

172. Answer (1)

The menstrual phase is followed by the follicular phase. During this phase, the primary follicles in the ovary grow to become fully mature Graafian follicle.

173. Answer (2)

The male reproductive accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes.

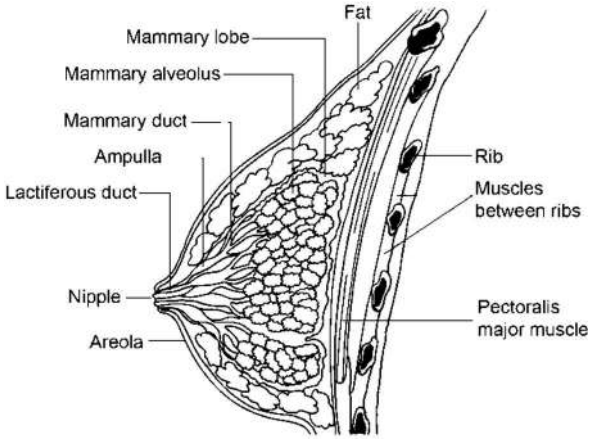
174. Answer (3)

Malonate is the competitive inhibitor of succinate.

175. Answer (3)

The two enzymes isolated from *E.coli* were responsible for restricting the growth of bacteriophages, where one added methyl groups to the bacterial DNA and the other cut the viral DNA at specific sites.

176. Answer (3)



177. Answer (2)
Pneumonia is a bacterial disease and bronchitis can be caused due to air pollutants.

178. Answer (2)
Salivary glands, mammary glands and sweat glands are the examples of multicellular glands.

179. Answer (3)
Hippocampus belongs to the class Osteichthyes. It has a 2-chambered heart.
Rana (Frog) is an amphibian having a 3-chambered heart.
Pavo is a bird and it has a 4-chambered heart. *Crocodilus* is a reptile and it has a 4-chambered heart.

180. Answer (3)
Nereis and *Pheretima* are annelids and possess closed circulatory system.

181. Answer (1)
Transmission of HIV cannot be caused by hugging, sharing food and using public toilets.

182. Answer (4)
High pH leads to association of oxygen and haemoglobin.

183. Answer (4)
A bioreactor does not contain any gene regulation system.

184. Answer (3)
Insulin cannot be orally administered to diabetic patients because it will degrade in the alimentary canal as insulin is proteinaceous in nature.

185. Answer (1)
Australopithecines probably lived in East African grasslands. Evidence shows that they hunted with stone weapons but essentially ate fruits.

SECTION - B

186. Answer (4)
The thymus gland is a lobular structure located between lungs behind sternum on the ventral side of aorta.

187. Answer (2)
The structures in different organisms which are not similar anatomically but they perform similar functions are called analogous organs, such as flippers of penguins and dolphins.

188. Answer (2)
Frequency of homozygous recessive genotype (q^2) = 0.09 (given)
$q = \sqrt{0.09} = 0.3$
According to Hardy-Weinberg equilibrium, p + q = 1
$p = 1 - q \Rightarrow 1 - 0.3 \Rightarrow 0.7$
Frequency of homozygous dominant genotype = p^2
$= (0.7)^2 = 0.49$
Percentage of individuals homozygous for dominant allele = 49%

189. Answer (2)
Nearly 45 to 50 million or 0.045 to 0.050 billion MTPs are performed in a year all over the world.
MTP is considered relatively safe during the first trimester, *i.e.,* upto 12 weeks of pregnancy.
Body of foetus covered with fine hair, eye-lids separate and eyelashes are formed by the end of the second trimester (24 weeks of pregnancy).

190. Answer (1)
Cranial bones – Frontal, Ethmoid, Temporal
Facial bones – Maxilla, Zygomatic, Lacrimal

191. Answer (1)
In cockroaches, the brain is represented by supra-oesophageal ganglion which supplies nerves to antennae and compound eyes.

192. Answer (1)
In earthworms, the nervous system is basically represented by ganglia arranged segmentwise on the ventral paired nerve cord.

193. Answer (2)
On treatment with $CaCl_2$ or with specific concentration of a divalent cation, the efficiency with which DNA enters the bacterium through pores in its cell wall increases.

194. Answer (2)
Diploid – Primary spermatocyte, spermatogonium, oogonia, primary oocyte
Haploid – Secondary spermatocyte, secondary oocyte, ovum, spermatid, spermatozoan

195. Answer (1)
Lack of relaxation between successive stimuli in sustained muscle contraction is known as tetanus.

196. Answer (2)
Each coxal bone is formed by the fusion of three bones – ilium, ischium and pubis. At the point of fusion of the above three bones, is a cavity called acetabulum to which the thigh bone articulates.

197 Answer (4)
The 'Reproductive and Child Health Care programmes' promote birth control methods.

198. Answer (3)

The RNA can be removed by the treatment with ribonuclease whereas proteins can be removed by the treatment with protease. To isolate DNA, we will not use DNase.

199. Answer (3)

Accumulation of urea in blood is called uremia.

200. Answer (3)

In ECG, the P-wave represents the electrical excitation of the atria. The QRS complex represents the depolarisation of the ventricles.

The end of the T-wave marks the end of ventricular systole.

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