SOLVED PAPER	NEET (UG) 05th May 2024	Code T4

Total Time Duration: 200 Minutes **Maximum Marks: 720**

Important Instructions

1. *The test is of **3 hours 20 minutes** duration and test booklet contains **200** multiple choice questions (four options with a single correct answer) from **Physics, Chemistry and Biology (Botany and Zoology)**. **50** questions in each subject are divided into two **Section (A and B)** as per details given below:*
   - *(a) **Section A** shall consist of **35 (Thirty-five)** questions in each subject (Question Nos- 1 to 35, 51 to 85, 101 to 135 and 151 to 185). All questions are compulsory.*
   - *(b) **Section B** shall consist of **15 (Fifteen)** questions in each subject (Question Nos- 36 to 50, 86 to 100, 136 to 150 and 80 to 200). In Section B, a candidate needs to **attempt any 10 (Ten)** questions out of **15 (Fifteen)** in each subject.*

   Candidates are advised to read all 15 questions in each subject of Section B** before they start attempting the question paper. In the event of a candidate attempting more than ten questions, **the first ten questions answered by the candidate shall be evaluated.
2. *Each question carries **4** marks. For each correct response, the candidate will get **4** marks. For each incorrect response, one mark will be deducted from the total scores. **The maximum marks are 720.***
3. *Use **blue/black ball point pen only** for writing particulars on this page/marking responses on answer Sheet.*
4. *Use of electronic/manual calculator is prohibited.*
5. ***No part of the test booklet and answer sheet shall be detached under any circumstances.***
6. *The candidates will write the correct test booklet code as given in the test booklet/answer sheet in the attendance sheet.*
7. *Compensatory time of one hour five minutes will be provided for the examination of three hours and 20 minutes duration, whether such candidate (having a physical limitation to write) uses the facility of scribe or not.*

PHYSICS

Section A

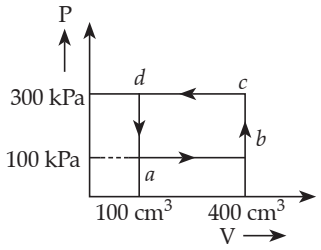
Q. 1. The moment of inertia of a thin rod about an axis passing through its mid point and perpendicular to the rod is 2400 g cm^2. The length of the 400 g rod is nearly:

(1) 20.7 cm **(2)** 72.0 cm
(3) 8.5 cm **(4)** 17.5 cm

Q. 2. A bob is whirled in a horizontal plane by means of a string with an initial speed of ω rpm. The tension in the string is T. If speed becomes 2ω while keeping the same radius, the tension in the string becomes:

(1) $\frac{T}{4}$ **(2)** $\sqrt{2}T$ **(3)** T **(4)** 4T

Q. 3. A thermodynamic system is taken through the cycle *abcda*. The work done by the gas along the path *bc* is:



(1) –90 J **(2)** –60 J **(3)** Zero **(4)** 30 J

Q. 4. $^{290}_{82}X \xrightarrow{\alpha} Y \xrightarrow{e^+} Z \xrightarrow{\beta^-} P \xrightarrow{e^-} Q$

In the nuclear emission stated above, the mass number and atomic number of the product Q respectively, are:

(1) 288, 82 **(2)** 286, 81 **(3)** 280, 81 **(4)** 286, 80

Q. 5. An unpolarised light beam strikes a glass surface at Brewster's angle. Then

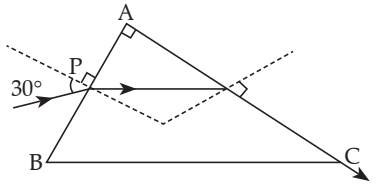
(1) both the reflected and refracted light will be completely polarised

(2) the reflected light will be completely polarised but the refracted light will be partially polarised
(3) the reflected light will be partially polarised
(4) the refracted light will be completely polarised

Q. 6. If c is the velocity of light in free space, the correct statements about photon among the following are:
(A) The energy of a photon is $E = h\nu$.
(B) The velocity of a photon is c.
(C) The momentum of a photon, $p = \frac{h\nu}{c}$
(D) In a photon-electron collision, both total energy and total momentum are conserved.
(E) Photon possesses positive charge
Choose the correct answer from the options given below:
(1) A, C and D only
(2) A, B, D and E only
(3) A and B only
(4) A, B, C and D only

Q. 7. Two bodies A and B of same mass undergo completely inelastic one dimensional collision. The body A moves with velocity v_1 while body B is at rest before collision. The velocity of the system after collision is v_2. The ratio $v_1 : v_2$ is
(1) 4 : 1 **(2)** 1 : 4 **(3)** 1 : 2 **(4)** 2 : 1

Q. 8. A light ray enters through a right angled prism at point P with the angle of incidence 30° as shown in figure. It travels through the prism parallel to its base BC and emerges along the face AC. The refractive index of the prism is:



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

Q. 9. If $x = 5 \sin\left(\pi t + \frac{\pi}{3}\right)$ m represents the motion of a particle executing simple harmonic motion, the amplitude and time period of motion, respectively, are:
(1) 5 cm, 1 s **(2)** 5 m, 1 s
(3) 5 cm, 2 s **(4)** 5 m, 2 s

Q. 10. At any instant of time t, the displacement of any particle is given by $2t - 1$ (SI unit) under the influence of force of 5N. The value of instantaneous power is (in SI unit):
(1) 7 **(2)** 6 **(3)** 10 **(4)** 5

Q. 11. A tightly wound 100 turns coil of radius 10 cm carries a current of 7 A. The magnitude of the magnetic field at the centre of the coil is (Take permeability of free space as $4\pi \times 10^{-7}$ SI unit):
(1) 4.4 mT **(2)** 44 T **(3)** 44 mT **(4)** 4.4 T

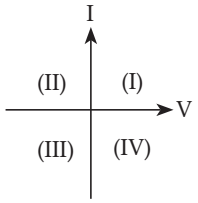
Q. 12. A particle moving with uniform speed in a circular path maintains:
(1) constant velocity but varying acceleration.
(2) varying velocity and varying acceleration
(3) constant velocity
(4) constant acceleration

Q. 13. A logic circuit provides the output Y as per the following truth table:

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

The expression for the output Y is:
(1) $\overline{B}$ **(2)** B
(3) $A.B + \overline{A}$ **(4)** $A.\overline{B} + \overline{A}$

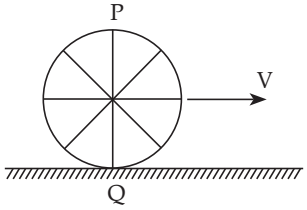
Q. 14. Consider the following statements A and B and identify the correct answer:



A. For a solar-cell the I-V characteristics lies in the (IV) quadrant of the given graph.
B. In a reverse biased p-n junction diode, the current measured in (μA), is due to majority charge carriers.
(1) Both A and B are correct.
(2) Both A and B are incorrect.
(3) A is correct but B is incorrect.
(4) A is incorrect but B is correct.

Q. 15. In an ideal transformer, the turns ratio is $\frac{N_p}{N_s} = \frac{1}{2}$. The ratio $V_s : V_p$ is equal to (the symbols carry their usual meaning):
(1) 1 : 1 **(2)** 1 : 4 **(3)** 1 : 2 **(4)** 2 : 1

Q. 16. A wheel of a bullock cart is rolling on a level road as shown in the figure below. If its linear speed is v in the direction shown, which one of the following options is correct (P and Q are any highest and lowest points on the wheel, respectively)?

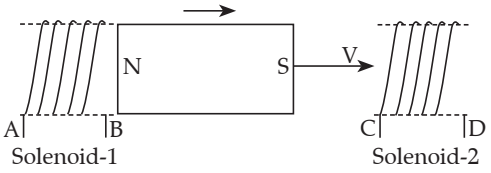


(1) Both the points P and Q move with equal speed.
(2) Point P has zero speed.
(3) Point P moves slower than point Q.
(4) Point P moves faster than point Q.

Q. 17. If the monochromatic source in Young's double slit experiment is replaced by white light, then
(1) there will be a central bright white fringe surrounded by a few coloured fringes.

(2) all bright fringes will be of equal width.
(3) interference pattern will disappear.
(4) there will be a central dark fringe surrounded by a few coloured fringes.

Q. 18.



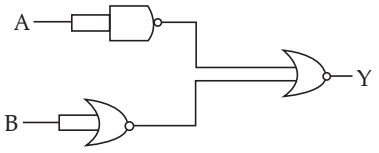
In the above diagram, a strong bar magnet is moving towards solenoid-2 from solenoid-1. The direction of induced current in solenoid-1 and that in solenoid-2, respectively, are through the directions:

(1) AB and CD **(2)** BA and DC
(3) AB and DC **(4)** BA and CD

Q. 19. In a vernier calipers, (N + 1) divisions of vernier scale coincide with N divisions of main scale. If 1 MSD represents 0.1 mm, the vernier constant (in cm) is:

(1) 100 N **(2)** 10(N + 1)
(3) $\frac{1}{10N}$ **(4)** $\frac{1}{100(N+1)}$

Q. 20. The output (Y) of the given logic gate is similar to the output of an/a:



(1) OR gate **(2)** AND gate
(3) NAND gate **(4)** NOR gate

Q. 21. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**
Assertion (A): The potential (V) at any axial point, at 2 m distance (r) from the centre of the dipole of dipole moment vector $\vec{P}$ of magnitude, 4×10^{-6} Cm, is $\pm 9 \times 10^3$ V.

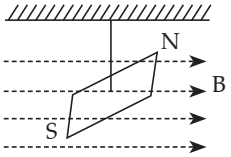
(Take $\frac{1}{4\pi\varepsilon_0} = 9\times10^9$ SI units)

Reason (R): $V = \pm\frac{2P}{4\pi\varepsilon_0 r^2}$, where r is the distance of any axial point, situated at 2 m from the centre of the dipole.

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

(1) A is true but R is false.
(2) A is false but R is true.
(3) Both A and R are true and R is the correct explanation of A.
(4) Both A and R are true and R is NOT the correct explanation of A.

Q. 22. In a uniform magnetic field of 0.049 T, a magnetic needle performs 20 complete oscillations in 5 seconds as shown. The moment of inertia of the needle is 9.8×10^{-6} kgm^2. If the magnitude of magnetic moment of the needle is $x \times 10^{-5}$ Am^2; then the value of 'x' is:



(1) 50 π^2 **(2)** 1280 π^2 **(3)** 5 π^2 **(4)** 128 π^2

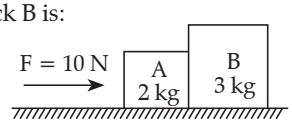
Q. 23. Match List-I with List-II

List-I (Material)	List-II (Susceptibility)
A. Diamagnetic	**I.** $\chi = 0$
B. Ferromagnetic	**II.** $0 > \chi \geq -1$
C. Paramagnetic	**III.** $\chi >> 1$
D. Non-magnetic	**IV.** $0 < \chi < \varepsilon$ (a small positive number)

Choose the correct answer from the options given below:

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

Q. 24. A horizontal force 10 N is applied to a block A as shown in figure. The mass of blocks A and B are 2 kg and 3 kg, respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is:

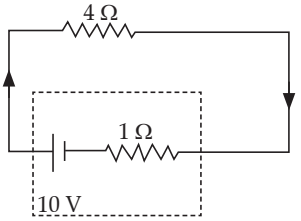


(1) 6 N **(2)** 10 N **(3)** zero **(4)** 4 N

Q. 25. Given below are two statements:
Statement I: Atoms are electrically neutral as they contain equal number of positive and negative charges.
Statement II: Atoms of each element are stable and emit their characteristic spectrum.
In the light of the above statements, choose the most appropriate answer from the options given below:

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

Q. 26. The terminal voltage of the battery, whose emf is 10V and internal resistance 1Ω, when connected through an external resistance of 4Ω as shown in the figure is:



(1) 8 V **(2)** 10 V **(3)** 4 V **(4)** 6 V

Q. 27. A wire of length 'l' and resistance 100 Ω is divided into 10 equal parts. The first 5 parts are connected

in series while the next 5 parts are connected in parallel. The two combinations are again connected in series. The resistance of this final combination is:

(1) 55 Ω **(2)** 60 Ω **(3)** 26 Ω **(4)** 52 Ω

Q. 28. The maximum elongation of a steel wire of 1 m length if the elastic limit of steel and its Young's modulus, respectively, are 8×10^8 Nm^{-2} and 2×10^{11} Nm^{-2}, is:

(1) 40 mm **(2)** 8 mm

(3) 4 mm **(4)** 0.4 mm

Q. 29. A thin flat circular disc of radius 4.5 cm is placed gently over the surface of water. If surface tension of water is 0.07 Nm^{-1}, then the excess force required to take it away from the surface is:

(1) 1.98 mN **(2)** 99 N

(3) 19.8 mN **(4)** 198 N

Q. 30. Match List I with List II.

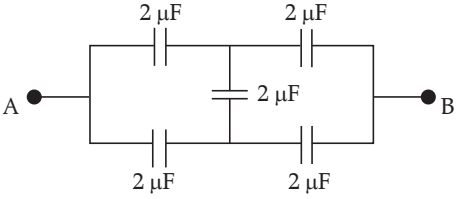
List-I (Spectral Lines of Hydrogen for transitions from)		List-II (Wavelengths (nm))	
A.	$n_2 = 3$ to $n_1 = 2$	**I.**	410.2
B.	$n_2 = 4$ to $n_1 = 2$	**II.**	434.1
C.	$n_2 = 5$ to $n_1 = 2$	**III.**	656.3
D.	$n_2 = 6$ to $n_1 = 2$	**IV.**	486.1

Choose the correct answer from the options given below:

(1) A-IV, B-III, C-I, D-II **(2)** A-I, B-II, C-III, D-IV

(3) A-II, B-I, C-IV, D-III **(4)** A-III, B-IV, C-II, D-I

Q. 31. In the following circuit, the equivalent capacitance between terminal A and terminal B is:



(1) 0.5 μF **(2)** 4 μF **(3)** 2 μF **(4)** 1 μF

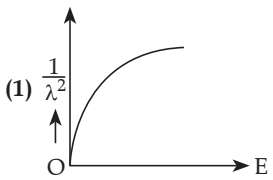
Q. 32. The mass of a planet is $\frac{1}{10}$th that of the earth and its diameter is half that of the earth. The acceleration due to gravity on that planet is:

(1) 4.9 ms^{-2} **(2)** 3.92 ms^{-2}

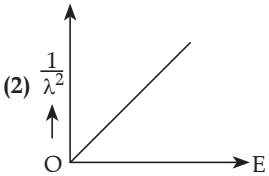
(3) 19.6 ms^{-2} **(4)** 9.8 ms^{-2}

Q. 33. The graph which shows the variation of $\left(\frac{1}{\lambda^2}\right)$ and its kinetic energy, E is (where λ is de Broglie wavelength of a free particle):

(1)



(2)



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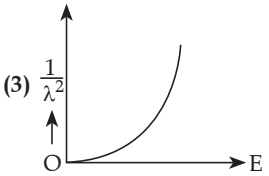

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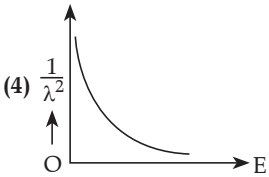


Q. 34. The quantities which have the same dimensions as those of solid angle are:

(1) strain and arc

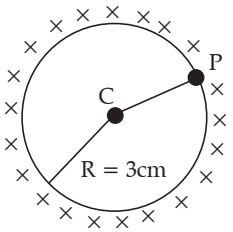
(2) angular speed and stress

(3) strain and angle

(4) stress and angle

Q. 35. A thin spherical shell is charged by some source. The potential difference between the two points C and P (in V) shown in the figure is:

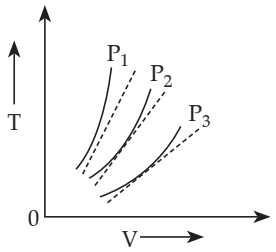
(Take $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ SI units)



(1) 0.5×10^5 **(2)** zero

(3) 3×10^5 **(4)** 1×10^5

Q. 36. The following graph represents the T – V curves of an ideal gas (where T is the temperature and V the volume) at three pressures P_1, P_2 and P_3 compared with those of Charles's law represented as dotted lines.



(1) $P_2 > P_1 > P_3$ **(2)** $P_1 > P_2 > P_3$

(3) $P_3 > P_2 > P_1$ **(4)** $P_1 > P_3 > P_2$

Q. 37. The property which is not of an electromagnetic wave travelling in free space is that :

(1) they travel with a speed equal to $\frac{1}{\sqrt{\mu_o \varepsilon_0}}$

(2) they originate from charges moving with uniform speed.

(3) they are transverse in nature.

(4) the energy density in electric field is equal to energy density in magnetic field.

Q. 38. A small telescope has an objective of focal length 140 cm and an eye piece of focal length 5.0 cm. The magnifying power of telescope for viewing a distant object?

(1) 17 **(2)** 32 **(3)** 34 **(4)** 28

Q. 39. A parallel plate capacitor is charged by connecting it to a battery through a resistor. If I is the current in the circuit, then in the gap between the plates:

(1) displacement current of magnitude equal to I flows in a direction opposite to that of I.

(2) displacement current of magnitude greater than I flows but can be in any direction.

(3) there is no current.

(4) displacement current of magnitude equal to I flows in the same direction as I.

Q. 40. A metallic bar of Young's modulus, 0.5×10^{11} N m^{-2} and coefficient of linear thermal expansion 10^{-5} °C^{-1}, length 1 m and area of cross-section 10^{-3} m^2 is heated from 0°C to 100°C without expansion of bending. The compressive force developed in it is:

(1) 100×10^3 N **(2)** 2×10^3 N

(3) 5×10^3 N **(4)** 50×10^3 N

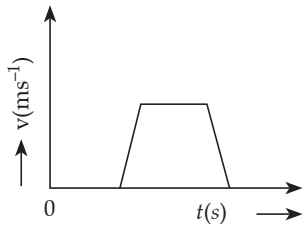
Q. 41. Two heaters A and B have power rating of 1 KW and 2 KW, respectively. Those two are first connected in series and then in parallel to a fixed power source. The ratio of power outputs for these two cases is:

(1) 1 : 2 **(2)** 2 : 3 **(3)** 1 : 1 **(4)** 2 : 9

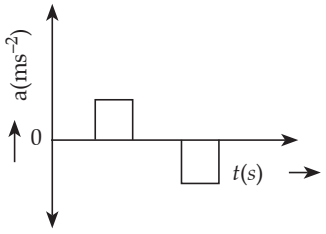
Q. 42. An iron bar of length / has magnetic moment M. It is bent at the middle of its length such that the two arms make an angle 60° with each other. The magnetic moment of this new magnet is:

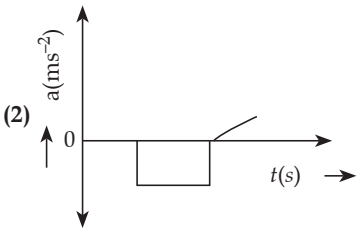
(1) 2 M **(2)** $\frac{M}{\sqrt{3}}$ **(3)** M **(4)** $\frac{M}{2}$

Q. 43. The velocity (v) – time (t) plot of the motion of a body is shown below :



The acceleration (a) – time (t) graph that best suits this motion is :

(1)


(2)


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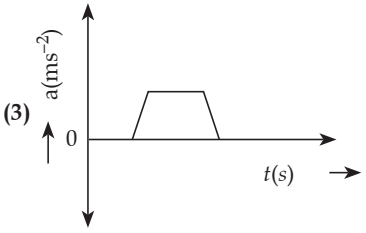

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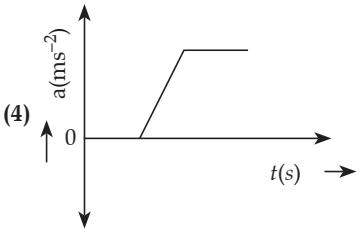
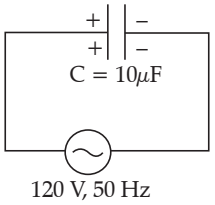


Q. 44. A 10 μF capacitor is connected to a 210 V, 50 Hz source as shown in figure. The peak current in the circuit is nearly ($\pi = 3.14$):

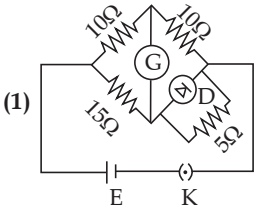


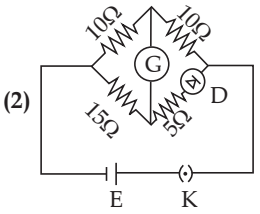
(1) 1.20 A **(2)** 0.35 A **(3)** 0.58 A **(4)** 0.93 A

Q. 45. A force defined by $F = \alpha t^2 + t$ acts on a particle at a given time t. The factor which is dimensionless, if α and β are constants, is:

(1) $\alpha\beta t$ **(2)** $\alpha\beta/t$ **(3)** $\beta t/\alpha$ **(4)** $\alpha t/\beta$

Q. 46. Choose the correct circuit which can achieve the bridge balance.

(1)


(2)


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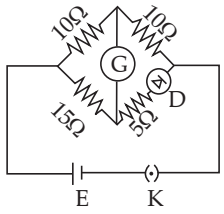
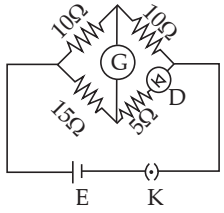


(4)



Q. 47. If the mass of the bob in a simple pendulum is increased to thrice its original mass and its length is made half its original length, then the new time period of oscillation is $\frac{x}{2}$ times its original time period. Then the value of x is

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

Q. 48. If the plates of a parallel plate capacitor connected to a battery are moved close to each other, then

A. the charge stored in it. increases.

B. the energy stored in it, decreases.

C. its capacitance increases.

D. the ratio of charge to its potential remains the same.

E. the product of charge and voltage increases.

Choose the most appropriate answer from the options given below:

(1) B, D and B only **(2)** A, B and C only

(3) A, B and E only **(4)** A, C and E only

Q. 49. The minimum energy required to launch a satellite of mass m from the surface of earth of mass M and radius R in a circular orbit at an altitude of 2R from the surface of the earth is:

(1) $\frac{GmM}{2R}$ **(2)** $\frac{GmM}{3R^2}$

(3) $\frac{5GmM}{6R}$ **(4)** $\frac{2GmM}{3R}$

Q. 50. A sheet is placed on horizontal surface in front of a strong magnetic pole. A force is needed to :

A. hold the sheet there is it is magnetic.

B. hold the sheet there if it is non-magnetic.

C. move the sheet away from the pole with uniform velocity if it is conducting.

D. move the sheet away from the pole with uniform velocity if it is both, non-conducting and nonpolar.

Choose the correct statement(s) from the options given below:

(1) A, C and D only **(2)** C only

(3) B and D only **(4)** A and C only

CHEMISTRY

Section A

Q. 51. Match **List - I** with **List - II:**

List - I (Process)	List-II (Conditions)
A. Isothermal process	I. No heat exchange
B. Isochoric process	II. Carried out at constant temperature
C. Isobaric process	III. Carried out at constant volume
D. Adiabatic process	IV. Carried out at constant pressure

Choose the **correct** answer from the options given below:

(1) A-I, B-II, C-III, D-IV

(2) A-II, B-III, C-IV, D-I

(3) A-IV, B-III, C-II, D-I

(4) A-IV, B-II, C-III, D-I

Q. 52. Match **List - I** with **List - II:**

List - I (Complex)	List-II (Type of isomerism)
A. $\left[Co(NH_3)_5(NO_2)\right]Cl_2$	I. Solvate isomerism
B. $\left[Co(NH_3)_5(SO_4)\right]Br$	II. Linkage isomerism
C. $\left[Co(NH_3)_6\right]\left[Cr(CN)_6\right]$	III. Ionization isomerism
D. $\left[Co(H_2O)_6\right]Cl_3$	IV. Coordination isomerism

Choose the **correct** answer from the options given below:

(1) A-I, B-IV, C-III, D-II

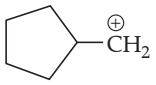
(2) A-II, B-IV, C-III, D-I

(3) A-II, B-III, C-IV, D-I

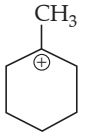
(4) A-I, B-III, C-IV, D-II

Q. 53. The most stable carbocation among the following is:

(1)



(2)



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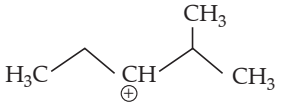

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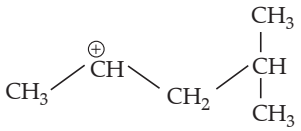
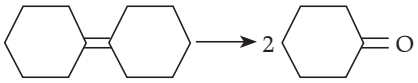
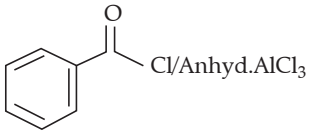
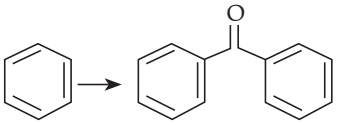
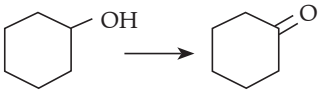
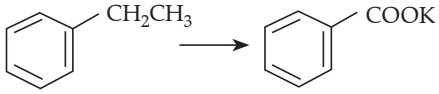


Q. 54. On heating, some solid substances change from solid to vapour state without passing through liquid" state. "The technique used for the purification of such solid substances based on the above principle is known as

(1) Distillation
(2) Chromatography
(3) Crystallization
(4) Sublimation

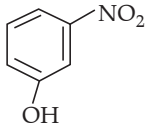
Q. 55. Match **List - I** with **List - II:**

List - I (Reaction)	List-II (Reagents/Condition)
A. 	I. 
B. 	II. CrO_3
C. 	III. $KMnO_4/KOH, \Delta$
D. 	IV. (i) O_3 (ii) Zn-H_2O

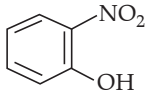
Choose the **correct** answer from the options given below:

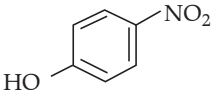
(1) A-IV, B-I, C-II, D-III
(2) A-I, B-IV, C-II, D-III
(3) A-IV, B-I, C-III, D-II
(4) A-III, B-I, C-II, D-IV

Q. 56. Intramolecular hydrogen bonding is present in

(1) 

(2) HF

(3) 

(4) 

Q. 57. The highest number of helium atoms is in

(1) 4 g of helium
(2) 2.271098 L of helium at STP
(3) 4 mol of helium
(4) 4 u of helium

Q. 58. For the reaction $2A \rightleftharpoons B + C$, $K_C = 4 \times 10^{-3}$. At a given time, the composition of reaction mixture is: $[A] = [B] = [C] = 2 \times 10^{-3}$ M
Then, which of the following is correct?

(1) Reaction has a tendency to go in backward direction.
(2) Reaction has gone to completion in forward direction.
(3) Reaction is at equilibrium.
(4) Reaction has a tendency to go in forward direction.

Q. 59. The E° value for the Mn^{3+}/Mn^{2+} couple is more positive than that of Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+} due to change of:

(1) d^4 to d^5 configuration
(2) d^3 to d^5 configuration
(3) d^5 to d^4 configuration
(4) d^5 to d^2 configuration

Q. 60. Fehling's solution 'A' is

(1) Alkaline solution of sodium potassium tartrate (Rochelle's salt)
(2) Aqueous sodium citrate
(3) Aqueous copper sulphate
(4) Alkaline copper sulphate

Q. 61. Match **List - I** with **List - II:**

List-I Compound	List-II Shape/geometry
A. NH_3	**I.** Trigonal pyramidal
B. BrF_5	**II.** Square planar
C. XeF_4	**III.** Octahedral
D. SF_6	**IV.** Square pyramidal

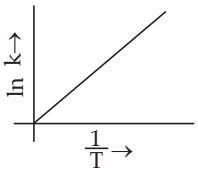
Choose the **correct** answer from the options given below:

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

Q. 62. Given below are two statements:
Statement I: Both $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ complexes are octahedral but differ in their magnetic behavior.
Statement II: $[Co(NH_3)_6]^{3+}$ is diamagnetic whereas $[CoF_6]^{3-}$ is paramagnetic
In the light of the above statements, Choose the correct answer form the options given below
(1) Statement I is true but Statement II is false.
(2) Statement I is false but Statement II is true.
(3) Both Statement I and Statement II are true.
(4) Both Statement I and Statement II are false.

Q. 63. Among group 16 elements, which one does NOT show –2 oxidation state
(1) Te **(2)** Po **(3)** O **(4)** Se

Q. 64. Which plot of *ln* k vs $\frac{1}{T}$ is consistent with Arrhenius equation?

(1)


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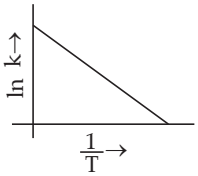

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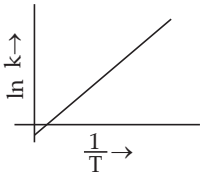

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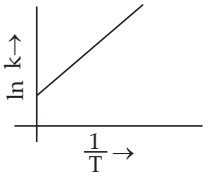


Q. 65. Arrange the following elements in increasing order of electronegativity:
N, O, F, C, Si
Choose the correct answer from the options given below
(1) O < F < N < C < Si
(2) F < O < N < C < Si
(3) Si < C < N < O < F
(4) Si < C < O < N < F

Q. 66. Given below are two statements:
Statement I: The boiling point of three isomeric pentanes follows the order
n-pentane > isopentane > neopentane
Statement II: When branching increases, the molecule attains a shape of sphere. This results in smaller surface area for contact, due to which the intermolecular forces between the spherical molecules are weak thereby lowering the boiling point.
In the light of the above statements, Choose the most appropriate answer form the options given below
(1) Statement I is correct but Statement II is incorrect
(2) Statement I is incorrect but Statement II is correct
(3) Both Statement I and Statement II are correct
(4) Both Statement I and Statement II are incorrect

Q. 67. Which reaction is **NOT** a redox reaction?
(1) $H_2 + Cl_2 \rightarrow 2HCl$
(2) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$
(3) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
(4) $2KClO_3 + I_2 \rightarrow 2KIO_3 + Cl_2$

Q. 68. Arrange the following elements in increasing order of first ionization enthalpy:
Li, Be, B, C, N
Choose the correct answer from the options given below:
(1) Li < Be < C < B < N
(2) Li < Be < N < B < C
(3) Li < Be < B < C < N
(4) Li < B < Be < C < N

Q. 69. Which one of the following alcohols reacts instantaneously with Lucas reagent?
(1) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2OH$
(2) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-OH$
(3) $CH_3-CH_2-CH_2-CH_2OH$
(4) $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-OH$

Q. 70. Match **List - I** with **List - II:**

List - I (Molecule)	List-II (Number and types of bond/s between two Corbon atoms)
A. ethane	I. one σ-bond and two π-bonds
B. ethene	II. two π-bonds
C. carbon molecule, C_2	III. one σ-bond
D. ethyne	IV. one σ-bond and one π-bond

Choose the **correct** answer from the options given below:
(1) A-III, B-IV, C-II, D-I
(2) A-III, B-IV, C-I, D-II
(3) A-I, B-IV, C-II, D-III
(4) A-IV, B-III, C-II, D-I

Q. 71. Given below are two statements:
Statement I: The boiling point of hydrides of Group 16 elements follow the order
$H_2O > H_2Te > H_2Se > H_2S$.

Statement II: On the basis of molecular mass, H_2O is expected to have lower boiling point than the other members of the group but due to the presence of extensive H-bonding in H_2O, it has higher boiling point.

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

(1) Statement I is true, but Statement II is false.

(2) Statement I is false, but Statement II is true.

(3) Both Statement I and Statement II are true.

(4) Both Statement I and Statement II are false.

Q. 72. Given below are two statements:

Statement I: Aniline does not undergo Friedel-Crafts alkylation reaction.

Statement II: Aniline cannot be prepared through Gabriel synthesis.

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

(1) Statement I is correct, but Statement II is false.

(2) Statement I is incorrect, but Statement II is true.

(3) Both Statement I and Statement II are true.

(4) Both Statement I and Statement II are false.

Q. 73. Match **List - I** with **List - II:**

List - I (Conversion)	List-II (Number of Faraday required)
A. 1mol of H_2O to O_2	I. 3F
B. 1mol of MnO_4^- to Mn^{2+}	II. 2F
C. 1.5mol of Ca from molten $CaCl_2$	III. 1F
D. 1mol of FeO to Fe_2O_3	IV. 5F

Choose the **correct** answer from the options given below:

(1) A-II, B-III, C-I, D-IV

(2) A-III, B-IV, C-II, D-I

(3) A-II, B-IV, C-I, D-III

(4) A-III, B-IV, C-I, D-II

Q. 74. In which of the following equilibria, K_P and K_C are **NOT** equal?

(1) $CO(g) + H_2O_{(g)} \rightleftharpoons CO_{2(g)} + H_{2(g)}$

(2) $2BrCl_{(g)} \rightleftharpoons Br_{2(g)} + Cl_{2(g)}$

(3) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$

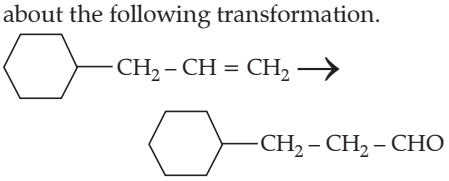
(4) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$

Q. 75. The Henry's law constant **(K_H)** values of three gases (A, B, C) in water are 145, 2×10^{-5} and 35 kbar, respectively. The solubility of these gases in water follow the order:

(1) A > C > B **(2)** A > B > C

(3) B > A > C **(4)** B > C > A

Q. 76. Identify the correct reagents that would bring about the following transformation.



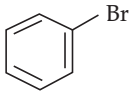
(1) (i) BH_3 (ii) $H_2O_2/\overset{\ominus}{O}H$
(iii) alk.$KMnO_4$ (iv) $H_3O^{\oplus}$

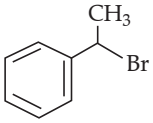
(2) (i) H_2O/H^+ (ii) PCC

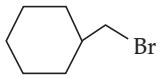
(3) (i) H_2O/H^+ (ii) CrO_3

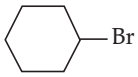
(4) (i) BH_3 (ii) $H_2O_2/\overset{\ominus}{O}H$
(iii) PCC

Q. 77. The compound that will undergo S_N1 reaction with the fastest rate is:

(1) 

(2) 

(3) 

(4) 

Q. 78. The energy of an electron in the ground state ($n = 1$) for He^+ ion is $-x$J, then that for an electron in $n = 2$ state for Be^{3+} ion in J is :

(1) $-4x$ **(2)** $-\frac{4}{9}x$ **(3)** $-x$ **(4)** $-\frac{x}{9}$

Q. 79. A compound with a molecular formula of C_6H_{14} has two tertiary carbons. Its **IUPAC** name is:

(1) 2,3-dimethylbutane

(2) 2,2-dimethylbutane

(3) *n*-hexane

(4) 2-methylpentane

Q. 80. The reagents with which glucose does **not** react to give the corresponding tests/products are

A. Tollen's reagent

B. Schiff's reagent

C. HCN

D. NH_2OH

E. $NaHSO_3$

Choose the correct options from the given below:

(1) B and E **(2)** E and D

(3) B and C **(4)** A and D

Q. 81. 'Spin only' magnetic moment same for which of the following ions?

A. Ti^{3+} **B.** Cr^{2+}

C. Mn^{2+} **D.** Fe^{2+}

E. Sc^{3+}

Choose the most appropriate answer from the options given below:

(1) B and C only **(2)** A and D only

(3) B and D only **(4)** A and E only

Q. 82. Match **List-I** with **List - II:**

List-I Quantum Number	List-II Information provided
A. m_l	**I.** Shape of orbital
B. m_s	**II.** Size of orbital
C. l	**III.** Orientation of orbital
D. n	**IV.** Orientation of spin of electron

Choose the **correct** answer from the options given below:

(1) A-III, B-IV, C-II, D-I

(2) A-II, B-I, C-IV, D-III

(3) A-I, B-III, C-II, D-IV

(4) A-III, B-IV, C-I, D-II

Q. 83. 1 gram of sodium hydroxide was treated with 25 mL of 0.75 M HCl solution, the mass of sodium hydroxide left unreacted is equal to

(1) Zero mg **(2)** 200 mg

(3) 750 mg **(4)** 250 mg

Q. 84. In which of the following processes entropy increases?

A. A liquid evaporates to vapour.

B. Temperature of a crystalline solid lowered form 130 K to 0 K.

C. $2\,NaHCO_{3(s)} \rightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$

D. $Cl_{2(g)} \rightarrow 2Cl_{(g)}$

Choose the correct answer from the options given below:

(1) A, C and D **(2)** C and D

(3) A and C **(4)** A, B and D

Q. 85. Activation energy of any chemical reactions can be calculated if one knows the value of

(1) Orientation of reactant molecules during collision.

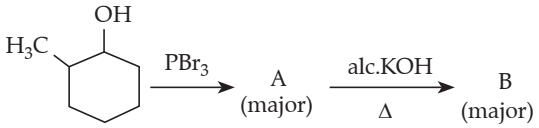
(2) Rate constant at two different temperatures.

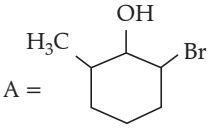
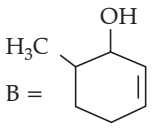
(3) Rate constant at standard temperatures.

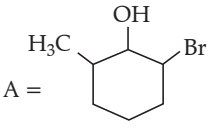
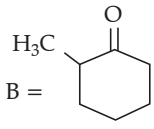
(4) Probability of collision.

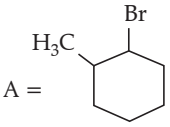
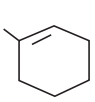
Section B

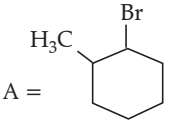
Q. 86. Major products A and B formed in the following reaction sequence, are



(1) A =  ; B = 

(2) A =  ; B = 

(3) A =  ; B = 

(4) A =  ; B = 

Q. 87. The work done during reversible isothermal expansion of one mole of hydrogen gas at 25°C from pressure of 20 atmosphere to 10 atmosphere is:

(Given R = 2.0 cal $K^{-1}mol^{-1}$)

(1) 413.14 calories **(2)** 100 calories

(3) 0 calorie **(4)** -413.14 calories

Q. 88. Consider the following reaction in a sealed vessel at equilibrium with concentrations of

$N_2 = 3.0 \times 10^{-3}M$, $O_2 = 4.2 \times 10^{-3}M$ and

$NO = 2.8 \times 10^{-3}M$

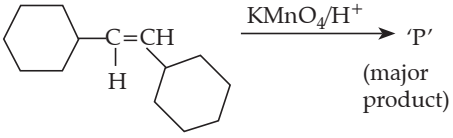
$2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$

If 0.1 $molL^{-1}$ of $NO_{(g)}$ is taken in a closed vessel, what will be degree of dissociation (α) of $NO_{(g)}$ at equilibrium?

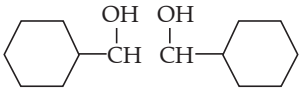
(1) 0.8889 **(2)** 0.717

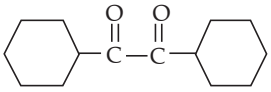
(3) 0.00889 **(4)** 0.0889

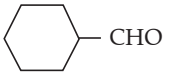
Q. 89. For the given reaction:

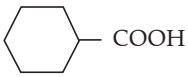


'P' is

(1) 

(2) 

(4) 

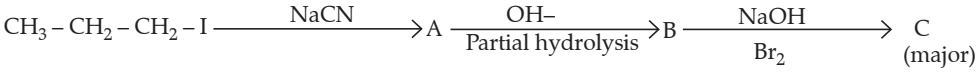
(4) 

Q. 90. The pair of lanthanoid ions which are diamagnetic is

(1) Gd^{3+} and Eu^{3+} **(2)** Pm^{3+} and Sm^{3+}

(3) Ce^{4+} and Yb^{2+} **(4)** Ce^{3+} and Eu^{2+}

Q. 91. Identify the major product C formed in the following reaction sequence:



(1) butanamide **(2)** α-bromobutanoic acid

(3) propylamine **(4)** butylamine

Q. 92. The products A and B obtained in the following reactions, respectively, are

$3ROH + PCl_3 \rightarrow 3RCl + A$

$ROH + PCl_5 \rightarrow RCl + HCl + B$

(1) H_3PO_4 and $POCl_3$

(2) H_3PO_3 and $POCl_3$
(3) $POCl_3$ and H_3PO_3
(4) $POCl_3$ and H_3PO_4

Q. 93. Given below are certain cations. Using inorganic qualitative analysis, arrange them in increasing group number from 0 to VI.
A. Al^{3+} **B.** Cu^{2+}
C. Ba^{2+} **D.** Co^{2+}
E. Mg^{2+}
Choose the correct answer from the options given below:
(1) E, C, D, B, A **(2)** E, A, B, C, D
(3) B, A, D, C, E **(4)** B, C, A, D, E

Q. 94. A compound X contains 32 % of A, 20% of B_2 and remaining percentage of C. Then, the empirical formula of X is:
(Given atomic masses of A = 64; B = 40; C = 32
(1) AB_2C_2 **(2)** ABC_4
(3) A_2BC_2 **(4)** ABC_3

Q. 95. The rate of a reaction quadruples where temperature changes from 27°C to 57°C calculate the energy of activation.
Given R = 8. 314 J K^{-1} mol^{-1}, log 4 = 0.6021
(1) 3.80 kJ/mol **(2)** 3804 kJ/mol
(3) 38.04 kJ/mol **(4)** 380.4 kJ/mol

Q. 96. The plot of osmotic pressure (π) vs concentration (mol L^{-1}) for a solution gives a straight line with slope 25.73 L bar mol^{-1}. The temperature at which the osmotic pressure measurement is done is
(Use R = 0.083 L bar mol^{-1} K^{-1})
(1) 25.73°C **(2)** 12.05°C
(3) 37°C **(4)** 310°C

Q. 97. During the preparation of Mohr's salt solution (Ferrous ammonium sulphate), which of the following acid is added to prevent hydrolysis of Fe^{2+} ion
(1) Dilute nitric acid
(2) Dilute sulphuric acid
(3) Dilute hydrochloric acid
(4) Concentrated sulphuric acid

Q. 98. Mass in grams of copper deposited by passing 9.6487 A current through a voltmeter containing copper sulphate solution for 100 seconds is:
(Given : Molar mass of Cu : 63 g mol^{-1}, 1F = 96487 C)
(1) 31.5 g **(2)** 0.0315 g
(3) 3.15 g **(4)** 0.315 g

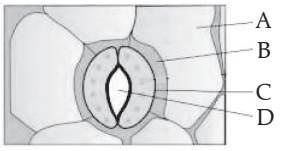
Q. 99. Identify the correct answer.
(1) Dipole moment of NF_3 is greater than that of NH_3.
(2) Three canonical forms can be drawn for CO_3^{2-} ion.
(3) Three resonance structures can be drawn for ozone
(4) BF_3 has non-zero dipole moment.

Q. 100. **Statement I:** $[Co(NH_3)_6]^{3+}$ is a homoleptic complex whereas $[Co(NH_3)_4Cl_2]^{+}$ is a heteroleptic complex.
Statement II: Complex $[Co(NH_3)_6]^{3+}$ has only one kind of ligands but $[Co(NH_3)_4Cl_2]^{+}$ has more than one kind of ligands.
In the light of the above statements, Choose the correct answer form the options given below
(1) Statement I is true but Statement II is false.
(2) Statement I is false but Statement II is true.
(3) Both Statement I and Statement II are true.
(4) Both Statement I and Statement II are false.

BOTANY

Section A

Q. 101. In the given figure, which component has thin outer walls and highly thickened inner walls?



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

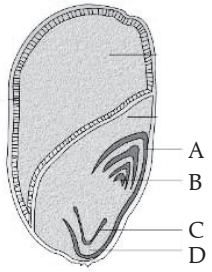
Q. 102. A transcription unit in DNA is defined primarily by the three regions in DNA and these are with respect to upstream and downstream end;
(1) Inducer, Repressor, Structural gene
(2) Promotor, Structural gene, Terminator
(3) Repressor, Operator gene, Structural gene
(4) Structural gene, Transposons, Operator gene

Q. 103. The equation of Verhulst-Pearl logistic growth is -

$$\frac{dN}{dt} = rN\left[\frac{K-N}{K}\right]$$

From this equation, K indicates :
(1) Carrying capacity
(2) Population density
(3) Intrinsic rate of natural increase
(4) Biotic potential

Q. 104. Identify the part of the seed from the given figure which is destined to form root when the seed germinates.



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

Q. 105. Inhibition of Succinic dehydrogenase enzyme by malonate is a classical example of:
(1) Competitive inhibition
(2) Enzyme activation

(3) Cofactor inhibition
(4) Feedback inhibition

Q. 106. A pink flowered Snapdragon plant was crossed with a red flowered Snapdragon plant. What type of phenotype/s is/are expected in the progeny?
(1) Only pink flowered plants
(2) Red, Pink as well as white flowered plants
(3) Only red flowered plants
(4) Red flowered as well as pink flowered plants

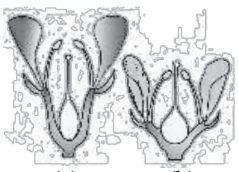
Q. 107. The type of conservation in which the threatened species are taken out from their natural habitat and placed in special setting where they can be protected and given special care is called:
(1) Semi-conservative method
(2) Sustainable development
(3) *in-situ* conservation
(4) Biodiversity conservation

Q. 108. These are regarded as major causes of biodiversity loss:
A. Over exploitation
B. Co-extinction
C. Mutation
D. Habitat loss and fragmentation
E. Migration
Choose the correct option :
(1) A, B and E only
(2) A, B and D only
(3) A, C and D only
(4) A, B, C and D only

Q. 109. Which of the following are required for the dark reaction of photosynthesis?
A. Light **B.** Chlorophyll
C. CO_2 **D.** ATP
E. NADPH
Choose the correct answer from the options given below:
(1) C, D and E only **(2)** D and E only
(3) A, B and C only **(4)** B, C and D only

Q. 110. Bulliform cells are responsible for -
(1) Increased photosynthesis in monocots
(2) Providing large spaces for storage of sugars
(3) Inward curling of leaves in monocots.
(4) Protecting the plant from salt stress

Q. 111. Identify the type of flowers based on the position of calyx, corolla and androecium with respect to the ovary from the given figures (a) and (b).



(a) (b)

(1) (a) Perigynous; (b) Epigynous
(2) (a) Perigynous; (b) Perigynous
(3) (a) Epigynous; (b) Hypogynous
(4) (a) Hypogynous; (b) Epigynous

Q. 112. Which one of the following is not a criterion for classification of fungi?
(1) Mode of spore formation
(2) Fruiting body
(3) Morphology of mycelium
(4) Mode of nutrition

Q. 113. Hind II always cuts DNA molecules at a particular point called recognition sequence and it consists of:
(1) 4 bp **(2)** 10 bp **(3)** 8 bp **(4)** 6 bp

Q. 114. Auxin is used by gardeners to prepare weed-free lawns. But no damage is caused to grass as auxin.
(1) does not affect mature monocotyledonous plants.
(2) can help in cell division in grasses, to produce growth.
(3) promotes apical dominance
(4) promotes abscission of mature leaves only.

Q. 115. Match **List I** with **List II:**

List-I	List-II
A. Two or more alternative forms of a gene	**I.** Back cross
B. Cross of F_1 progeny with homozygous recessive parent	**II.** Ploidy
C. Cross of F_1 progeny with any of the parents	**III.** Allele
D. Number of chromosome sets in plant	**IV.** Test cross

Choose the correct answer from the options given below :
(1) A-III, B-IV, C-I, D-II
(2) A-IV, B-III, C-II, D-I
(3) A-I, B-II, C-III, D-IV
(4) A-II, B-I, C-III, D-IV

Q. 116. Spindle fibers attach to kinetochores of chromosomes during -
(1) Anaphase **(2)** Telophase
(3) Prophase **(4)** Metaphase

Q. 117. Match **List I** with **List II:**

List-I	List-II
A. *Clostridium butylicum*	**I.** Ethanol
B. *Saccharomyces cerevisiae*	**II.** Streptokinase
C. *Trichoderma polysporum*	**III.** Butyric acid
D. *Streptococcus sp.*	**IV.** Cyclosporin-A

Choose the correct answer from the options given below :
(1) A-III, B-I, C-IV, D-II
(2) A-IV, B-I, C-III, D-II

(3) A-III, B-I, C-II, D-IV
(4) A-II, B-IV, C-III, D-I

Q. 118. Which one of the following can be explained on the basis of Mendel's Law of Dominance?
A. Out of one pair of factors one is dominant and the other is recessive.
B. Alleles do not show any expression and both the characters appear as such in F_2 generation.
C. Factors occur in pairs in normal diploid plants.
D. The discrete unit controlling a particular character is called factor.
E. The expression of only one of the parental characters is found in a monohybrid cross.
Choose the correct answer from the options given below:
(1) B, C and D only **(2)** A, B, C, D and E
(3) A, B and C only **(4)** A, C, D and E only

Q. 119. What is the fate of a piece of DNA carrying only gene of interest which is transferred into an alien organism?
A. The piece of DNA would be able to multiply itself independently in the progeny cells of the organism.
B. It may get integrated into the genome of the recipient.
C. It may multiply and be inherited along with the host DNA.
D. The alien piece of DNA is not an integral part of chromosome.
E. It shows ability to replicate.
Choose the correct answer from the options given below :
(1) B and C only **(2)** A and E only
(3) A and B only **(4)** D and E only

Q. 120. How may molecules of ATP and NADPH are required for every molecule of CO_2 fixed in the Calvin cycle?
(1) 3 molecules of ATP and 3 molecules of NADPH
(2) 3 molecules of ATP and 2 molecules of NADPH
(3) 2 molecules of ATP and 3 molecules of NADPH
(4) 2 molecules of ATP and 2 molecules of NADPH

Q. 121. In a plant, black seed color (BB/Bb) is dominant over white seed color (bb). In order to find out the genotype of the black seed plant, with which of the following genotype will you cross it?
(1) Bb **(2)** BB/Bb
(3) BB **(4)** bb

Q. 122. Lecithin, a small molecular weight organic compound found in living tissues, is an example of:
(1) Glycerides **(2)** Carbohydrates
(3) Amino acids **(4)** Phospholipids

Q. 123. Match **List I** with **List II:**

List-I	List-II
A. *Rhizopus*	**I.** Mushroom
B. *Ustilago*	**II.** Smut fungus
C. *Puccinia*	**III.** Bread mould
D. *Agaricus*	**IV.** Rust fungus

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

Q. 124. Tropical regions show greatest level of species richness because -
A. Tropical latitudes have remained relatively undisturbed for millions of years, hence more time was available for species diversification.
B. Tropical environments are more seasonal
C. More solar energy is available in tropics
D. Constant environments promote niche specialization.
E. Tropical environments are constant and predictable
Choose the correct answer form the options given below:
(1) A, B and E only **(2)** A, B and D only
(3) A, C, D and E only **(4)** A and B only

Q. 125. Match **List I** with **List II:**

List-I	List-II
A. Nucleolus	**I.** Site of formation of glycolipid
B. Centriole	**II.** Organization like the cartwheel
C. Leucoplasts	**III.** Site for active ribosomal RNA synthesis
D. Golgi apparatus	**IV.** For storing nutrients

Choose the correct answer from the options given below :
(1) A-III, B-IV, C-II, D-I
(2) A-I, B-II, C-III, D-IV
(3) A-III, B-II, C-IV, D-I
(4) A-II, B-III, C-I, D-IV

Q. 126. The lactose present in the growth medium of bacteria is transported to the cell by the action of
(1) Permease **(2)** Polymerase
(3) Beta-galactosidase **(4)** Acetylase

Q. 127. Given below are two statements:
Statement I: Chromosomes become gradually visible under light microscope during leptotene stage.
Statement II: The beginning of diplotene stage is recognized by dissolution of synaptonemal complex.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is true but Statement II is false.
(2) Statement I is false but Statement II is true.
(3) Both Statement I and Statement II are true.
(4) Both Statement I and Statement II are false

Q. 128. Formation of interfascicular cambium from fully developed parenchyma cells is an example for

(1) Dedifferentiation
(2) Maturation
(3) Differentiation
(4) Redifferentiation

Q. 129. Given below are two statements:
Statement I: Parenchyma is living but collenchyma is dead tissue.
Statement II: Gymnosperms lack xylem vessels but presence of xylem vessels is the characteristic of angiosperms.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is true but Statement II is false.
(2) Statement I is false but Statement II is true.
(3) Both Statement I and Statement II are true.
(4) Both Statement I and Statement II are false.

Q. 130. Identify the set of correct statements:
A. The flowers of *Vallisneria* are colourful and produce nectar.
B. The flowers of waterlily are not pollinated by water.
C. In most of water-pollinated species, the pollen grains are protected from wetting.
D. Pollen grains of some hydrophytes are long and ribbon like.
E. In some hydrophytes, the pollen grains are carried passively inside water.
Choose the correct answer from the options given below:
(1) A, C, D and E only
(2) B, C, D and E only
(3) C, D and E only
(4) A, B, C and D only

Q. 131. Which of the following is an example of actinomorphic flower?
(1) *Pisum* **(2)** *Sesbania*
(3) *Datura* **(4)** *Cassia*

Q. 132. The capacity to generate a whole plant from any cell of the plant is called:
(1) Differentiation
(2) Somatic hybridization
(3) Totipotency
(4) Micropropagation

Q. 133. Given below are two statements:
Statement I: Bt toxins are insect group specific and coded by a gene *cry* IAc.
Statement II: Bt toxin exists as inactive protoxin in *B. thuringiensis*. However, after ingestion by the insect the inactive protoxin gets converted into active form due to acidic pH of the insect gut.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is true but Statement II is false
(2) Statement I is false but Statement II is true
(3) Both Statement I and Statement II are true
(4) Both Statement I and Statement II are false

Q. 134. List of endangered species was released by-
(1) FOAM **(2)** IUCN
(3) GEAC **(4)** WWF

Q. 135. The cofactor of the enzyme carboxypeptidase is:
(1) Flavin **(2)** Haem
(3) Zinc **(4)** Niacin

Section B

Q. 136. Match **List I** with **List II:**

List I		List II	
A.	Citric acid cycle	**I.**	Cytoplasm
B.	Glycolysis	**II.**	Mitochondrial matrix
C.	Electron transport system	**III.**	Intermembrane space of mitochondria
D.	Proton gradient	**IV.**	Inner mitochondrial membrane

Choose the correct answer from the option given below:
(1) A-III, B-IV, C-I, D-II
(2) A-IV, B-III, C-II, D-I
(3) A-I, B-II, C-III, D-IV
(4) A-II, B-I, C-IV, D-III

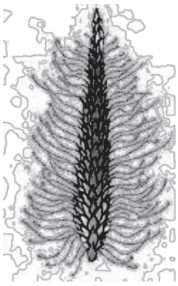
Q. 137. Which of the following statement is correct regarding the process of replication in *E.coli*?
(1) The DNA dependent DNA polymerase catalyses polymerization in 5′ → 3′ as well as 3′ → 5′ direction.
(2) The DNA dependent DNA polymerase catalyses polymerization in 5′ → 3′ direction.
(3) The DNA dependent DNA polymerase catalyses polymerization in one direction that is 3′ → 5′.
(4) The DNA dependent RNA polymerase catalyses polymerization in one direction, that is 5′ → 3′.

Q.138. Match **List I** with **List II:**

List-I		List-II	
A.	Robert May	**I.**	Species-Area relationship
B.	Alexander von Humboldt	**II.**	Long term ecosystem experiment using outdoor plots
C.	Paul Ehrlich	**III.**	Global species diversity at about 7 million
D.	David Tilman	**IV.**	Rivet popper hypothesis

Choose the correct answer from the options given below :
(1) A-I, B-III, C-II, D-IV
(2) A-III, B-IV, C-II, D-I
(3) A-II, B-III, C-I, D-IV
(4) A-III, B-I, C-IV, D-II

Q. 139. Identify the correct description about the given figure:



(1) Cleistogamous flowers showing autogamy.
(2) Compact inflorescence showing complete autogamy.
(3) Wind pollinated plant inflorescence showing flowers with well exposed stamens.
(4) Water pollinated flowers showing stamens with mucilaginous covering.

Q. 140. Identify the step in tricarboxylic acid cycle, which does not involve oxidation of substrate.
(1) Succinyl-CoA → Succinic acid
(2) Isocitrate → α-ketoglutaric acid
(3) Malic acid → Oxaloacetic acid
(4) Succinic acid → Malic acid

Q. 141. Given below are two statements:
Statement I: In C_3 plants, some O_2 binds to RuBisCO, hence CO_2 fixation is decreased.
Statement II: In C_4 plants, mesophyll cells show very little photorespiration while bundle sheath cells do not show photorespiration.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is true but Statement II is false
(2) Statement I is false but Statement II is true
(3) Both Statement I and Statement II are true
(4) Both Statement I and Statement II are false

Q. 142. In an ecosystem if the Net Primary Productivity (NPP) of first trophic level is $100x(\text{kcal m}^{-2})\ yr^{-1}$, what would be the GPP (Gross Primary Productivity) of the third trophic level of the same ecosystem?
(1) $10x(\text{kcalm}^{-2})\text{yr}^{-1}$
(2) $\frac{100x}{3x}(\text{kcalm}^{-2})\text{yr}^{-1}$
(3) $\frac{x}{10}(\text{kcalm}^{-2})\text{yr}^{-1}$
(4) $x(\text{kcalm}^{-2})\text{yr}^{-1}$

Q. 143. Match **List I** with **List II:**

List I		List II	
A.	GLUT-4	**I.**	Hormone
B.	Insulin	**II.**	Enzyme
C.	Trypsin	**III.**	Intercellular ground substance
D.	Collagen	**IV.**	Enables glucose transport into cells

Choose the correct answer from the options given below:
(1) A-II, B-III, C-IV, D-I
(2) A-III, B-IV, C-I, D-II
(3) A-IV, B-I, C-II, D-III
(4) A-I, B-II, C-III, D-IV

Q. 144. Match **List I** with **List II:**

List I		List II	
A.	Frederick Griffith	**I.**	Genetic code
B.	Francois Jacob & Jacque Monod	**II.**	Semi-conservative mode of DNA replication
C.	Har Gobind Khorana	**III.**	Transformation
D.	Meselson & Stahl	**IV.**	*Lac* operon

Choose the **correct** answer from the options given below:
(1) A-II, B-III, C-IV, D-I
(2) A-IV, B-I, C-II, D-III
(3) A-III, B-II, C-I, D-IV
(4) A-III, B-IV, C-I, D-II

Q. 145. The DNA present in chloroplast is:
(1) Linear, single stranded
(2) Circular, single stranded
(3) Linear, double stranded
(4) Circular, double stranded

Q. 146. Spraying sugarcane crop with which of the following plant growth regulators, increases the length of stem, thus, increasing the yield?
(1) Cytokinin **(2)** Abscisic acid
(3) Auxin **(4)** Gibberellin

Q. 147. Read the following statements and choose the set of correct statements:
In the members of Phaeophyceae.
A. Asexual reproduction occurs usually by biflagellate zoospores.
B. Sexual reproduction is by oogamous method only.
C. Stored food is in the form of carbohydrates which is either mannitol or laminarin.
D. The major pigments found are chlorophyll a, c and carotenoids and xanthophyll.
E. Vegetative cells have a cellulosic wall, usually covered on the outside by gelatinous coating of algin.
Choose the correct answer from the options given below:
(1) A, C, D and E only **(2)** A, B, C and E only
(3) A, B, C and D only **(4)** B, C, D and E only

Q. 148. Which of the following are fused in somatic hybridization involving two varieties of plants?
(1) Protoplasts **(2)** Pollens
(3) Callus **(4)** Somatic embryos

Q. 149. Match **List I** with **List II:**

List I	List II
A. Rose	**I.** Twisted aestivation
B. Pea	**II.** Perigynous flower
C. Cotton	**III.** Drupe
D. mango	**IV.** Marginal placentation

Choose the correct answer from the options given below:
(1) A-IV, B-III, C-II, D-I
(2) A-II, B-III, C-IV, D-I
(3) A-II, B-IV, C-I, D-III
(4) A-I, B-II, C-III, D-IV

Q. 150. Match **List I** with **List II:**

List I (Types of Stamens)	List II (Example)
A. Monoadelphous	**I.** Citrus
B. Diadelphous	**II.** Pea
C. Polyadelphous	**III.** Lily
D. Epiphyllous	**IV.** China-rose

Choose the correct answer from the options given below:
(1) A-I, B-II, C-IV, D-III
(2) A-III, B-I, C-IV, D-II
(3) A-IV, B-II, C-I, D-III
(4) A-IV, B-I, C-II, D-III

ZOOLOGY

Section A

Q. 151. Match **List I** with **List II:**

List I	List II
A. Common Cold	**I.** Plasmodium
B. Haemozoin	**II.** Typhoid
X. Widal test	**III.** Rhinoviruses
Δ. Allergy	**IV.** Dust mites

Choose the correct answer from the options given below:
(1) A-III, B-I, C-II, D-IV
(2) A-IV, B-II, C-III, D-I
(3) A-II, B-IV, C-III, D-I
(4) A-I, B-III, C-II, D-IV

Q. 152. The flippers of the penguins and dolphins are the example of the
(1) Convergent evolution
(2) Divergent evolution
(3) Adaptive radiation
(4) Natural selection

Q. 153. Given below are some stages of human evolution Arrange them in correct sequence.
(Past to recent)
A. *Homo habilis*
B. *Homo sapiens*
C. *Homo neanderthalensis*
D. *Homo erectus*
Choose the correct sequence of human evolution from the options given below;
(1) C-B-D-A **(2)** A-D-C-B
(3) D-A-C-B **(4)** B-A-D-C

Q. 154. Which one of the following factors will not affect the Hardy-Weinberg equilibrium?
(1) Gene migrations
(2) Constant gene pool
(3) Genetic recombination
(4) Genetic drift

Q. 155. Which of the following factors are favourable for the formation of oxyhaemoglobin in alveoli?
(1) Low pCO_2 and High H^+ concentration
(2) Low pCO_2 and High temperature
(3) High pO_2 and High pCO_2
(4) High pO_2 and Lesser H^+ concentration

Q. 156. Which of the following is not a natural/traditional contraceptive method?
(1) Lactational amenorrhea
(2) Vaults
(3) Coitus interruptus
(4) Periodic abstinence

Q. 157. Match **List I** with **List II:**

List I	List II
A. Pons	**I.** Provides additional space for Neurons, regulates posture and balance.
B. Hypothalamus	**II.** Controls respiration and gastric secretions.
C. Medulla	**III.** Connects different regions of the brain.
D. Cerebellum	**IV.** Neuro secretory cells

Choose the correct answer from the options given below:
(1) A-I, B-III, C-II, D-IV
(2) A-II, B-I, C-III, D-IV
(3) A-II, B-III, C-I, D-IV
(4) A-III, B-IV, C-II, D-I

Q. 158. Given below are two statements:
Statement I: The presence or absence of hymen is not a reliable indicator of virginity.
Statement II: The hymen is torn during the first coitus only.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is true but Statement II is false.
(2) Statement I is false but Statement II is true.

(3) Both Statement I and Statement II are true.
(4) Both Statement I and Statement II are false.

Q. 159. Match **List I** with **List II:**

List I	List II
A. Axoneme	**I.** Centriole
B. Cartwheel pattern	**II.** Cilia and flagella
C. Crista	**III.** Chromosome
D. Satellite	**IV.** Mitochondria

Choose the correct answer from the options given below:
(1) A-II, B-IV, C-I, D-III
(2) A-II, B-I, C-IV, D-III
(3) A-IV, B-III, C-II, D-I
(4) A-IV, B-II, C-III, D-I

Q. 160. Match **List I** with **List II:**

List I	List II
A. Typhoid	**I.** Fungus
B. Leishmaniasis	**II.** Nematode
C. Ringworm	**III.** Protozoa
D. Filariasis	**IV.** Bacteria

Choose the correct answer from the options given below:
(1) A-III, B-I, C-IV, D-II
(2) A-II, B-IV, C-III, D-I
(3) A-I, B-III, C-II, D-IV
(4) A-IV, B-III, C-I, D-II

Q. 161. Given below are two statements:
Statement I: In the nephron, the descending limb of loop of Henle is impermeable to water and permeable to electrolytes
Statement II: The proximal convoluted tubule is lined by simple columnar brush border epithelium and increases the surface area for reabsorption.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is true but Statement II is false.
(2) Statement I is false but Statement II is true.
(3) Both Statement I and Statement II are true.
(4) Both Statement I and Statement II are false.

Q. 162. Match **List I** with **List II:**

List I	List II
A. α-1 antitrypsin	**I.** Cotton bollworm
B. Cry IAb	**II.** ADA deficiency
C. Cry IAc	**III.** Emphysema
D. Enzyme replacement therapy	**IV.** Corn borer

Choose the correct answer from the option given below:
(1) A-III, B-IV, C-I, D-II
(2) A-II, B-IV, C-I, D-III
(3) A-II, B-I, C-IV, D-III
(4) A-III, B-I, C-II, D-IV

Q. 163. Match **List I** with **List II:**

List I	List II
A. Non-medicated IUD	**I.** Multiload 375
B. Copper releasing IUD	**II.** Progestogens
C. Hormone releasing IUD	**III.** Lippes loop
D. Implants	**IV.** LNG-20

Choose the correct answer from the options given below:
(1) A-IV, B-I, C-II, D-III
(2) A-III, B-I, C-IV, D-II
(3) A-III, B-I, C-II, D-IV
(4) A-I, B-III, C-IV, D-II

Q. 164. Consider the following statements:
A. Annelids are true coelomates
B. Poriferans are pseudocoelomates
C. Aschelminthes are acoelomates
D. Platyhelminthes are pseudocoelomates
Choose the correct answer from the options given below:
(1) C only **(2)** D only
(3) B only **(4)** A only

Q. 165. Match **List I** with **List II:**

List I	List II
A. Down's syndrome	I. 11^{th} chromosome
B. α-Thalassemia	II. 'X' chromosome
C. β-Thalassemia	III. 21^{st} chromosome
D. Klinefelter's syndrome	IV. 16^{th} chromosome

Choose the correct answer from the options given below:
(1) A-III, B-IV, C-I, D-II
(2) A-IV, B-I, C-II, D-III
(3) A-I, B-II, C-III, D-IV
(4) A-II, B-III, C-IV, D-I

Q. 166. Following are the stages of pathway for conduction of an action potential through the heart:
A. AV bundle
B. Purkinje fibres
C. AV node
D. Bundle branches
E. SA node
Choose the correct sequence of pathway from the options given below:
(1) B-D-E-C-A **(2)** E-A-D-B-C
(3) E-C-A-D-B **(4)** A-E-C-B-D

Q. 167. Match **List I** with **List II:**

List I	List II
A. Lipase	**I.** Peptide bond
B. Nuclease	**II.** Ester bond
C. Protease	**III.** Glycosidic bond
D. Amylase	**IV.** Phosphodiester bond

Choose the correct answer from the options given below:

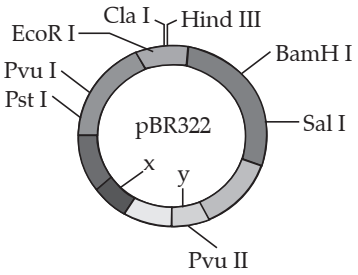
(1) A-II, B.IV, C-I, D-III

(2) A-IV, B-I, C-III, D-II

(3) A-IV, B-II, C-III, D-I

(4) A-III, B-II, C-I, D-IV

Q. 168. The following diagram showing restriction sites in *E. coli* cloning vector pBR322. Find the role of 'X' and 'Y' genes:



(1) The gene 'X' is for protein involved in replication of Plasmid and 'Y' for resistance to antibiotics.

(2) Gene 'X' is responsible for recognition sites and 'Y' is responsible for antibiotic resistance.

(3) The gene 'X' is responsible for resistance to antibiotics and 'Y' for protein involved in the replication of Plasmid.

(4) The gene 'X' is responsible for controlling the copy number of the linked DNA and 'Y' for protein involved in the replication of Plasmid.

Q. 169. The "Ti plasmid" of *Agrobacterium tumefaciens* stands for

(1) Tumor inducing plasmid

(2) Temperature independent plasmid

(3) Tumour inhibiting plasmid

(4) Tumor independent plasmid

Q. 170. Match **List I** with **List II:**

List I	List II
A. Pleurobrachia	I. Mollusca
B. Radula	II. Ctenophora
C. Stomochord	III. Osteichthyes
D. Air bladder	IV. Hemichordata

Choose the correct answer from the options given below:

(1) A-II, B-IV, C-I, D-III,

(2) A-IV, B-III, C-II, D-I,

(3) A-IV, B-II, C-III, D-I

(4) A-II, B-I, C-IV, D-III

Q. 171. Which of the following statements is incorrect?

(1) Bio-reactors are used to produce small scale bacterial cultures.

(2) Bio-reactors have an agitator system, an oxygen delivery system and foam control system.

(3) A bio-reactor provides optimal growth conditions for achieving the desired product.

(4) Most commonly used bio-reactors are of stirring type.

Q. 172. Which one is the correct product of DNA dependent RNA polymerase to the given template?

3'TACATGGCAAATATCCATTCA5'

(1) 5'AUGUACCGUUUAUAGGGAAGU3'

(2) 5'ATGTACCGTTTATAGGTAAGT3'

(3) 5' AUGUACCGUUUAUAGGUAAGU3'

(4) 5'AUGUAAAGUUUAUAGGUAAGU3'

Q. 173. Match **List I** with **List II:**

List I	List II
A. Cocaine	**I.** Effective sedative in surgery
B. Heroin	**II.** *Cannabis sativa*
C. Morphine	**III.** *Erythroxylum*
D. Marijuana	**IV.** *Papaver somniferum*

Choose the correct answer from the options given below:

(1) A-II, B-I, C-III, D-IV

(2) A-III, B-IV, C-I, D-II

(3) A-IV, B-III, C-I, D-II

(4) A-I, B-III, C-II, D-IV

Q. 174. Match **List I** with **List II:**

List I (Sub Phases of Prophase I)	List II (Specific characters)
A. Diakinesis	**I.** Synaptonemal complex formation
B. Pachytene	**II.** Completion of terminalisation of chiasmata
C. Zygotene	**III.** Chromosomes look like thin threads
D. Leptotene	**IV.** Appearance of recombination nodules

Choose the correct answer from the options given below:

(1) A-II, B-IV, C-I, D-III

(2) A-IV, B-III, C-II, D-I

(3) A-IV, B-II, C-III, D-I

(4) A-I, B-II, C-IV, D-III

Q. 175. In both sexes of cockroach, a pair of jointed filamentous structures called anal cerci are present on:

(1) 8^{th} and 9^{th} segment **(2)** 11^{th} segment

(3) 5^{th} segment **(4)** 10^{th} segment

Q. 176. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R:**
Assertion A: Breast-feeding during initial period of infant growth is recommended by doctors for bringing a healthy baby.
Reason R: Colostrum contains several antibodies absolutely essential to develop resistance for the new born baby.
In the light of the above statements, choose the most appropriate answer from the options given below :

(1) **A** is correct but **R** is not correct.

(2) **A** is not correct but **R** is correct.

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

(4) Both **A** and **R** are correct but **R** is NOT the correct explanation of **A**.

Q. 177. Match **List I** with **List II:**

List I	List II
A. *Pterophyllum*	**I.** Hag fish
B. *Myxine*	**II.** Saw fish
C. *Pristis*	**III.** Angel fish
D. *Exocoetus*	**IV.** Flying fish

Choose the correct answer from the options given below:

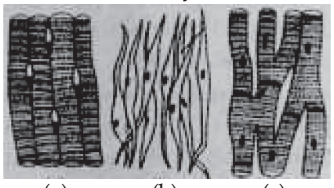
(1) A-IV, B-I, C-II, D-III

(2) A-III, B-II, C-I, D-IV

(3) A-II, B-I, C-III, D-IV

(4) A-III, B-I, C-II, D-IV

Q. 178. Three types of muscles are given as a, b and c. Identify the correct matching pair along with their location in human body:



(a) (b) (c)

Name of muscle/location

(1) (a) Skeletal – Biceps
(b) Involuntary – Intestine
(c) Smooth - Heart.

(2) (a) Involuntary - Nose tip
(b) Skeletal - Bone
(c) Cardiac - Heart.

(3) (a) Smooth – Toes
(b) Skeletal – Legs
(c) Cardiac - Heart.

(4) (a) Skeletal - Triceps
(b) Smooth - Stomach
(c) Cardiac - Heart.

Q. 179. Which of the following is not a steroid hormone?

(1) Progesterone **(2)** Glucagon

(3) Cortisol **(4)** Testosterone

Q. 180. Match **List I** with **List II:**

List I	List II
A. Fibrous joints	**I.** Adjacent vertebrae, limited movement
B. Cartilaginous joints	**II.** Humerus and Pectoral girdle, rotational movement
C. Hinge joints	**III.** Skull, don't allow any movement
D. Ball and socket joints	**IV.** Knee, help in locomotion

Choose the correct answer from the options given below:

(1) A-II, B-III, C–I, D-IV

(2) A-III, B-I, C-IV, D-II

(3) A-IV, B-II, C-III, D-I

(4) A-I, B-III, C-II, D-IV

Q. 181. Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R**:
Assertion A: FSH acts upon ovarian follicles in female and Leydig cells in male.
Reason R: Growing ovarian follicles secrete estrogen in female while interstitial cells secrete androgen in male human being.
In the light of the above statements, choose the correct answer from the options given below :

(1) **A** is true but **R** is false

(2) **A** is false but **R** is true

(3) Both **A** and **R** are true and **R** is the correct explanation of **A**.

(4) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**.

Q. 182. Match **List I** with **List II:**

List I	List II
A. Expiratory capacity	**I.** Expiratory reserve volume + Tidal volume + Inspiratory reserve volume
B. Functional residual Capacity	**II.** Tidal volume + Expiratory reserve volume
C. Vital capacity	**III.** Tidal volume + Inspiratory reserve volume
D. Inspiratory capacity	**IV.** Expiratory reserve volume + Residual volume

Choose the correct answer from the options given below:

(1) A-II, B-I, C-IV D-III

(2) A-I, B-III, C-II, D-IV

(3) A-II, B-IV, C-I, D-III

(4) A-III, B-II, C-IV, D-I

Q. 183. Following are the stages of cell division:

A. Gap 2 phase **B.** Cytokinesis

C. Synthesis phase **D.** Karyokinesis

E. Gap 1 phase

Choose the correct sequence of stages from the options given belove:

(1) B-D-E-A-C **(2)** E-C-A-D-B

(3) C-E-D-A-B **(4)** E-B-D-A-C

Q. 184. Which of the following are Autoimmune disorders?

A. Myasthenia gravis

B. Rheumatoid arthritis

C. Gout

D. Muscular dystrophy

E. Systemic Lupus Erythematosus (SLE)

Choose the most appropriate answer from the options given below :

(1) B, C & E only **(2)** C, D & E only

(3) A, B & D only **(4)** A, B & E only

Q. 185. Which of the following is not a component of Fallopian tube?

(1) Infundibulum **(2)** Ampulla

(3) Uterine fundus **(4)** Isthmus

Section B

Q. 186. As per ABO blood grouping system, the blood group of father is B^+, mother is A^+ and child is O^+.

Their respective genotype can be

A. $I^Bi / I^Ai / ii$ **B.** $I^BI^B / I^AI^A / ii$

C. $I^AI^B / iI^A / I^Bi$ **D.** $I^Ai / I^Bi / I^Ai$

E. $iI^B / iI^A / I^AI^B$

Choose the most appropriate answer from the options given below:

(1) C & B only **(2)** D & E only

(3) A only **(4)** B only

Q. 187. Match **List I** with **List II:**

List I	List II
A. Exophthalmic goiter	**I.** Excess secretion of cortisol, moon face & hyperglycemia
B. Acromegaly	**II.** Hypo-secretion of thyroid hormone and stunted growth.
C. Cushing's syndrome	**III.** Hyper secretion of thyroid hormone & protruding eye balls.
D. Cretinism	**IV.** Excessive secretion of growth hormone.

Choose the correct answer from the options given below:

(1) A-III, B-IV, C-II, D-I

(2) A-III, B-IV, C-I, D-II

(3) A-I, B-III, C-II, D-IV

(4) A-IV, B-II, C-I, D-III

Q. 188. Match **List I** with **List II:**

List I	List II
A. Mesozoic Era	**I.** Lower invertebrates
B. Proterozoic Era	**II.** Fish & Amphibia
C. Cenozoic Era	**III.** Birds & Reptiles
D. Paleozoic Era	**IV.** Mammals

Choose the correct answer from the options given below:

(1) A-I, B-II, C-IV, D-III

(2) A-III, B-I, C-IV, D-II

(3) A-II, B-I, C-III, D-IV

(4) A-III, B-I, C-II, D-IV

Q. 189. The following are the statements about non–chordates :

A. Pharynx is perforated by gill slits.

B. Notochord is absent.

C. Central nervous system is dorsal.

D. Heart is dorsal if present.

E. Post anal tail is absent.

Choose the most appropriate answer from the options given below :

(1) B, D & E only **(2)** B, C & D only

(3) A & C only **(4)** A, B & D only

Q. 190. Given below are two statements :

Statement I: The cerebral hemispheres are connected by nerve tract known as corpus callosum.

Statement II: The brain stem consists of the medulla oblongata, pons and cerebrum.

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

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

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

(3) Both Statement I and Statement II are correct.

(4) Both Statement I and Statement II are incorrect.

Q. 191. Match **List I** with **List II:**

List I	List II
A. Unicellular glandular epithelium	**I.** Salivary glands
B. Compound epithelium	**II.** Pancreas
C. Multicellular glandular epithelium	**III.** Goblet cells of alimentary canal
D. Endocrine glandular epithelium	**IV.** Moist surface of buccal cavity

Choose the correct answer from the options given below:

(1) A-III, B-IV, C-I, D-II

(2) A-II, B-I, C-IV, D-III

(3) A-II, B-I, C-III, D-IV

(4) A-IV, B-III, C-I, D-II

Q. 192. Match **List I** with **List II:**

List I	List II
A. P wave	**I.** Heart muscles are electrically silent.
B. QRS complex	**II.** Depolarisation of ventricles.
C. T wave	**III.** Depolarisation of atria.
D. T-P gap	**IV.** Repolarisation of ventricles.

Choose the correct answer from the options given below:

(1) A-II, B-III, C-I, D-IV

(2) A-IV, B-II, C-I, D-III

(3) A-I, B-III, C-IV, D-II

(4) A-III, B-II, C-IV, D-I

Q. 193. Given below are two statements:

Statement I: Mitochondria and chloroplasts are both double membrane bound organelles.

Statement II: Inner membrane of mitochondria is relatively less permeable, as compared to chloroplast.

In the light of the above statements, choose the

most appropriate answer from the options given below:

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

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

(3) Both Statement I and Statement II are correct.

(4) Both Statement I and Statement II are incorrect.

Q. 194. Match **List I** with **List II:**

List I	List II
A. The structures used for storing of food.	**I.** Gizzard
B. Ring of 6-8 blind tubules at junction of foregut and midgut.	**II.** Caeca
C. Ring of 100-150 yellow coloured thin filaments at junction of midgut and hindgut.	**III.** Malpighian tubules
D. The structures used for grinding the food.	**IV.** Crop

Choose the correct answer from the options given below:

(1) A-IV, B-III, C-II, D-I

(2) A-III, B-II, C-IV, D-I

(3) A-IV, B-II, C-III, D-I

(4) A-I, B-II, C-III, D-IV

Q. 195. Match **List I** with **List II:**

List I	List II
A. RNA polymerase III	**I.** snRNPs
B. Termination of transcription	**II.** Promotor
C. Splicing of Exons	**III.** Rho factor
D. TATA box	**IV.** SnRNAs, tRNA

Choose the correct answer from the options given below:

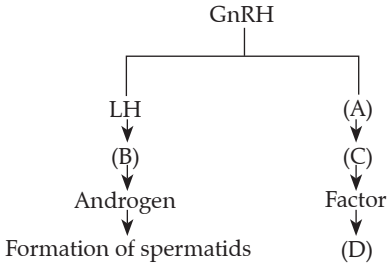
(1) A-III, B-IV, C-I, D-II

(2) A-IV, B-III, C-I, D-II

(3) A-II, B-IV, C-I, D-III

(4) A-III, B-II, C-IV, D-I

Q. 196. Identify the correct option (A), (B), (C), (D) with respect to spermatogenesis.



(1) FSH, Sertoli Cells, Leydig cells, spermatogenesis.

(2) ICSH, Leydig Cells, Sertoli cells, spermatogenesis.

(3) FSH, Leydig Cells, Sertoli cells, spermiogenesis

(4) ICSH, Interstitial cells, Leydig cells, spermiogenesis.

Q. 197. Choose the correct statement given below regarding juxta medullary nephron.

(1) Loop of Henle of juxta medullary nephron runs deep into medulla.

(2) Juxta medullary nephrons outnumber the cortical nephrons.

(3) Juxta medullary nephrons are located in the columns of Bertini.

(4) Renal corpuscle of juxta medullary nephron lies in the outer portion of the renal medulla.

Q. 198. Given below are two statements :

Statement I: Gause's competitive exclusion principle states that two closely related species competing for different resources cannot exist indefinitely.

Statement II: According to Gause's principle, during competition, the inferior will be eliminated. This may be true if resources are limiting.

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

(1) Statement I is true but Statement II is false.

(2) Statement I is false but Statement II is true.

(3) Both Statement I and Statement II are true.

(4) Both Statement I and Statement II are false.

Q. 199. Given below are two statements :

Statement I: Bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced.

Statement II: Both bone marrow and thymus provide micro environments for the development and maturation of T-lymphocytes.

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

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

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

(3) Both Statement I and Statement II are correct.

(4) Both Statement I and Statement II are incorrect.

Q. 200. Regarding catalytic cycle of an enzyme action, select the correct sequential steps :

A. Substrate enzyme complex formation.

B. Free enzyme ready to bind with another substrate.

C. Release of products.

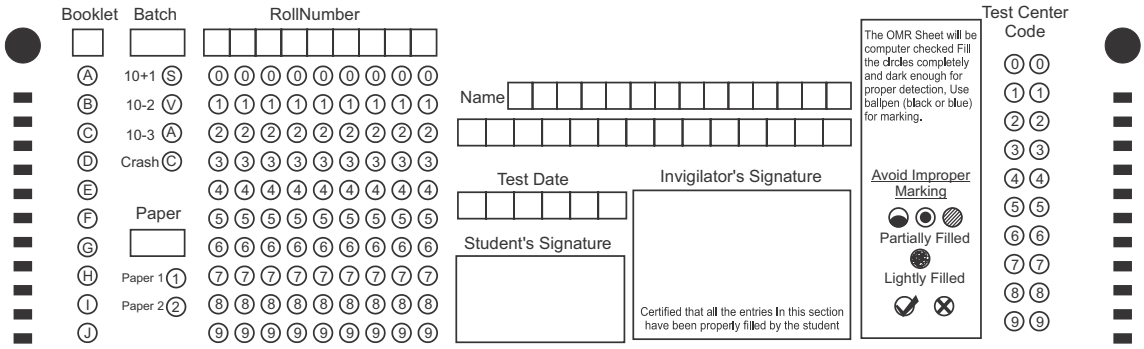
D. Chemical bonds of the substrate broken.

E. Substrate binding to active site.

Choose the correct answer from the options given below :

(1) B, A, C, D, E **(2)** E, D, C, B, A

(3) E, A, D, C, B **(4)** A, E, B, D, C



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

Answer Key			
Q. No.	**Answer**	**Topic's Name**	**Chapter Name**
PHYSICS			
1	3	Moment of Inertia	Rotational Motion
2	4	Centripetal Force	Laws of Motion
3	3	Workdone in Cyclic Process	Thermodynamics
4	2	Radioactive Decay	Nuclei
5	2	Brewster's Law	Wave Optics
6	4	Einstein's Photo electric Effect	Dual Nature of Matter and Radiation
7	4	Inelastic Collision	Work, Energy and Power
8	4	Refraction of Prism, Critical Angle	Ray Optics
9	4	Simple Harmonic Motion	Oscillations
10	3	Power	Work, Energy and Power
11	1	Magnetic Field in a coil	Magnetic Effects of Current
12	2	Uniform Circular Motion	Motion in a Plane
13	1	Logic Gates	Electronic Devices
14	3	Solar Cells	Electronic Devices
15	4	Transformer	Alternating Current
16	4	Motion of Centre of Mass	Rotational Motion
17	1	Young's Double Slit Experiment	Wave Optics
18	3	Lenz's Law	Electromagnetic Induction
19	4	Vernier Caliper	Experimental Skills
20	2	Logic Gates	Electronic Devices
21	1	Potential due to a dipole	Electric Potential and Capacitance
22	2	Oscillation of a Freely Suspended Magnet	Magnetism and Matter
23	3	Magnetic Materials	Magnetism and Matter
24	1	Motion of Connected Bodies	Laws of Motion
25	1	Atoms	Atoms
26	1	Terminal Potential Difference	Current Electricity
27	4	Combination of Resistances	Current Electricity
28	3	Young's Modulus of Elasticity	Mechanical Properties of Solids
29	3	Surface Energy	Mechanical Properties of Fluids
30	4	Hydrogen Spectrum	Atoms
31	3	Combination of Capacitors	Electric Potential and Capacitance

32	2	Acceleration due to Gravity	Gravitation
33	2	de-Broglie Wavelength	Dual Nature of Matter and Radiation
34	3	Dimensional Analysis	Physics and Measurement
35	2	Potential due to a Spherical Shell	Electic Potential and Capacitance
36	2	Ideal Gas Equation	Kinetic Theory of Gases
37	2	Electromagnetic Waves	Electromagnetic Waves
38	4	Telescope	Ray Optics
39	4	Parallel plate Capacitor	Electric Potential and Capacitance
40	4	Thermal Expansion	Thermal Properties of Matter
41	4	Electric Power	Current Electricity
42	4	Magnetic Moment	Magnetism and Matter
43	1	Velocity-time, Acceleration-time Graphs	Motion in a Straight line
44	4	Purely Capacitive Circuit	Alternating Current
45	4	Dimensional Analysis	Physics and Measurement
46	3	Baising in Diodes	Electronic Devices
47	4	Time Period of a Pendulum	Oscillations
48	4	Capacitor	Electric Potential and Capacitance
49	3	Potential Energy of a Satellite	Gravitation
50	4	Electromagnetic Induction	Electromagnetic Induction
CHEMISTRY			
51	2	Different types of processes	Chemical Thermodynamics
52	3	Isomerism	Co-ordination Compounds
53	2	Carbocation	Basic Principles of Organic Chemistry
54	4	Techniques of Purification	Purification and Chracterization of Organic Compounds
55	1	Oxidation	Hydrocarbons
56	3	Hydrogen Bonding	Atomic Structure
57	3	Mole Concept	Some Basic Concepts of Chemistry
58	1	Chemical Equilibria	Equilibrium
59	1	SRP	Chemical Bonding and Molecular Structure
60	3	Fehling's solution	Principles related to Practical Chemistry
61	3	Geometry	Atomic Structure
62	3	Magnetic Nature	Co-ordination Compounds
63	2	Oxidation State	Redox Reaction
64	2	Arrhenius Equation	Chemical Kinetics

65	3	Trends in Physical Properties	P-Block Elements
66	3	Physical Properties of Alkones	Hydrocarbons
67	2	Redox Reaction	Redox Reaction
68	4	Ionisation Enthalpy	Chemical Bonding and Molecular Structure.
69	2	Alcohol	Organic Compounds containing Oxygen
70	1	Types of Bonds	Chemical Bonding and Molecular Structure
71	3	Group-16 elements	Atomic Structure
72	3	Amines	Organic Compounds Containing Nitrogen
73	3	Conductance of Electrolytic Solution	Electrochemistry
74	3	Equilibrium Constants	Equilibrium
75	4	Henry's Law	Solution
76	4	Alkenes	Hydrocarbons
77	2	Substitution Nucleophilic Reaction	Organic compounds containing Halogen
78	3	Bohr's atomic model	Atomic Structure
79	1	IUPAC Nomenclature	Hydrocarbons
80	1	Carbohydrates	Biomolecules
81	3	Transition Elements	*d*- and *f*- Block Elements
82	4	Quantum Numbers	Atomic Structure
83	4	Mole concept	Some Basic Concepts of Chemistry
84	1	Entropy	Chemical Thermodynamics
85	2	Energy of Activation	Chemical Kinetics
86	3	Chemical Properties	Organic Compounds containing halogen
87	4	Concept of Work	Chemical Thermodynamics
88	2	Degree Of Dissociation	Equilibrium
89	4	Aldehydes and Ketones	Organic Compounds containing oxygen
90	3	Lanthanoides and Actinoides	*d*- and *f*- Block Elements
91	3	Amines	Organic compounds containing Nitrogen
92	2	Alcohol	Organic compounds containing oxygen
93	3	Qualitative Salt Analysis	Principles related to Practical Chemistry
94	4	Empirical and Molecular Formulae	Some Basic Concepts Of Chemistry
95	3	Arrhenius equation	Chemical Kinetics
96	3	Osmotic Pressure	Solution
97	2	Mohr's Salt	Principles related to Practical Chemistry
98	4	Faraday's first law of electrolysis	Electrochemistry
99	2	Dipole Moment	Chemical Bonding And Molecular Structure
100	3	Ligands	Co-ordination Compounds

BOTANY			
101	3	Epidermal Tissue System	Anatomy of Flowering Plants
102	2	Transcription Unit	Molecular Basis of Inheritance
103	1	Growth Models	Organisms and Populations
104	1	Parts of Seed	Morphology of Flowering Plants
105	1	Enzyme Action	Biomolecules
106	4	Incomplete Dominance	Principles of Inheritance and Variation
107	4	Conservation of Biodiversity	Biodiversity and Conservation
108	2	Loss of Biodiversity	Biodiversity and Conservation
109	1	Dark reaction of Photosynthesis	Photosynthesis in Higher Plants
110	3	Bulliform cells	Anatomy of Flowering Plants
111	2	Parts of Flower	Sexual Reproduction in flowering Plants
112	4	Kingdom Fungi	Biological Classification
113	4	Tools of Recombinant technology	Biotechnology : Principles and Processes
114	1	Plant hormones	Plant Growth and Development
115	1	Principles of Inheritance	Principles of Inheritance and Variation
116	4	Cell Cycle	Cell Cycle and Cell Division
117	1	Microbes in Industrial Production	Microbes in human welfare
118	4	Mendel's Law of Dominance	Principles of Inheritance and Variation
119	1	Insertion of Foreign DNA	Biotechnology : Principles and Processes
120	2	Calvin Cycle	Photosynthesis in Higher Plants
121	4	Mendel's Law of Dominance	Principles of Inheritance and Variation
122	4	Organic Compounds	Biomolecules
123	3	Kingdom Fungi	Biological Classification
124	3	Species Richness	Biodiversity and Conservation
125	3	Cell Organelles	Cell: The Unit of Life
126	1	Regulation of Gene Expression	Molecular Basis of Inheritance
127	3	Cell Cycle	Cell Cycle and Cell Division
128	1	Dedifferentiation	Anatomy of Flowering Plants
129	2	Plant Tissues	Plant Growth and Development
130	2	Pollination	Sexual Reproduction in flowering Plants
131	3	Types of Flower	Morphology of Flowering Plants
132	3	Totipotency	Plant Growth and Development
133	1	GM Crops	Biotechnology and Its Applications

134	2	Endangered Species	Biodiversity and Conservation
135	3	Enzyme Action	Biomolecules
136	4	Respiration in Plants	Respiration in Plants
137	2	DNA Replication	Molecular Basis of Inheritance
138	4	Contribution of Scientists	Biodiversity and Conservation
139	3	Pollination	Sexual Reproduction in flowering Plants
140	1	Tricarboxylic acid Cycle	Respiration in Plants
141	1	C3 and C4 Plants	Photosynthesis in Higher Plants
142	1	Productivity	Ecosystem
143	3	Hormones and Enzymes	Biomolecules
144	4	Contribution of Scientists	Molecular Basis of Inheritance
145	4	Cell Organelles	Cell: The Unit of Life
146	4	Plant Growth Regulators	Plant Growth and Development
147	1	Kingdom Algae	Biological Classification
148	1	Somatic Hybridization	Biotechnology and Its Applications
149	3	Types of Aestivation	Morphology of Flowering Plants
150	3	Types of Stamens	Morphology of Flowering Plants
ZOOLOGY			
151	1	Human Diseases	Human Health and Diseases
152	1	Evidences of Evolution	Evolution
153	2	Human Evolution	Evolution
154	2	Hardy-Weinberg equilibrium	Principles of Inheritance and Variation
155	4	Exchange of Gases	Breathing and Exchange of Gases
156	2	Contraceptive Method	Reproductive Health
157	4	Parts of Human Brain	Neural Control and Coordination
158	1	Female Reproductive System	Human Reproduction
159	2	Cell Organelles	Cell: The Unit of Life
160	4	Human diseases	Human Health and Diseases
161	4	Human Excretory System	Excretory Products and their Elimination
162	1	Biotechnology and its Applications	Biotechnology and its Applications
163	2	Contraceptive Method	Reproductive Health
164	4	Salient features of Animals	Animal Kingdom
165	1	Chromosomal Disorders	Principles of Inheritance and Variation
166	3	Parts of Human Circulation System	Body fluids and Circulation

167	1	Classification and Nomenclature of Enzymes	Biomolecules
168	4	Cloning Vectors	Biotechnology : Principles and Processes
169	1	Cloning Vectors	Biotechnology : Principles and Processes
170	4	Salient features of Animals	Animal Kingdom
171	1	Bioreactors	Biotechnology : Principles and Processes
172	3	Transcription	Molecular Basis of Inheritance
173	2	Drug Abuse	Human Health and Diseases
174	1	Cell Cycle	Cell Cycle and Cell Division
175	4	Salient features of Animals	Animal Kingdom
176	3	Pregnancy	Human Reproduction
177	4	Salient features of Animals	Animal Kingdom
178	4	Types of Muscles	Locomotion and Movement
179	2	Hormones	Chemical coordination and Regulation
180	2	Types of Joints	Locomotion and Movement
181	2	Menstrual Cycle	Human Reproduction
182	3	Lung Capacity	Breathing and Exchange of Gases
183	2	Cell Cycle	Cell Cycle and Cell Division
184	4	Autoimmune Disorders	Human Health and Diseases
185	3	Female Reproductive System	Human Reproduction
186	3	Blood Groups	Principles of Inheritance and Variation
187	2	Autoimmune Disorders	Human Health and Diseases
188	2	Geological Time scale	Evolution
189	1	Non–chordates	Animal Kingdom
190	1	Parts of Human Brain	Neural Control and Coordination
191	1	Animal tissues	Animal tissues
192	4	Cardiac cycle	Body fluids and Circulation
193	1	Cell Organelles	Cell: The Unit of Life
194	3	Cockroach	Animal tissues
195	2	Transcription	Molecular Basis of Inheritance
196	3	Spermatogenesis	Human Reproduction
197	1	Human Excretory System	Excretory Products and their Elimination
198	3	Population Interactions	Organisms and Populations
199	3	Basic concepts of Immunology	Human Health and Diseases
200	3	Evnzyme Action	Biomolecules

NEET (UG)
Examination
5th May 2024 Paper

ANSWERS WITH EXPLANATION

PHYSICS

1. **Option (3) is correct.**

Explanation: The moment of inertia of a thin rod about an axis passing through its mid-point and perpendicular to the rod is,

$$\frac{ML^2}{12} = 2400$$

$$\Rightarrow \quad L^2 = \frac{12\times 2400}{400} = \sqrt{72}$$

$$\Rightarrow \quad L \approx 8.5 \text{ cm}$$

2. **Option (4) is correct.**

Explanation: Centripetal force $F_c = mr\omega^2 = T$

Now $T' = mr(2\omega)^2$

$= 4mr\omega^2$

$= 4T$

3. **Option (3) is correct.**

Explanation: Along the path *bc*, volume is constant. So, the work done will be zero.

4. **Option (2) is correct.**

Explanation: ${}^{290}_{82}X \xrightarrow{\alpha} {}^{286}_{80}Y \xrightarrow{e^+} {}^{286}_{79}Z \xrightarrow{\beta^-} {}^{286}_{80}P \xrightarrow{e^-} {}^{286}_{81}Q$

5. **Option (2) is correct.**

Explanation: At Brewster's angle, the reflected light is completely polarised perpendicular to the plane of incidence. This means the reflected light wave's electric field vibrates in a single plane. However, the refracted light is not fully polarised.

6. **Option (4) is correct.**

Explanation: E = hv (statement A is correct)

Photon travels with the speed of light (c), hence statement B is correct.

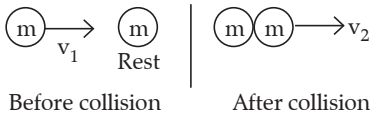
Momentum of photon is $\frac{hv}{c}$, so statement C is correct.

Total energy and momentum are conserved in a photo-electron collision. Statement D is also correct.

Photons are electrically neutral, and are massless. Hence statements E is incorrect.

7. **Option (4) is correct.**

Explanation: Applying principle of conservation of momentum, $mv_1 + 0 = 2mv_2$



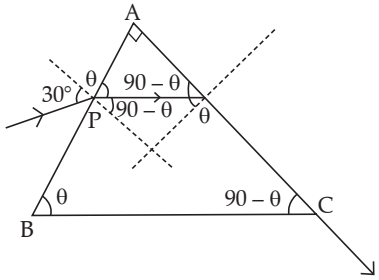
$$\Rightarrow \quad v_2 = \frac{v_1}{2}$$

Now $\frac{v_1}{v_2} = \frac{v_1}{v_1/2} = v_1 \times \frac{2}{v_1} = 2$

$$\Rightarrow \quad v_1 : v_2 = 2 : 1$$

8. **Option (4) is correct.**

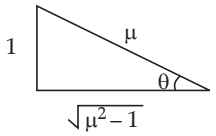
Explanation:



For surface *AC*, using snell's law

$$\mu \sin\theta = 1$$

$$\Rightarrow \quad \sin\theta = \frac{1}{\mu}$$



For Surface AB, using Snell's law

$$\sin 30° = \mu \sin(90 - \theta)$$

$$\sin 30° = \mu \cos\theta$$

$$\frac{1}{2} = \mu \times \frac{\sqrt{\mu^2 - 1}}{\mu}$$

$$\frac{1}{2} = \sqrt{\mu^2 - 1}$$

$$\Rightarrow \quad \mu = \frac{\sqrt{5}}{2}$$

9. **Option (4) is correct.**

Comparing with the equation $x = A \sin(\omega t + \Phi)$

We get $\omega = \pi$ rads^{-1}

$$T = \frac{2\pi}{\omega} = 2 \text{ s}$$

And amplitude is 5 m.

10. **Option (3) is correct.**

Explanation: Instantaneous velocity, $v = \frac{ds}{dt}$

$= \frac{d}{dt}(2t-1) = 2\ \text{ms}^{-1}$

Instantaneous power $P = FV$

$= 5 \times 2 = 10\ \text{W}$

11. Option (1) is correct.

Explanation: Magnetic field $B = \frac{\mu_0 NI}{2R}$

$= \frac{4\pi \times 10^{-7} \times 100 \times 7}{2 \times 10 \times 10^{-2}}$

$= \frac{28\pi \times 10^{-4}}{2}$

$= 14\pi \times 10^{-4}\ \text{T}$

$\approx 44 \times 10^{-4} \times 10^{3}\ \text{mT}$

$\approx 4.4\text{mT}$

12. Option (2) is correct.

Explanation: When a particle moves in a circular path with uniform speed, its velocity is constantly changing because velocity is a vector quantity, and its direction changes as it moves along the circular path. Additionally, since velocity is changing, acceleration is present which is also changing.

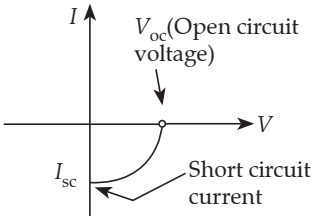
13. Option (1) is correct.

Explanation: Truth table clearly indicates that out (Y) is just inverse of $\overline{B}$ i.e., output Y is B. So, option (1) is correct.

14. Option (3) is correct.

Explanation: In a reverse biased $p - n$ junction diode, the current is due to the minority charge carriers.

And the $I - V$ characteristics of a solar cell is



15. Option (4) is correct.

Explanation: For an ideal transformer

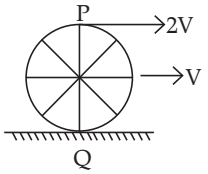
$$\frac{N_p}{N_s} = \frac{V_p}{V_s} = \frac{1}{2}$$

$$\Rightarrow \quad \frac{V_s}{V_p} = \frac{2}{1}$$

Or, $V_s : V_p = 2 : 1$

16. Option (4) is correct.

Explanation:



Point P moves at a speed twice the speed of v.

While $v = 0$ (at point Q)

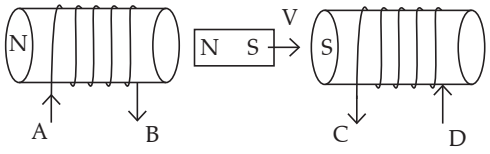
17. Option (1) is correct.

Explanation: White light consists of a mixture of different wavelengths corresponding to various colors. When white light is used in the double-slit experiment, the different colors of light will interfere with each other, creating an interference pattern. However, because each color has a different wavelength, they will interfere differently, resulting in colored fringes. The central fringe will appear white because all colors combine to produce white light, but the surrounding fringes will exhibit colors due to variations in the interference patterns for different wavelengths.

18. Option (3) is correct.

Explanation: According to Lenz's law, the induced magnetic field in a loop of wire will oppose the change in magnetic flux through the loop.

Hence using this law, we get



19. Option (4) is correct.

Explanation: According to the question

$(N + 1)\text{VSD} = N\ \text{MSD}$

So, $1\ \text{VSD} = \left(\frac{N}{N+1}\right)\text{MSD}$

Now vernier constant = 1 MSD – 1 VSD

$= 1\,\text{MSD} - \left(\frac{N}{N+1}\right)\text{MSD}$

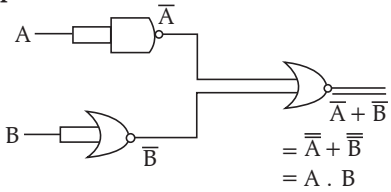
$= \left(\frac{N}{N+1}\right)\text{MSD}$

$= \frac{1}{N+1} \times 0.1\ \text{mm}$

$= \frac{1}{100(N+1)}\text{cm}$

20. Option (2) is correct.

Explanation:



A.B = (AND Gate)

21. Option (1) is correct.

Explanation: Potential at an axial point due to a dipole

$$V = \pm \frac{1}{4\pi\varepsilon_0} \frac{p}{r^2}$$

$$= \pm 9\times10^{9}\times\frac{4\times10^{-6}}{4}$$

$$= \pm 9\times10^{3} \text{ volt}$$

So, the assertion is true but the reason is false.

22. Option (2) is correct.

Explanation: Given

$T = \frac{5}{20}$s

$I = 9.8 \times 10^{-6}$ kgm^2

$m = x \times 10^{-5}$ Am^2

$B = 0.049$ T

Now $T = 2\pi\sqrt{\frac{I}{mB}}$

$$\Rightarrow \quad \frac{5}{20} = 2\pi\sqrt{\frac{9.8\times10^{-6}}{x\times10^{-5}\times0.049}}$$

$$\Rightarrow \quad \frac{5}{20} = 2\pi\sqrt{\frac{200\times10^{-1}}{x}}$$

$$\Rightarrow \quad \frac{25}{400} = 4\pi^2\left(\frac{20}{x}\right)$$

$$\Rightarrow \quad x = 16\times4\pi^2\times20$$

$$\Rightarrow \quad x = 1280\pi^2$$

23. Option (3) is correct.

Explanation: For diamagnetic material, $0 > \chi \geq -1$

For ferromagnetic material, $\chi >> 1$

For paramagnetic material, $0 < \chi < \varepsilon$ (a small positive number)

For a non-magnetic material, $\chi = 0$

24. Option (1) is correct.

Explanation: Acceleration $a = \frac{10}{5} = 2$ ms^{-2}

Now normal reaction $R = m_B \times a = 3 \times 2 = 6$ N

25. Option (1) is correct.

Explanation: Statement II is incorrect because while atoms of each element do emit characteristic spectra, they are not necessarily always stable. Atoms can undergo various processes such as radioactive decay or chemical reactions, leading to instability and changes in their properties.

26. Option (1) is correct.

Explanation: Terminal potential difference

$V = E - Ir$

$$= 10 - \left(\frac{10}{4+1}\right)\times1$$

$= 10 - 2$

$= 8$ V

27. Option (4) is correct.

Explanation: Resistance of each part

$(R) = \frac{100}{10} = 10\Omega$

The total resistance of series Connection

$R_s = nR = 50\Omega$

The total resistance of parallel connection

$R_p = R/n = 2\Omega$

Now $R_{equivalent} = R_s + R_p$

$= 50 + 2$

$= 52\Omega$

28. Option (3) is correct.

Explanation: Young's modulus, $Y = \frac{\text{stress}}{\frac{\Delta l}{l}}$

$$\Rightarrow \quad \Delta l = \frac{\text{stress}\times l}{Y}$$

$$\Rightarrow \quad \Delta l = \frac{8\times10^{8}\times1}{2\times10^{11}}$$

$$\Rightarrow \quad \Delta l = 4\times10^{-3} \text{ m} = 4 \text{ mm}.$$

29. Option (3) is correct.

Explanation: The excess force required

$F = (2\pi R)T$

$= 2\pi \times 4.5 \times 10^{-2} \times 0.07$

$= 9\pi \times 7 \times 10^{-4}$

$= \frac{9\pi\times7}{10}\times10^{-3}$

$= \frac{63\pi}{10}$mN

$= 19.8$ mN

30. Option (4) is correct.

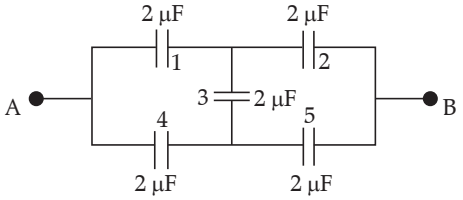
Explanation: We have $\frac{1}{\lambda} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

Here value of n_1 is fixed, so $n_2 \propto \frac{1}{\lambda}$

i.e n_2 increases wavelength decreases.

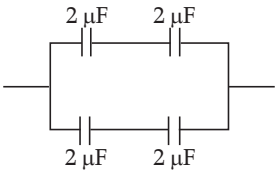
31. Option (3) is correct.

Explanation:



As the bridge is balanced, the capacitor 3 can be neglected.

Hence,



C_1 and C_2 are in series

$C_{S_1} = 1\mu$F

again C_4 and C_5 are in series

$C_{S_2} = 1\mu$F

Now $C = C_{S_1} + C_{S_2} = 1 + 1 = 2\mu$F

32. Option (2) is correct.

Explanation: Acceleration due to gravity, $g = \frac{GM}{R^2}$

Now, $g' = \frac{M/10}{\frac{R^2}{4}} \times G$

$\Rightarrow g' = \frac{GM}{10} \times \frac{4}{R^2} = \frac{4GM}{10R^2}$

$\Rightarrow g' = \frac{4}{10} \times g$

$\Rightarrow g' = \frac{4}{10} \times 9.8 = 3.92 \text{ ms}^{-2}$

33. Option (2) is correct.

Explanation: We have $\lambda = \frac{h}{\sqrt{2mE}}$

$\Rightarrow \sqrt{E} \propto \frac{1}{\lambda}$

$\Rightarrow E \propto \frac{1}{\lambda^2}$

34. Option (3) is correct.

Explanation: Solid angle, strain and angle are dimensionless quantities.

35. Option (2) is correct.

Explanation: Electric potential due to a uniform charged spherical shell is constant everywhere inside the shell and its value is equal to that on the surface of the shell,

Hence $V_c = V_p$

$\therefore$ Potential difference = 0

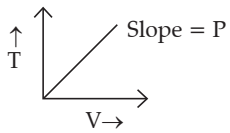
36. Option (2) is correct.

Explanation: From ideal gas equation

$PV = nRT$

$\Rightarrow T = \left(\frac{P}{nR}\right)V$

i.e. $T \propto V$ and slope will be $\frac{P}{nR}$



So, $P_1 > P_2 > P_3$

37. Option (2) is correct.

Explanation: Electromagnetic waves are produced by accelerating charges, not by charges moving with a uniform speed. This is a fundamental characteristic of electromagnetic waves and is known as Maxwell's equations.

38. Option (4) is correct.

Explanation: Magnifying power $m = \frac{f_0}{f_e}$

$= \frac{140}{5}$

$= 28$

39. Option (4) is correct.

Explanation: During the charging process of the capacitor through a resistor connected to a battery, the current I in the circuit primarily flows through the resistor. Simultaneously, there is a changing electric field between the plates of the capacitor, which induces a displacement current. According to Ampere's law with Maxwell's addition, the displacement current is equal in magnitude to the conduction current (I) and flows in the same direction.

40. Option (4) is correct.

Explanation: $F = Y A \alpha \Delta\theta$

$= 0.5 \times 10^{11} \times 10^{-3} \times 10^{-5} \times 100$

$= 50 \times 10^3$ N

41. Option (4) is correct.

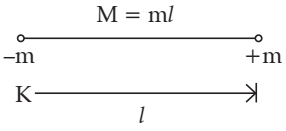
Explanation: $P_S = \frac{P_1 P_2}{P_1 + P_2} = \frac{2}{3}$ kW

$P_P = P_1 + P_2 = 3$ kW

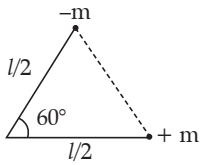
Now $\frac{P_S}{P_P} = \frac{2/3}{3} = \frac{2}{9}$

42. Option (4) is correct.

Explanation:



When the rod is bent at the middle,



$l_{\text{eff}} = 2 \times \frac{l}{2} \sin 30$

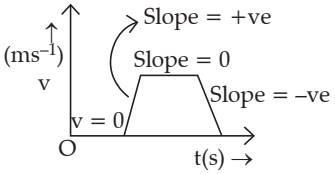
$= \frac{l}{2}$

So, $M' = m \times \frac{l}{2}$

$\Rightarrow M' = \frac{M}{2}$

43. Option (1) is correct.

Explanation:



So, option (1) will be the corresponding acceleration-time graph.

44. Option (4) is correct.

Explanation:

$V_{rms} = 210$ V

$= V_0 = 210\sqrt{2}$ V

$$I_0 = \frac{V_0}{X_C}$$
$$= V_0\omega C = V_0 \times 2\pi f \times C$$
$$= 210\sqrt{2} \times 2\pi \times 50 \times 10 \times 10^{-6}$$
$$= 0.93 \text{ A}$$

45. Option (4) is correct.

Explanation: $F = \alpha t^2 + \beta t$

Now $[\alpha T^2] = [M^1L^1T^{-2}]$

and $[\beta T] = [M^1L^1T^{-2}]$

So, $[\alpha] = [M^1L^1T^{-4}]$

and $[\beta] = [M^1L^1T^{-3}]$

Now $\left[\frac{\alpha t}{\beta}\right] = \frac{[M^1L^1T^{-4}] \times [T]}{[M^1L^1T^{-3}]}$

$= [M^0L^0T^0]$

46. Option (3) is correct.

Explanation: In fig - 1; the network is short circuited.

In fig - 4; the diode is in reverse biased.

In fig - 2; the diode is in reverse biased.

If fig - 3; the diode is in forward biased and bridge can be balanced if

$$\frac{P}{Q} = \frac{R}{S}$$
$$\frac{10}{15} = \frac{10}{5 + R_d}$$
$$R_d = 10\ \Omega$$

47. Option (4) is correct.

Explanation: Time period of a pendulum

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

Now $T' = 2\pi\sqrt{\frac{l}{2g}} = \frac{1}{\sqrt{2}}T$

$$\Rightarrow \frac{x}{2} \times T = \frac{1}{\sqrt{2}}T$$
$$\Rightarrow \sqrt{2}x = 2$$
$$\Rightarrow x = \frac{2}{\sqrt{2}} = \sqrt{2}$$

48. Option (4) is correct.

Explanation: $C = \frac{\varepsilon_0 A}{d}$

if d decreases, then C increases.

As the battery is connected, then V = constant

Now $q \propto C$

i.e., if C increases, q also increases.

and we have energy stored $U = \frac{1}{2}CV^2$

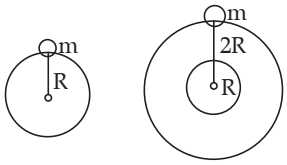
as C increases, U also increases.

$\frac{q}{V} = C$ increases

qV will also increase.

49. Option (3) is correct.

Explanation:



$$W = E_2 - E_1$$
$$= \frac{-GMm}{2 \times 3R} + \frac{GMm}{R}$$
$$= \frac{-GMm + 6GMm}{6R}$$
$$= \frac{5GMm}{6R}$$

50. Option (4) is correct.

Explanation:

Let's analyse each statement

A. Hold the sheet there if it is magnetic.

This statement seems correct because a magnetic material in a magnetic field would experience a force of attraction or repulsion. So, to hold the place we must apply some force.

B. Hold the sheet there if it is non-magnetic.

Non-magnetic materials do not interact strongly with magnetic fields, so they would not require a force to hold them in place in front of a magnetic pole.

C. Move the sheet away from the pole with uniform velocity if it is conducting.

If the sheet is conducting and moving away from the pole with uniform velocity, then eddy current will produced in the sheet and an electromagnetic force of attraction will be generated. To overcome this force, we must apply some force.

D. Move the sheet away from the pole with uniform velocity if it is both, non-conducting and non-polar. Since non-conducting and non-polar materials don't interact significantly with magnetic fields, they wouldn't require a force to move away from the pole with uniform velocity.

CHEMISTRY

51. Option (2) is correct.

Explanation:

A. Isothermal Process	II. Carried out at constant temperature
B. Isochoric process	III. Carried out at constant volume
C. Isobaric process	IV. Carried out at constant pressure
D. Adiabatic process	I. No heat exchange

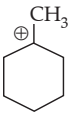
52. Option (3) is correct.

Explanation:

A. $[Co(NH_3)_5(NO_2)]Cl_2$	II. Linkage isomerism
B. $[Co(NH_3)_5(SO_4)]Br$	III. Ionization isomerism
C. $[Co(NH_3)_6][Cr(CN)_6]$	IV. Coordination isomerism
D. $[Co(H_2O)_6]Cl_3$	I. Solvate isomerism

53. Option (2) is correct.

Explanation: Stability order of carbocation is as 3° Carbocation > 2° Carbocation >1° Carbocation



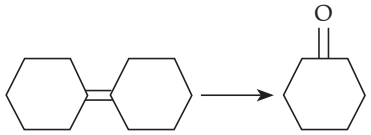
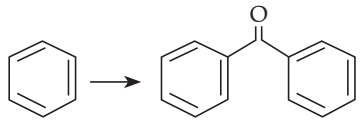
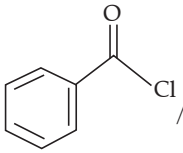
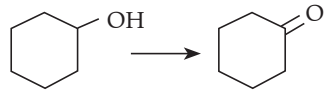
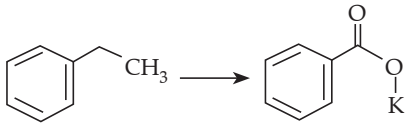
is a tertiary carbocation, while rest are secondary $C^{\oplus}$. Hence, it is most stable carbocation among the given compounds.

54. Option (4) is correct.

Explanation: On heating, if solid directly gets converted into gaseous form instead of liquid this process is known as sublimation. So, the technique used for the purification of such solid substances based on the above principle is known as sublimation.

55. Option (1) is correct.

Explanation:

Reaction	Reagents/Condition	Process involved
(A) 	IV. (i) O_3 (ii) Zn-H_2O	Ozonolysis
(B) 	I.  /Anhydrous $AlCl_3$	Friedal Craft Acylation
(C) 	II. CrO_3	Mild oxidation
(D) 	III. $KMnO_4/KOH, \Delta$	Strong oxidation

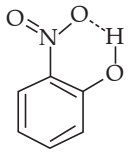
56. Option (3) is correct.

Explanation: Intramolecular hydrogen bonding takes place within the same molecule. This occurs only when two functional groups are present in a molecule.

In HF, intermolecular hydrogen bonding is possible but intramolecular hydrogen bonding is not possible.

In *m*-nitrophenol and *p*-nitrophenol both $-NO_2$ and -OH groups are far apart from each other so intramolecular hydrogen bonding is not possible.

In *o*-nitrophenol, $-NO_2$ and -OH groups are on adjacent carbon atoms so they can form hydrogen bonding and such hydrogen bonding is known as intramolecular hydrogen bonding.



o-nitrophenol

57. Option (3) is correct.

Explanation: 1. In 4g

Number of He atoms = No. Of moles × N_A

= (Mass/Molar mass) × N_A

= (4/4) × 6.022 × 10^{23}

= 6.022 × 10^{23} atoms

2. In 2.271098 L of helium at STP

Number of He atoms = (2.271098/22.4) × N_A

= 0.1013 × 6.022 × 10^{23}

= 0.6100 × 10^{23} atoms

3. In 4 mol of helium

Number of He atoms = Number of moles × N_A

$= 4 \times 6.022 \times 10^{23}$

$= 24.088 \times 10^{23}$ atoms

4. In 4u of Helium

Number of atoms = Number of moles × N_A

$= (4u/4) \times 6.022 \times 10^{23}$

$= 6.022 \times 10^{23}$

Hence, the highest number of He atoms are in 4 mol He.

58. Option (1) is correct.

Explanation: For the reaction,

$$2A \rightleftharpoons B + C$$

quotient is given by

$$Q_c = \frac{[B][C]}{[A]^2}$$

$$= \frac{[2\times10^{-3}][2\times10^{-3}]}{[2\times10^{-3}]^2}$$

$= 1$

$K_c = 4 \times 10^{-3}$ (given)

On comparing, $K_c < Q_c$

Hence, reaction has a tendency to go in backward direction.

59. Option (1) is correct.

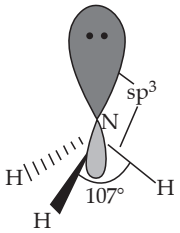
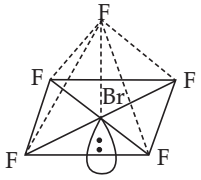
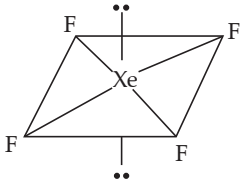
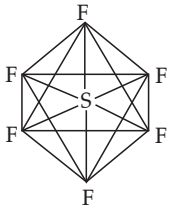
Explanation: The positive E° value for the couple Mn^{3+}/Mn^{2+} is due to the much higher third ionization energy of Mn (where the required change is half filled d^5 (extra stable) to d^4. As $Cr^{3+}(t_{2g})$ is more stable than Cr^{2+}, therefore, E^0 value for couple Cr^{3+}/Cr^{2+} is negative.

60. Option (3) is correct.

Explanation: Fehling's solution 'A' is aqueous solution of copper sulphate. It is prepared by dissolving pentahydrated copper sulphate in distilled water and then adding some drops of dilute sulphuric acid.

61. Option (3) is correct.

Explanation:

Compound	Shape/Geometry
A. NH_3	(i) Trigonal pyramidal 
B. BrF_5	(iv) Square pyramidal 
C. XeF_4	(ii) Square planer 
D. SF_6	(iii) Octahedral 

62. Option (3) is correct.

Explanation: $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ complexes are octahedral. In $[Co(NH_3)_6]^{3+}$ all electrons are in paired (t_{2g}^6 e_g^0) form so it is diamagnetic. In $[CoF_6]^{3-}$ four electrons are unpaired (t_{2g}^3 e_g^1) so it is paramagnetic.

Hence, given both the statements are true.

63. Option (2) is correct.

Explanation: Down the group, electropositivity increases. Po is highly electropositive element so it does not show –2 oxidation state.

64. Option (2) is correct.

Explanation: Arrhenius equation is

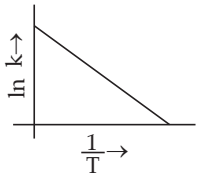
$k = Ae^{-Ea/RT}$

$ln(k) = ln(A) + ln(e^{-Ea/RT})$

$ln(k) = ln(A) + (-Ea/RT)$

$ln(k) = ln(A) + (-Ea/R)(1/T)$

Since $ln(A)$ is a constant, the equation corresponds to that of a straight line ($y = mx + c$) whose slope (m) is –Ea/R. When the logarithm of the rate constant (ln K) is plotted on the Y-axis and the inverse of the absolute temperature (1/T) is plotted on the X-axis, the resulting graph is called an Arrhenius plot.



65. Option (3) is correct.

Explanation: Electronegativity is the tendency of an atom to attract the shared pair of electrons towards itself.

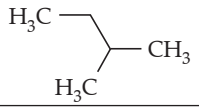
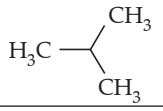
Number of electrons and size of atom are responsible for electronegativity.

Fluorine have 7 electrons in its outermost shell and it require only 1 electron for completion of its octet and its atomic size is vary small so it is highest electronegative element.

Electronegativity increases across the period and decreases down the group. So correct order of electronegativity is Si < C < N < O < F.

66. Option (3) is correct.

Explanation:

n-pentane	CH_3-CH_2-CH_2-CH_2-CH_3
Iso-pentane	
Neo-pentane	

When branching increases, the molecule attains a shape of sphere. This results in smaller surface area for contact, due to which the intermolecular forces between the spherical molecules are weak thereby lowering the boiling point.

Hence, both the statements are correct.

67. Option (2) is correct.

Explanation: The reaction in which reduction as well as oxidation takes place simultaneously is called redox reaction.

In the reaction

$BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4 + 2NaCl$

Oxidation number of all elements in reactant and product are same that is there is no oxidation or reduction takes place so it is not redox reaction.

68. Option (4) is correct.

Explanation: The minimum amount of energy required to remove the most loosely bound electron in the isolated gaseous atom is known as ionisation enthalpy.

Li, Be, B, C, N all are the elements belonging to second period of modern periodic table. Across the period from left to right atomic size decreases and effective nuclear charge increases so ionization enthalpy also increases.

But in case of Be and B, Be has all paired electrons in its outermost shell and boron has 1 unpaired electron so ionization enthalpy of Be is more than B.

Hence correct order of ionization enthalpy is

Li < B < Be < C < N

69. Option (2) is correct.

Explanation: An alcohol and Lucas reagent gives two step reaction. In first step carbocation is formed and in second step alkyl chloride is formed.

Tertiary carbocation is more stable than primary and secondary so lucas reagent reacts instantaneously with tertiary alcohol.

70. Option (1) is correct.

Explanation:

Molecule	Number and Types of Bonds
A. Ethane (CH_3-CH_3)	III. one σ-bond
B. Ethene ($CH_2 = CH_2$)	IV. one σ-bond and one π-bond
C. Carbon molecule C_2	II. two π-bonds
D. Ethyne (HC ≡ CH)	I. one σ-bond and two π-bonds

71. Option (3) is correct.

Explanation: As the molecular mass increases boiling point increases. But in water, intermolecular hydrogen bonding is present which is not in another molecules. So, H_2O has higher boiling point than other.

Hence, both the statements are correct.

72. Option (3) is correct.

Explanation: Positive charge on nitrogen is strongly electron-withdrawing and thus deactivates the ring for further acylation or alkylation reactions. So aniline does not undergo Friedel Craft alkylation.

Aryl halides does not undergo nucleophilic substitution with phthalimide. So, aniline can not be synthesized by Gabriel phthalimide synthesis. So, both the statements are correct.

73. Option (3) is correct.

Explanation:

Conversion	Number of Faradays required
A. 1mol of H_2O to O_2	II. 2F
B. 1mol of MnO_4^- to Mn^{2+}	IV. 5F

C. 1.5mol of Ca from molten $CaCl_2$	I. 3F
D. 1mol of FeO to Fe_2O_3	III. 1F

(A) $H_2O \longrightarrow 2H^+ + 1/2O_2 + 2e^-$
Q = nF (n = number of electrons given by Q
= 2F

(B) $MnO_4^- + 5e^- \longrightarrow Mn^{2+}$
Q = nF
Q = 5F

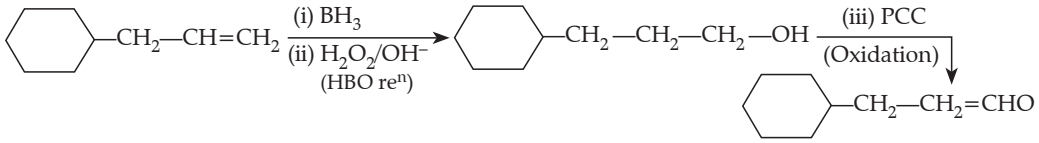
(C) $CaCl_2 \longrightarrow Ca^{2+} + 2Cl^-$
$Ca^{2+} + 2e \longrightarrow Ca$
1 mol = $2e^-$
1.5mol = $3e^-$
Q = nF
= 3F

(D) Oxidation number of Fe in FeO is +2
Oxidation number of Fe in Fe_2O_3 is +3
1 electron is required to conversion
Q = nF
= 1F

74. Option (3) is correct.
Explanation: $K_p = K_c (RT)^{\Delta ng}$
If $\Delta n_g = 0$. Then $K_p = K_c$
(1) $\Delta n_g = 2 - 2 = 0$
(2) $\Delta n_g = 2 - 2 = 0$
(3) $\Delta n_g = 2 - 1 = 1$
(4) $\Delta n_g = 2 - 2 = 0$
Hence K_p and K_c are not equal in reaction (3), i.e.,
$PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$

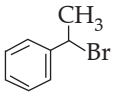
75. Option (4) is correct.
Explanation: The Henry's law constant and solubility of gas in liquid are inversely proportional to each other hence, correct order of solubility is B > C > A.

76. Option (4) is correct.



77. Option (2) is correct.
Explanation: The compound in which stable carbocation formation capacity is more gives S_N1 reaction with fastest rate.

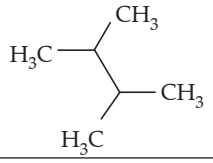
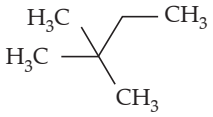
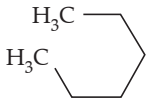
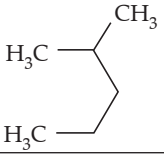
In 2-Bromo-2-phynylethane, carbocation formed is tertiary and is more stable than other due to resonance so 2- Bromo-2-phenylethane gives S_N1 reaction with fastest rate.



78. Option (3) is correct.
Explanation: For He^+
$E_n = -13.6 (Z^2/n^2)$
$= -13.6 (2^2/1^2)$
$= -13.6 \times 4$
$= -54.4$
$= -xJ$

For Be^{+3}
$E_n = -13.6 (Z^2/n^2)$
$= -13.6 (4^2/2^2)$
$= -13.6 \times 4$
$= -54.4$
$= -xJ$

79. Option (1) is correct.
Explanation:

IUPAC name	Structure	No. of tertiary C atoms	Molcular Formula
2,3-dimethylbutane		2	C_6H_{14}
2,2-dimethylbutane		0	C_6H_{14}
n-hexane		0	C_6H_{14}
2-methylpentane		1	C_6H_{14}

80. Option (1) is correct.

Explanation: Glucose does not react with Schiff's reagent and $NaHSO_3$ due to absence of aliphatic aldehydes in the ring structure and absence of free aldehydic group.

81. Option (3) is correct.

Explanation: The species which have same number of unpaired electrons have same spin only magnetic moment.

Electronic configuration of

$Ti^{3+} = [Ar]3d^1$

Number of unpaired electrons = 1

$Cr^{2+} = [Ar]\ 3d^4$

Number of unpaired electrons =4

$Mn^{2+} = [Ar]3d^5$

Number of unpaired electrons =5

$Fe^{2+} = [Ar]\ 3d^6$

Number of unpaired electrons =4

$Sc^{3+} = [Ar]$

Number of unpaired electrons =0

Hence Cr^{2+} and Fe^{2+} have same spin only magnetic moment.

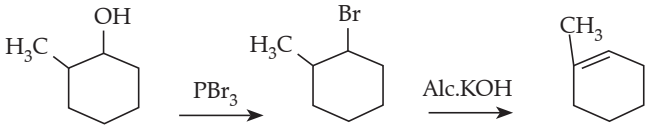
82. Option (4) is correct.

Explanation:

Quantum Number	Information Provided
A. m_l	(iii) Orientation of orbital
B. m_s	(iv) Orientation of spin electron
C. l	(i) Shape of orbital
D. n	(ii) Size of orbital

86. Option (3) is correct.

Explanation:



87. Option (4) is correct.

Explanation: Work Done = $-2.303\ R\ T \log (P_1/P_2)$

$= -2.303 \times 2 \times 298 \times \log (20/10)$

$= -2.303 \times 2 \times 298 \times \log 2$

$= -413.14K$

88. Option (2) is correct.

Explanation: For the given reaction,

$$2NO(g) \rightleftharpoons N_2(g) + O_2(g)$$

$$k_{eq} = \frac{[N_2][O_2]}{[NO]^2}$$

$$= \frac{[3\times10^{-3}][4.2\times10^{-3}]}{[2.8\times10^{-3}]^2}$$

$$= 1.6$$

83. Option (4) is correct.

Explanation: Number of mole of NaOH in 1g = 1/40 = 0.025 moles

Number of mole of HCl in 25 mL = $\frac{(0.75\times25)}{1000}$

= 0.01875

Number of moles of NaOH unreacted = 0.025 – 0.01875 = 0.00625

Mass of NaOH unreacted = Number of moles unreacted × Molar mass

= 0.00625 × 40

= 0.25g = 250mg

84. Option (1) is correct.

Explanation: Entropy increases with increase in disorder or randomness of the system.

Randomness increases with increase in temperature.

In system A, liquid evaporates to vapours i.e., randomness increases automatically entropy increases.

In system B, temperature is lowered i.e., randomness lowered and entropy also lowered.

In system C, solid reactant gets convert into gas i.e., randomness increases and entropy also increases.

In system D, molecule is converted into its corresponding atoms so randomness and entropy both increases.

So, option (1) is correct.

85. Option (2) is correct.

Explanation: Activation energy of a chemical reaction can be determined by evaluating rate constants at two different temperature.

By Arrhenius equation

$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303\,R}\log\left(\frac{T_2 - T_1}{T_1T_2}\right)$$

Now, $2\ NO = N_2 + O_2$

At t=0 0.1 0 0

At t=10. 1–k α/2 α/2

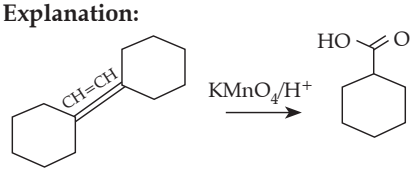
$$k_{eq} = \frac{(\alpha/2)^2}{(0.1-\alpha)^2}$$

$\alpha = 0.717$

Degree of dissociation = 0.717

89. Option (4) is correct.

Explanation:



90. Option (3) is correct.

Explanation: The electronic configuration of Ce^{4+} = [Xe]

The electronic configuration of Yb^{2+} = [Xe] $4f^{14}$

In above pair, all electrons are in paired form so this pair is diamagnetic.

91. Option (3) is correct.

Explanation:

$$CH_3-CH_2-CH_2-I \xrightarrow{NaCN} CH_3-CH_2-CH_2-CN$$ (Nucleophilic substitution reaction)

$$CH_3-CH_2-CH_2-CN \xrightarrow[\text{Partial Hydrolysis}]{OH^-} CH_3-CH_2-CH_2-CONH_2$$

$$CH_3-CH_2-CH_2-CONH_2 \xrightarrow{NaOH/Br_2} \underset{\text{Propylamine}}{CH_3-CH_2-CH_2-NH_2}$$ (Hoffmann Bromamids degradation reactions)

92. Option (2) is correct.

Explanation: Alcohol on reaction with PCl_3 and PCl_5 always gives permanent side product H_3PO_3 and $POCl_3$ respectively.

93. Option (3) is correct.

Explanation:

Group	Cations	Group Reagant
Group zero	NH_4^+	None
Group-I	Pb^{2+}	Dilute HCl
Group-II	Pb^{2+}, Cu^{2+}, As^{3+}	H_2S gas in presence of dil. HCl
Group-III	Al^{3+}, Fe^{3+}	NH_4OH in presence of NH_4Cl
Group-IV	Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}	H_2S in presence of NH_4OH
Group-V	Ba^{2+}, Sr^{2+}, Ca^{2+}	$(NH_4)_2CO_3$ in presence of NH_4OH
Group-VI	Mg^{2+}	None

94. Option (4) is correct.

Explanation:

$$A = \frac{32}{64} = \frac{1}{2}$$

$$2A = 1$$

$$B = \frac{20}{40} = \frac{1}{2}$$

$$2B = 1$$

$$C = \frac{48}{32} = \frac{3}{2}$$

$$2C = 3$$

1 atom of A , 1 atom of B combines with 3 atoms of C to form a compound with empirical formula ABC_3

95. Option (3) is correct.

Explanation: $\log\frac{k_2}{k_1} = \frac{E_a}{2.303R} \times \log\left(\frac{T_2 - T_1}{T_1T_2}\right)$

$$\log\frac{4}{1} = \frac{E_a}{2.303 \times 8.314} \times \log\frac{330-300}{330 \times 300}$$

$Ea = \log 4 \times 2.303 \times 8.314/0.0003$

$= 0.6021 \times 2.303 \times 8.314/0.0003$

$= 38.04$ kJ/mol

96. Option (3) is correct.

Explanation: $\Pi = CRT$

Comparing with

$$y = mx$$

$$m = RT$$

$$\text{Slope} = RT$$

$$T = \frac{\text{Slope}}{R}$$

$$= \frac{25.73}{0.083}$$

$= 310K$

$= (310 - 273)\ °C$

$= 37°C$

97. Option (2) is correct.

Explanation: Fe^{2+} and Al^{3+} ions undergo hydrolysis, therefore, while preparing aqueous solutions of ferrous sulphate and aluminium sulphate in water, 2-3 mL dilute sulphuric acid is added to prevent the hydrolysis of these salts.

98. Option (4) is correct.

Explanation: $W = (E/96487) \times 9.6487 \times 100$

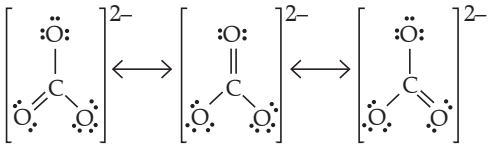
Putting $E = \frac{63}{2}$

$$W = 0.315g$$

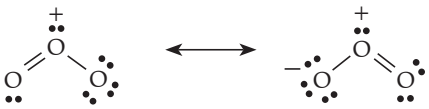
99. Option (2) is correct.

Explanation: (1) Dipole moment of NF_3 is less than that of NH_3

(2) Canonical forms of CO_3^{2-}



(3) Resonance structures of ozone



(4) Dipole moment of BF_3 is zero.

So only second statement is correct.

100. Option (3) is correct.

Explanation: Both statements are correct.

$[Co(NH_3)_4Cl_2]^+$ is a homoleptic complex and has only one type of ligands.

$[Co(NH_3)_4]^+$ is a heteroleptic complex and has more than one, i.e., two types ligands.

BOTANY

Section A

101. Option (3) is correct

Explanation: The component (c) is guard cell which has thin outer walls and highly thickened inner walls. The guard cells are bean-shaped with an inner inwardly curved wall towards the stomatal pore. The thick wall of Guard cells facilitate the opening of the stomatal pore during transpiration.

102. Option (2) is correct.

Explanation: A transcription unit is a section of DNA that contains the information for producing a functional RNA molecule. This unit typically includes a promoter region, the coding sequence for the gene, and a terminator sequence. During transcription, RNA polymerase binds to the promoter and synthesizes a complementary RNA molecule using the DNA template.

103. Option (1) is correct.

Explanation: K represents carrying capacity. Carrying capacity refers to the maximum population size of a species that a particular environment can sustain indefinitely, given the resources available in that environment. It represents the equilibrium population size where the birth rate equals the death rate and resources are not depleted beyond the environmental capacity to regenerate them. Beyond the carrying capacity, population growth tends to stabilize or decline due to factors such as competition for resources, predation, disease, or environmental degradation.

104. Option (1) is correct.

Explanation: Part C is a radicle. The part of the seed that germinates to form the root is the radicle, which is part of the embryonic axis. The radicle is the embryonic root of the plant-to-be. It anchors the seedlings in the soil and begins to grow downward, facilitating the uptake of water and nutrients from the soil. This process is essential for the establishment of the seedling and the subsequent growth of the plant's root system.

105. Option (1) is correct.

Explanation: The inhibition of succinate dehydrogenase by malonate is an example of competitive inhibition. In competitive inhibition, a molecule (the inhibitor) binds to the active site of an enzyme, preventing the substrate from binding and thereby inhibiting the enzyme's activity. In this case, malonate competes with succinate for binding to the active site of succinate dehydrogenase, which is an enzyme involved in the citric acid cycle. As a result, malonate inhibits the enzyme's ability to catalyze the conversion of succinate to fumarate, disrupting cellular metabolism.

106. Option (4) is correct.

Explanation: In the case of incomplete dominance, the heterozygous condition results in an intermediate phenotype between the two homozygous phenotypes. Therefore, the flowers of the progeny would likely exhibit shades that are intermediate between red and pink, resulting in flowers that are both red and pink. This blending of colors is characteristic of incomplete dominance.

107. Option (4) is correct.

Explanation: *Ex situ* conservation is a type of biodiversity conservation refers to the conservation of biological diversity outside of the organism's natural habitat. It involves the transfer of biological material from its original location and placing it in a controlled environment, such as botanical gardens, zoos, or captive breeding programs.

108. Option (2) is correct.

Explanation: Biodiversity loss is driven by habitat destruction, climate change, over exploitation, pollution, invasive species, and habitat fragmentation. Human activities, such as agriculture, urbanization, and resource extraction, are the primary causes. These factors disrupt ecosystems, lead to species extinctions, and threaten global biodiversity.

109. Option (1) is correct.

Explanation: The dark reactions of photosynthesis, also known as the Calvin cycle or C3 cycle, requires three main components: carbon dioxide (CO_2), ATP (adenosine triphosphate), and NADPH (nicotinamide adenine dinucleotide phosphate hydrogen). These molecules are produced during the light-dependent reactions of photosynthesis, which occur in the thylakoid membranes of the chloroplasts. In the dark reactions, CO_2 is fixed

into organic molecules (such as glucose) using the energy stored in the form of ATP and the reducing power of NADPH.

110. Option (3) is correct.

Explanation: Bulliform cells are responsible for the rolling and unrolling of leaves in response to changes in water availability. These specialized cells are typically found in grasses and other monocots. When the plant experiences water stress, the bulliform cells lose turgor pressure, causing the leaves to roll up, which reduces the surface area exposed to sunlight and minimizes water loss through transpiration. Conversely, when water availability increases, the bulliform cells regain turgor pressure, causing the leaves to unroll and maximize photosynthetic efficiency.

111. Option (2) is correct.

Explanation: Both are perigynous. Perigynous flowers have floral parts such as sepals, petals, and stamens attached to the rim of a cup-like structure called the hypanthium, which surrounds the ovary. In perigynous flowers, the ovary is positioned inferiorly, meaning it sits below the attachment point of the floral parts.

112. Option (4) is correct.

Explanation: The morphology of the mycelium, mode of spore formation and fruiting bodies form the basis for the division of the kingdom into various classes of Fungi. The mode of nutrition is not a criterion for the classification of fungi. Thus, option (4) is the answer.

113. Option (4) is correct.

Explanation: Hind II was the first restriction endonuclease to be isolated whose functioning depended on a specific DNA nucleotide sequence. It was found that Hind II always cut DNA molecules at a particular point by recognising a specific sequence of six base pairs, i.e., GTPy/PuAC. This specific base sequence is known as the recognition sequence for Hind II. Thus, option (4) is the answer.

114. Option (1) is correct.

Explanation: Auxin does not affect mature monocotyledonous plants, including grasses. Monocots, such as grasses, have a different vascular system and growth pattern that makes them less sensitive to auxin. Therefore, auxin does not have a significant effect on mature monocot plants like grasses.

115. Option (1) is correct.

Explanation: In genetics, alleles are different forms of a gene.

A test cross involves crossing an organism with a homozygous recessive parent to determine its genotype.

A back cross is a cross between an F_1 individual and one of its parent lines.

Ploidy refers to the number of chromosome sets in a cell or organism.

Thus, option (1): A-III, B-IV, C-I, D-II is the answer.

116. Option (4) is correct.

Explanation: Spindle fibers attach to kinetochores of chromosomes during Metaphase. In this phase of mitosis or meiosis, chromosomes align along the metaphase plate, and spindle fibers from opposite poles of the cell attach to the kinetochores of each chromosome, ensuring they are correctly positioned for separation during anaphase.

117. Option (1) is correct.

Explanation: *Clostridium butylicum* produces butyric acid, utilized in various industrial processes.

Saccharomyces cerevisiae is employed for ethanol production due to its fermentation capabilities.

Trichoderma polysporum is associated with the synthesis of cyclosporin-A, a valuable immunosuppressant.

Streptococcus sp. produces streptokinase, an enzyme used therapeutically for clot dissolution.

118. Option (4) is correct.

Explanation: Mendel's Law of Dominance asserts that in a heterozygote, one allele is expressed over the other, evident in the monohybrid cross where only one parental trait is expressed. Mendel also introduced the concept of discrete hereditary units, termed factors (now known as genes), and highlighted the paired nature of these factors in diploid organisms, all central to understanding inheritance patterns.

119. Option (1) is correct.

Explanation: When a DNA fragment carrying a gene of interest is transferred into an alien organism, it may integrate into the recipient's genome becoming a permanent part of its genetic material. Alternatively, it may replicate independently, being inherited alongside the host DNA. These processes facilitate the expression and transmission of the gene of interest within the recipient organism.

120. Option (2) is correct.

Explanation: During the Calvin cycle, for every molecule of CO_2 that is fixed, 3 molecules of ATP and 2 molecules of NADPH are utilized. The ATP provides energy, while the NADPH provides reducing power for the conversion of CO_2 into carbohydrates.

121. Option (4) is correct.

Explanation: To find out the genotype of the black seed plant, which is either BB or Bb, one need to perform a test cross with a plant that has a homozygous recessive genotype for seed color (bb). When performing a test cross, the objective is to determine the genotype of an individual with a dominant phenotype but an unknown genotype. By crossing it with an individual that is homozygous recessive (bb), all offspring will display the dominant phenotype if the unknown individual is homozygous dominant (BB) and half will display the dominant phenotype if the unknown individual is heterozygous (Bb).

122. Option (4) is correct.

Explanation: Lecithin is a phospholipid, which belongs to the category of Phospholipids. It is a crucial component of cell membranes and is found abundantly in living tissues.

123. Option (3) is correct.

Explanation: *Rhizopus* is a genus of fungi known for its bread mould species.

Ustilago is associated with smut fungi, causing plant diseases.

Puccinia encompasses rust fungi, which affect various plants.

Agaricus includes mushroom species used in culinary applications.

124. Option (3) is correct.

Explanation: Tropical regions boast the highest species richness due to a combination of factors. These regions have experienced prolonged environmental stability, providing ample time for species diversification. Abundant solar energy fuels diverse ecosystems, while relatively constant and predictable conditions promote niche specialization. These factors collectively contribute to the exceptional biodiversity observed in tropical latitudes.

125. Option (3) is correct.

Explanation: The nucleolus is a structure within the nucleus responsible for producing ribosomal RNA (rRNA) and assembling ribosomes.

Centrioles are cylindrical structures found in animal cells, and they possess a nine-fold arrangement of microtubules, similar to the structure of a cartwheel.

Leucoplasts are colorless plastids found in plant cells, primarily responsible for storing nutrients such as starch, oils, and proteins.

The Golgi apparatus is involved in modifying, sorting, and packaging macromolecules for transport. It also plays a role in the synthesis of glycolipids.

126. Option (1) is correct.

Explanation: Permease is a type of transport protein that facilitates the movement of lactose across the bacterial cell membrane. It is involved in the active transport of lactose into the cell, allowing bacteria to utilize lactose as a carbon source for growth and metabolism.

127. Option (3) is correct.

Explanation: During the leptotene stage of meiosis, chromosomes gradually condense and become visible under a light microscope. In the diplotene stage, the synaptonemal complex, which holds homologous chromosomes together, begins to dissolve. This dissolution marks the beginning of diplotene. Therefore, both statements are true, as they accurately describe key events during prophase I of meiosis.

128. Option (1) is correct.

Explanation: Interfascicular cambium formation involves the transformation of fully developed parenchyma cells back into meristematic cells capable of further division and differentiation. This process, known as dedifferentiation, allows these cells to regain their stem cell-like properties and contribute to the formation of new vascular tissue in plants.

129. Option (2) is correct.

Explanation: Both parenchyma and collenchyma tissues are living tissues. Collenchyma cells provide support to young plant parts and are alive at maturity. Gymnosperms typically lack vessels in their xylem, whereas angiosperms have vessels in addition to tracheids.

130. Option (2) is correct.

Explanation: Flowers of *Vallisneria* are not colourful and do not produce nectar. Thus, statement (A) is incorrect.

The flowers of water lily emerge above the level of water and are pollinated by insects or wind. Thus, statement (B) is correct.

In most water-pollinated species, the pollen grains are protected from wetting via the mucilage covering. Thus, statement (C) is correct.

Pollen grains of some hydrophytes are long and ribbon-like. This is true as some hydrophytes have elongated pollen grains to facilitate their dispersal in water. Thus, statement (D) is correct.

In some hydrophytes such as *Vallisneria*, the pollen grains are carried passively inside water. Thus, statement (E) is correct.

Thus, the correct answer is option (2).

131. Option (3) is correct.

Explanation: Actinomorphic flowers are radially symmetrical, meaning their parts are arranged symmetrically around a central point, allowing the flower to be divided into similar halves in any plane. *Datura* flowers typically exhibit radial symmetry, making them an example of actinomorphic flowers.

132. Option (3) is correct.

Explanation: Totipotency refers to the ability of a cell to develop into a complete organism. In plants, totipotent cells have the capacity to regenerate an entire plant from a single cell. This property is the basis for techniques such as micropropagation, where plants are propagated from small pieces of tissue culture, and somatic embryogenesis, where embryos are induced from somatic cells.

133. Option (1) is correct.

Explanation: Bt toxins are indeed insect group-specific and are encoded by various *cry* genes, including *cryIAc*. Bt toxins exist as inactive protoxins in *Bacillus thuringiensis* (Bt) bacteria. Upon ingestion by susceptible insects, the alkaline

pH of the insect gut activates these protoxins, converting them into their active forms, which are toxic to the insect.

134. Option (2) is correct.

Explanation: The International Union for Conservation of Nature and Natural resources (IUCN) maintains the Red List of Threatened Species, which includes assessments of the conservation status of various species worldwide, including their categorization as endangered, vulnerable, or extinct.

135. Option (3) is correct.

Explanation: Carboxypeptidase is a metallo-enzyme, meaning it requires a metal ion cofactor for its activity. In the case of carboxypeptidase, the cofactor is typically a zinc ion. Zinc ions play a crucial role in the catalytic activity of carboxypeptidase by coordinating with certain amino acid residues within the active site of enzyme carboxypeptidase. Facilitating the hydrolysis of peptide bonds in proteins.

Section B

136. Option (4) is correct.

Explanation: In cellular respiration, metabolic pathways occur in different cellular compartments. Glycolysis, occurring in the cytoplasm, breaks down glucose into pyruvate. The citric acid cycle takes place in the mitochondrial matrix, where pyruvate is further oxidized. The electron transport system is embedded in the inner mitochondrial membrane and generates a proton gradient across it. This gradient powers ATP synthesis and occurs in the intermembrane space.

137. Option (2) is correct.

Explanation: During DNA replication, DNA polymerase catalyzes the addition of nucleotides to the growing DNA strand in the 5′ to 3′ direction. DNA polymerase synthesizes the new DNA strand by adding nucleotides to the 3′ end of the growing strand. This process ensures that the DNA molecule is replicated accurately and efficiently.

138. Option (4) is correct.

Explanation: Robert May contributed significantly to our understanding of global species diversity, suggesting that there are approximately 7 million species on Earth.

Alexander von Humboldt explored the relationship between the size of a habitat (area) and the number of species it supports, known as the species-area relationship.

Paul Ehrlich proposed the rivet popper hypothesis, which states that the species in an ecosystem is equivalent to rivets in an airplane, suggesting that removing certain species can lead to ecosystem collapse.

David Tilman conducted long-term ecosystem experiments using outdoor plots to study the dynamics of plant communities and the factors influencing species diversity.

Thus, option (4): A-III, B-I, C-IV, D-II is the answer.

139. Option (3) is correct.

Explanation: Figure represents wind pollinated plant inflorescence showing flowers with well exposed stamens. In wind-pollinated plant inflorescences, flowers typically have exposed stamens to facilitate the dispersal of pollen grains by wind. This adaptation optimizes the chances of successful pollination in environments where insects are less likely to visit.

140. Option (1) is correct.

Explanation: In the tricarboxylic acid (TCA) cycle, the conversion of succinyl-CoA to succinic acid does not involve the oxidation of the substrate. Instead, this step involves the conversion of succinyl-CoA to succinate with the release of Coenzyme A (CoA). The oxidation steps in the TCA cycle occur during the conversion of isocitrate to α-ketoglutaric acid and α-ketoglutaric acid to succinyl-CoA.

141. Option (1) is correct.

Explanation: In C_3 plants, RuBisCO can also bind to oxygen (O_2) instead of carbon dioxide (CO_2), resulting in decreased CO_2 fixation and a process known as photorespiration. Thus, statement I is correct.

In C_4 plants, photorespiration does not occur as they lack RuBisCO in mesophyll. Thus, statement II is incorrect.

Therefore, the answer is option (1).

142. Option (1) is correct.

Explanation: To calculate the Gross Primary Productivity (GPP) of the third trophic level from the Net Primary Productivity (NPP) of the first trophic level, we can use the trophic level energy transfer efficiency, which is typically around 10%.

GPP of the third trophic level = NPP of the first trophic level / Trophic level energy transfer efficiency

Given: NPP of the first trophic level = $100x$ (kcal m^{-2} yr^{-1}) Trophic level energy transfer efficiency = 10% = 10

So, GPP of the third trophic level = $100x / 10 = 10x$ (kcal m^{-2} yr^{-1})

Therefore, the correct answer is (1).

143. Option (3) is correct.

Explanation: GLUT-4 is a glucose transporter protein that facilitates the transport of glucose molecules across cell membranes, particularly in response to insulin signalling. Insulin is a hormone produced by the pancreas that plays a central role in regulating glucose metabolism.

Trypsin is a digestive enzyme produced by the pancreas that plays a key role in the breakdown of proteins in the small intestine.

Collagen is the main structural protein found in the extracellular matrix of connective tissues.

144. Option (4) is correct.

Explanation: Frederick Griffith discovered bacterial transformation, where genetic material can be transferred between bacteria.

Francois Jacob and Jacques Monod elucidated the *lac* operon, a model for gene regulation.

Har Gobind Khorana deciphered the genetic code, determining how nucleotide triplets specify amino acids.

Meselson and Stahl demonstrated semi-conservative nature of DNA replication, confirming Watson and Crick's model.

145. Option (4) is correct.

Explanation: The DNA present in chloroplasts, the organelles responsible for photosynthesis in plant cells, is typically circular and double-stranded. This DNA resembles bacterial DNA and is often referred to as plastid DNA. It plays a crucial role in chloroplast function and replication.

146. Option (4) is correct.

Explanation: Gibberellins are plant hormones that promote stem elongation by stimulating cell division and cell elongation. Spraying sugarcane crops with gibberellins can increase stem length, resulting in taller plants and potentially higher yields. This hormone is commonly used in agriculture to promote growth in various crops, including sugarcane.

147. Option (1) is correct.

Explanation: In Phaeophyceae, asexual reproduction primarily involves biflagellate zoospores. Stored carbohydrates are typically mannitol or laminarin. Major pigments are chlorophyll a, c, carotenoids, and xanthophyll. Vegetative cells possess a cellulosic wall, often covered by a gelatinous coating of algin. While sexual reproduction can occur via the oogamous method, it can also involve isogamous reproduction.

148. Option (1) is correct.

Explanation: In somatic hybridization, the protoplasts (cells with their cell walls removed) from two different plant varieties are fused together. This fusion allows the genetic material from the two varieties to combine, potentially leading to the creation of a hybrid plant with desired traits. Pollens, callus, and somatic embryos are not typically fused in somatic hybridization processes.

149. Option (3) is correct.

Explanation: Rose flowers are perigynous.

Sweet pea shows marginal placentation. In marginal placentation, a ridge is formed by the placenta along the ventral suture of the ovary.

In twisted aestivation, the margin of one appendage overlaps the next one and so on. This kind of arrangement of petals is observed in the flower of cotton.

Botanically, mango is a drupe, consisting of an outer skin, a fleshy edible portion, and a central stone enclosing a single seed – also called stone fruit, like a plum, cherry, or peach.

150. Option (3) is correct.

Explanation: Monoadelphous stamens, found in China-rose, have their filaments fused into a single bundle.

Diadelphous stamens, exemplified by the pea plant, have their filaments fused into two bundles.

Polyadelphous stamens, as seen in citrus plants, have their filaments fused into multiple bundles.

Epiphyllous stamens, characteristic of lilies, arise from the petals or sepals instead of the floral axis.

ZOOLOGY

Section A

151. Option (1) is correct.

Explanation: Common cold, one of the most infectious human ailments is caused by Rhinoviruses

Haemozoin is released in blood due to ruptured RBCs after *Plasmodium* infection. Haemozoin is responsible for the chills and high fever recurring every three to four days. Widal test is used to confirm the typhoid fever. Allergy is caused due to the allergen- dust mites.

152. Option (1) is correct.

Explanation: Flippers of the Penguins and Dolphins perform similar functions but are anatomically dissimilar structures. This is an example of analogous structures or different in origin. Hence, analogous structures are a result of convergent evolution - different structures evolving from different ancestors for the same function and hence having similarities.

153. Option (2) is correct.

Explanation: Correct sequence of stages of human evolution from past to recent is: *Homo habilis* → *Homo erectus* → *Homo neanderthalensis* → *Homo sapiens*.

154. Option (2) is correct.

Explanation: Five factors are known to affect Hardy-Weinberg equilibrium. These are gene migration or gene flow, genetic drift, mutation, genetic recombination and natural selection. If the gene pool remains constant, meaning that there are no changes in allele frequencies then the population will be in Hardy-Weinberg equilibrium or it will not affect Hardy-Weinberg equilibrium.

155. Option (4) is correct.

Explanation: In the alveoli, where there is high pO_2, low pCO_2, lesser H^+ concentration and lower temperature, all the factors are favourable for the formation of oxyhaemoglobin, whereas in the tissues, where low pO_2, high pCO_2, high H^+ concentration and higher temperatures exist, the conditions are favourable for the dissociation of oxygen from the oxyhaemoglobin.

156. Option (2) is correct.

Explanation: Vault is a barrier method of contraception which is made of rubber that is inserted into the female reproductive tract to cover the cervix during the coitus. Periodic abstinence is a natural contraceptive method in which the couples avoid or abstain from coitus from day 10 to 17 of the menstrual cycle when ovulation could be expected. Withdrawal or coitus interruptus is another natural method in which the male partner withdraws his penis from the vagina just before ejaculation so as to avoid insemination. Lactational amenorrhea (absence of menstruation) method is also a natural method based on the fact that ovulation and therefore the cycle does not occur during the period of intense lactation following parturition.

157. Option (4) is correct.

Explanation: The correct answer is option (4) because:

A. Pons – Part of hindbrain which consists of fibre tracts that interconnect different regions of the brain.

B. Hypothalamus – Contains several groups of neurosecretory cells, which secrete hypothalamic hormones.

C. Medulla – Part of hindbrain which contains centres which control respiration and gastric secretions.

D. Cerebellum – Part of hindbrain with convoluted surface which provides additional space for neurons and regulates posture and balance.

158. Option (1) is correct.

Explanation: The hymen is often torn during the first coitus (intercourse). However, it can also be broken by a sudden fall or jolt, insertion of a vaginal tampon, active participation in some sports like horseback riding, cycling, etc. In some women, the hymen persists even after coitus. Thus, the presence or absence of hymen is not a reliable indicator of virginity or sexual experience.

159. Option (2) is correct.

Explanation: Axoneme forms the core in cilia and flagella. The centrioles in a centrosome lie perpendicular to each other in which each has an organisation like the cartwheel. The inner membrane in mitochondria forms a number of infolding known as Cristae. Satellite is short segment of chromosomes.

160. Option (4) is correct.

Explanation: Typhoid is caused by *Salmonella typhi* (Bacteria)

Leishmaniasis is caused by *Leishmania donovani*, a protozoan.

Ringworm is caused by Fungi belonging to the genera *Microsporum*, *Trichophyton* and *Epidermophyton*

Filariasis is caused by *Wuchereria bancrofti* and *W. malayi* (Nematode).

161. Option (4) is correct.

Explanation: The descending limb of the loop of Henle is permeable to water but relatively impermeable to electrolytes. Water moves out of the descending limb through osmosis, while electrolytes are reabsorbed in the ascending limb. The proximal convoluted tubule is lined with simple cuboidal epithelium with microvilli, not columnar epithelium. Microvilli increase the surface area for reabsorption of water, ions, and other substances.

162. Option (1) is correct.

Explanation: The correct answer is option (1) as:

Human protein (α-1-antitrypsin) is used for treatment of Emphysema. *Cry* I Ab gene controls corn borer .*Cry* I Ac gene controls cotton bollworms .Enzyme replacement therapy can be used as treatment option in ADA deficiency.

163. Option (2) is correct.

Explanation: Lippes loop is a non-medicated Intra Uterine Devices (IUD).

Multiload 375 is a copper releasing Intra Uterine Devices (IUD).

LNG-20 is a hormone releasing Intra Uterine Devices (IUD).

Progestogens are used as implants.

164. Option (4) is correct.

Explanation: Annelids are true coelomate animals. Poriferans are acoelomates, Aschelminthes are pseudocoelomates and Platyhelminthes are acoelomates.

165. Option (1) is correct.

Explanation: Down's syndrome is due to the presence of an additional copy of chromosome number 21. Klinefelter's syndrome is caused due to presence of an additional copy of X-chromosome resulting into a karyotype of 47, XXY. α-Thalassemia is controlled by two closely linked genes HBA1 and HBA2 on chromosome 16 of each parent. β-Thalassemia is controlled by a single gene HBB on chromosome 11 of each parent.

166. Option (3) is correct.

Explanation: The SAN generates an action potential which stimulates both the atria to undergo a simultaneous contraction – the atrial systole. The action potential is conducted to the ventricular side by the AVN and AV bundle from

where the bundle of His transmits it through the entire ventricular musculature (Purkinje fibres). Therefore, the correct pathway of conduction of action potential is SA → AV node → AV bundle → Bundle branches → Purkinje fibres.

167. Option (1) is correct.

Explanation: Lipase – Digests ester bond found in lipids.

Nuclease – Helps in digestion of phosphodiester bonds found in nucleic acids.

Protease – Helps in digestion of peptide bond found in proteins.

Amylase – Digests the glycosidic bonds found in carbohydrates *i.e.*, digest starch into smaller molecules, ultimately yielding maltose, which is further cleaved into two glucose molecules by maltase.

168. Option (4) is correct.

Explanation: The 'X' in the given diagram represents ori which is responsible for controlling the copy number of the linked DNA and 'Y' represents rop which codes for protein involved in the replication of plasmid.

169. Option (1) is correct.

Explanation: Ti plasmid of *Agrobacterium tumefaciens* is tumor inducing plasmid, containing T-DNA which causes tumor in several dicot plants by transforming normal plant cells into a tumor. The tumor inducing (Ti) plasmid of *Agrobacterium tumifaciens* has now been modified into a cloning vector

170. Option (4) is correct.

Explanation: Pleurobrachia belongs to the Phylum Ctenophora. Radula is a file-like rasping organ for feeding in Mollluscs. Stomochord is a rudimentary structure in the collar region of Hemichordates which is similar to notochord. Air bladder is present in Osteichthyes which maintains buoyancy.

171. Option (1) is correct.

Explanation: Bio-reactors yield bacterial cultures in large quantities, where large volumes (100-1000 litres) of culture could be processed. Bio-reactors have an agitator system, an oxygen delivery system and foam control system. A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions (temperature, pH, substrate, salts, vitamins, oxygen). The most commonly used bioreactors are of stirring type.

172. Option (3) is correct.

Explanation: The strand that has the polarity 3′ → 5′ acts as a template, and is also referred to as template strand. The other strand which has the polarity (5′ → 3′) and the sequence same as RNA (except thymine at the place of uracil), is the product obtained during transcription.

Template DNA is : 3′TACATGGCAAATATCCATTCA5′

The product will be:

5′AUGUACCGUUUAUAGGUAAGU3′

173. Option (2) is correct.

Explanation:

A. Cocaine is obtained from plant *Erythroxylum coca*, stimulating action on CNS.

B. Heroin is obtained by the acetylation of morphine which is obtained from the latex of poppy plant *Papaver somniferum*.

C. Morphine is obtained from *Papaver somniferum* and is an effective sedative in surgery.

D. Marijuana is obtained from the flower tops, leaves and the resin of *Cannabis sativa*.

174. Option (1) is correct.

Explanation:

(A) Diakinesis is marked by the completion of terminalisation of chiasmata.

(B) Pachytene is characterised by the appearance of recombination nodules.

(C) Zygotene is characterised by formation of Synaptonemal complex.

(D) Leptotene is marked by chromosomes looking like thin threads.

175. Option (4) is correct.

Explanation: The 10^{th} segment bears a pair of jointed filamentous structures called anal cerci in both the sexes.

176. Option (3) is correct.

Explanation: Breast-feeding during initial period of infant growth is recommended by doctors for bringing a healthy baby as colostrum contains several antibodies absolutely essential to develop resistance for the new born baby. The yellowish fluid colostrum secreted by mother during the initial days of lactation has abundant antibodies (IgA) to protect the infant.

177. Option (4) is correct.

Explanation: *Pterophyllum* is the scientific name for Angel fish.

Myxine is the scientific name for Hag fish.

Pristis is the scientific name for Saw fish.

Exocoetus is the scientific name for Flying fish.

178. Option (4) is correct.

Explanation: Figure (a) represents skeletal muscle fibres which are closely attached to skeletal bones. In a typical skeletal muscle such as triceps and biceps, striated muscle fibres are bundled together in a parallel fashion. Figure (b) represents smooth muscle fibres which are present in the wall of internal organs such as stomach, intestines, bladder, and blood vessels. Figure (c) represents cardiac muscle fibres which are exclusively present in the heart.

179. Option (2) is correct.

Explanation: Glucagon is a peptide hormone secreted from pancreas. Cortisol, Testosterone and Progesterone are steroid hormones.

180. Option (2) is correct.

Explanation: Fibrous joints do not allow any movement. This type of joint is shown by the flat skull bones which fuse end-to-end with the help of dense fibrous connective tissues in the form of sutures. Cartilaginous joint is present between the adjacent vertebrae in the vertebral column and permits limited movements. Hinge joint is a type of synovial joint present in knee and help in locomotion. Ball and socket joint is also a type of synovial joint present between humerus and pectoral girdle and allows rotational movement.

181. Option (2) is correct.

Explanation: In males, FSH acts on the Sertoli cells and stimulates secretion of some factors which help in the process of spermiogenesis whereas in females it stimulates follicular development as well as secretion of estrogen by the growing follicles. In males, LH affects Leydig cells leading to secretion of androgens. Thus, Assertion is false. Growing ovarian follicles secrete estrogen in females while interstitial cells secrete androgen in male human being.

182. Option (3) is correct.

Explanation: Expiratory capacity = Tidal volume + Expiratory reserve volume

Functional residual capacity = Expiratory reserve volume + Residual volume

Vital capacity = Expiratory reserve volume + Tidal volume + Inspiratory reserve volume

Inspiratory capacity = Tidal volume + Inspiratory reserve volume

183. Option (2) is correct.

Explanation: The cell cycle comprises distinct stages: Gap 1 (G1) phase involves cell growth, preparing for DNA replication. Synthesis (S) phase follows, where DNA duplicates. Gap 2 (G2) phase facilitates further growth and readiness for division. Karyokinesis divides the nucleus into two identical sets of chromosomes. Finally, cytokinesis splits the cytoplasm, yielding two daughter cells.

184. Option (4) is correct.

Explanation: Myasthenia gravis, Rheumatoid arthritis and Systemic Lupus Erythematosus (SLE) are autoimmune disorders. Muscular dystrophy is a genetic disorder which progressively affects the skeletal muscles. Gout is the inflammation of joints due to deposition of uric acid crystals.

185. Option (3) is correct.

Explanation: The uterine fundus is the upper, dome-shaped part of the uterus, above the opening of fallopian tubes. Infundibulum is the part of oviduct which is closer to the ovary. Ampulla is the wider part of the oviduct. Isthmus is the last and narrow part of the oviduct that links to the uterus.

Section B

186. Option (3) is correct.

Explanation: Genotype of father with blood group B^+ is I^Bi/iI^B

Genotype of mother with blood group A^+ is I^Ai/iI^A

Genotype of child with blood group O^+ is ii

187. Option (2) is correct.

Explanation: Exophthalmic goiter involves protruding eyeballs due to hyperthyroidism. Acromegaly results from excess growth hormone, causing enlarged bones and tissues. Cushing's syndrome is characterized by elevated cortisol levels, leading to symptoms like a moon face and hyperglycemia. Cretinism stems from hypothyroidism during infancy, resulting in stunted growth and developmental delays

188. Option (2) is correct.

Explanation: The Mesozoic Era is associated with the dominance of birds and reptiles. The Proterozoic Era marked the presence of lower invertebrates. Mammals flourished during the Cenozoic Era. The Paleozoic Era witnessed the rise of fish and amphibians.

189. Option (1) is correct.

Explanation: Pharynx is perforated by gill slits in Chordates whereas Gill slits are absent in non-chordates. Notochord is absent in non-chordates. Central nervous system is ventral in non-chordates. Heart is dorsal (if present) in non-chordates. A post-anal tail is absent in non-chordates.

190. Option (1) is correct.

Explanation: In human brain, a deep cleft divides the cerebrum longitudinally into two halves, which are termed as the left and right cerebral hemispheres. The cerebral hemispheres are connected by a tract of nerve fibres called corpus callosum. Three major regions make up the brain stem *i.e.*, mid brain, pons and medulla oblongata. Cerebrum is a part of forebrain which does not form brain stem.

191. Option (1) is correct.

Explanation: Unicellular glandular epithelium comprises goblet cells found in the alimentary canal. Compound epithelium lines the moist surface of the buccal cavity. Multicellular glandular epithelium forms structures like salivary glands. Endocrine glandular epithelium, found in the pancreas, secretes hormones.

192. Option (4) is correct.

Explanation: The P wave corresponds to atrial depolarisation in the heart. The QRS complex signifies ventricular depolarisation. The T wave represents ventricular repolarisation. The T-P gap indicates a period when heart muscles are electrically silent.

193. Option (1) is correct.

Explanation: Both mitochondria and chloroplasts are double membrane bound cell organelles. Inner membrane of mitochondria and chloroplast are impermeable, because they have specific transporters for selective transport of ions.

194. Option (3) is correct.

Explanation: In the digestive system of a cockroach, the crop serves to store food. The caeca, located at the foregut-midgut junction, aid in digestion. Yellow filaments at the midgut-hindgut junction are the Malpighian tubules, responsible for waste excretion. The gizzard grinds food particles.

195. Option (2) is correct.

Explanation: In transcription, RNA polymerase III synthesizes small nuclear RNAs (snRNAs) and transfer RNAs (tRNAs). Termination of transcription involves the Rho factor. Splicing of exons utilizes small nuclear ribonucleoproteins (snRNPs). The TATA box serves as a promoter region.

196. Option (3) is correct.

Explanation: GnRH is a hypothalamic hormone acts at the anterior pituitary gland and stimulates secretion of two gonadotropins – luteinising hormone (LH) and follicle stimulating hormone (FSH). FSH acts on the Sertoli cells and stimulates secretion of some factors which help in the process of spermiogenesis. LH acts at the Leydig cells and stimulates synthesis and secretion of androgens. Androgens, in turn, stimulate the process of spermatogenesis.

197. Option (1) is correct.

Explanation: The length of loop of Henle of juxta medullary nephron is longer than the length of loop of Henle of cortical nephron and runs deep into medulla. Juxta medullary nephrons are lesser in number than cortical nephrons. Juxta medullary nephrons are not present in columns of Bertini. Renal corpuscle of juxta medullary nephron lies in inner cortical region.

198. Option (3) is correct.

Explanation: Gause's competitive exclusion principle states that closely related species competing for the same resources cannot coexist indefinitely. When resources are limited, the inferior competitor is likely to be eliminated. Both statements accurately summarize these key aspects of the principle, highlighting its importance in understanding species interactions and community dynamics in ecology.

199. Option (3) is correct.

Explanation: Both bone marrow and thymus play vital roles in the development and maturation of T-lymphocytes. Bone marrow serves as the primary lymphoid organ, producing all blood cells, including lymphocytes. The thymus provides a microenvironment for T-cell maturation. Therefore, both organs are crucial for the proper functioning of the immune system, particularly in T-cell-mediated immunity.

200. Option (3) is correct.

Explanation: The catalytic cycle of an enzyme action can be described in the following steps:

1. First, the substrate binds to the active site of the enzyme, fitting into the active site (E).
2. The substrate diffuses towards the 'active site' and forms an 'ES' complex (A).
3. The binding of the substrate induces the enzyme to alter its shape, fitting more tightly around the substrate.
4. The active site of the enzyme, now in close proximity of the substrate breaks the chemical bonds of the substrate (D) and the new enzyme-product complex is formed.
5. The enzyme releases the products of the reaction (C) and the free enzyme is ready to bind to another molecule of the substrate (B) and run through the catalytic cycle once again.

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