

Time : **3 hrs.** Q. Paper, Answers & Solutions Max. Marks : **720**
for **NEET (UG) - 2022**

Important Instructions :

- 1 The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on ORIGINAL Copy carefully with blue/ black ball point pen only.
- 2 The test is of **3 hours 20 minutes** duration and the 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 Sections (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 186 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.**
- 3 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.**
- 4 Use **Blue/Black Ball Point Pen** only for writing particulars on this page/ marking responses on Answer Sheet.
- 5 Rough work is to be done in the space provided for this purpose in the Test Booklet only.
- 6 On completion of the test, the candidate **must hand over the Answer Sheet (ORIGINAL and OFFICE Copy)** to the Invigilator before leaving the room/hall. **The candidates are allowed to take away this Test Booklet with them.**
- 7 **The CODE for this Booklet is T1.** Make sure that the CODE printed on the Original Copy of the Answer Sheet **is the same as that on this Test Booklet.** In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.
- 8 The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.
- 9 Use of white fluid for correction is **NOT** permissible on the Answer Sheet.
- 10 Each candidate must show on-demand his/her Admit Card to the Invigilator.
- 11 No candidate, without special permission of the centre Superintendent or Invigilator, would leave his/her seat.
- 12 The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign (with time) the Attendance Sheet **twice. Cases, where a candidate has not signed the Attendance Sheet second time, will be deemed not to have handed over the Answer Sheet and dealt with as an Unfair Means case.**
- 13 Use of Electronic/Manual Calculator is prohibited.
- 14 The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Room/Hall. All cases of unfair means will be dealt with as per the Rules and Regulations of this examination.
- 15 **No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.**
- 16 The candidates will write the Correct Test Booklet Code as given in the Test Booklet/Answer Sheet in the Attendance Sheet.
- 17 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

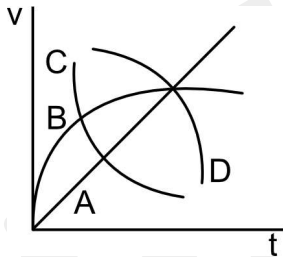
1. A square loop of side 1 m and resistance 1Ω is placed in a magnetic field of 0.5 T. If the plane of loop is perpendicular to the direction of magnetic field, the magnetic flux through the loop is:

- (1) 0.5 weber
- (2) 1 weber
- (3) zero weber
- (4) 2 weber

Ans. (1)

Sol. $\phi = B.A = 0.5 \text{ Wb}$

2. A spherical ball is dropped in a long column of a highly viscous liquid. The curve in the graph shown, which represents the speed of the ball (v) as a function of time (t) is:



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

Ans. (1)

Sol. Speed of the ball increases and becomes constant after a while.

3. The angular speed of a fly wheel moving with uniform angular acceleration changes from 1200 rpm to 3120 rpm in 16 seconds. The angular acceleration in rad/s^2 is:

- (1) 4π
- (2) 12π
- (3) 104π
- (4) 2π

Ans. (1)

Sol. $\alpha = \left(\frac{3120 - 1200}{16} \right) \times \frac{2\pi}{60}$

$$\frac{1920}{16} \times \frac{2\pi}{60} = 4\pi$$

4. The angle between the electric lines of force and the equipotential surface is

- (1) 45°
- (2) 90°
- (3) 180°
- (4) 0°

Ans. (2)

Sol. \vec{E} is always perpendicular to equipotential surfaces.

5. An electric lift with a maximum load of 2000 kg (lift + passengers) is moving up with a constant speed of 1.5 ms^{-1} . The fractional force opposing the motion is 3000 N. The minimum power delivered by the motor to the lift in watts is : ($g = 10 \text{ ms}^{-2}$)

- (1) 20000
- (2) 34500
- (3) 23500
- (4) 23000

Ans. (2)

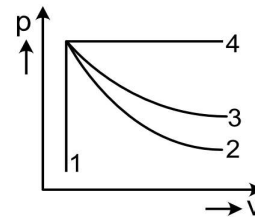
Sol. $P = (mg + f)v$

$$= (2000 \times 10 + 3000) 1.5$$

$$23000 \times 1.5$$

$$= 34500 \text{ N.}$$

6. An ideal gas undergoes four different processes from the same initial state as shown in the figure below. Those processes are adiabatic, isothermal, isobaric and isochoric. The curve which represents the adiabatic process among 1, 2, 3 and 4 is :



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

Ans. (1)

Sol. The curve 2 represents adiabatic process.

7. The peak voltage of the ac source is equal to

- (1) the rms value of the ac source
- (2) $\sqrt{2}$ times the rms value of the ac source
- (3) $1/\sqrt{2}$ times the rms value of the ac source
- (4) the value of voltage supplied to the circuit

Ans. (2)

Sol. $V_0 = \sqrt{2} V_{\text{rms}}$

8. A shell of mass m is at rest initially. It explodes into three fragments having mass in the ratio $2 : 2 : 1$. If the fragments having equal mass fly off along mutually perpendicular directions with speed v , the speed of the third (lighter) fragments is

- (1) $\sqrt{2}v$
- (2) $2\sqrt{2}v$
- (3) $3\sqrt{2}v$
- (4) v

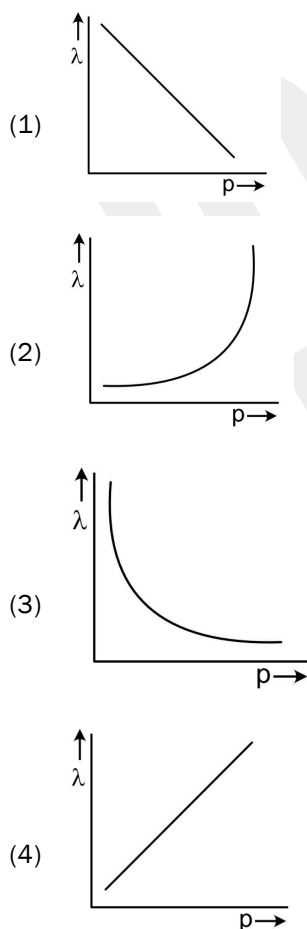
Ans. (2)

$$\text{Sol. } \sqrt{\left(\frac{2m}{5}v\right)^2 + \left(\frac{2m}{5}v\right)^2} = \frac{m}{5}v'$$

$$\sqrt{2} \frac{2}{5}v = \frac{v'}{5}$$

$$v' = 2\sqrt{2}v$$

9. The graph which shows the variation of the de Broglie wavelength (λ) of a particle and its associated momentum (p) is:



Ans. (3)

$$\text{Sol. } \lambda = \frac{h}{p} \quad \lambda \propto \frac{1}{p}$$

10. Two hollow conducting spheres of radii R_1 and R_2 ($R_1 > R_2$) have equal charges. The potential would be:

- (1) more on smaller sphere
- (2) equal on both the spheres
- (3) dependent on the material property of the sphere
- (4) more on bigger sphere

Ans. (1)

$$\text{Sol. } V_{\text{smaller}} = kq \left(\frac{1}{R_1} + \frac{1}{R_2} \right)$$

$$V_{\text{bigger}} = \frac{2kq}{R_1}$$

11. A biconvex lens has radii of curvature, 20 cm each. If the refractive index of the material of the lens is 1.5, the power of the lens is :

- (1) +20 D
- (2) +5 D
- (3) infinity
- (4) +2 D

Ans. (2)

$$\text{Sol. } \frac{1}{f} = (\mu - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

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

$$\Rightarrow f = 20 \text{ cm}$$

$$\Rightarrow P = +5 \text{ D}$$

12. In half wave rectification, if the input frequency is 60 Hz, then the output frequency would be:

- (1) 30 Hz
- (2) 60 Hz
- (3) 120 Hz
- (4) zero

Ans. (2)

Sol. In Half wave rectifier output frequency = input frequency.

13. In a Young's double slit experiment, a student observes 8 fringes in a certain segment of screen when a monochromatic light of 600 nm wavelength is used. If the wavelength of light is changed to 400 nm, then the number of fringes he would observe in the same region of the screen is:

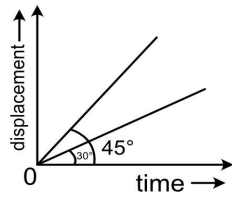
- (1) 8
- (2) 9
- (3) 12
- (4) 6

Ans. (3)

Sol. $600 \times 8 = 400 \times n$, where n is the number of fringes when wavelength = 400 nm.

$$n = 12$$

14. The displacement-time graphs of two moving particles make angles of 30° and 45° with the x-axis as shown in the figure. The ratio of their respective velocity is :



- (1) 1:1
(2) 1:2
(3) $1:\sqrt{3}$
(4) $\sqrt{3}:1$

Ans. (3)

$$\text{Sol. } \frac{V_1}{V_2} = \frac{\tan 30^\circ}{\tan 45^\circ} = \frac{1}{\sqrt{3}}$$

15. The dimensions $[MLT^{-2}A^{-2}]$ belong to the :

- (1) self inductance
(2) magnetic permeability
(3) electric permittivity
(4) magnetic flux

Ans. (2)

$$\text{Sol. } [L] = [M^1L^2T^{-2}A^{-2}]$$

$$[\mu] = [M^1L^1T^{-2}A^{-2}]$$

$$[\epsilon] = [M^{-1}L^{-3}T^4A^2]$$

$$[\phi] = [M^1L^2T^{-2}A^{-1}]$$

16. Let T_1 and T_2 be the energy of an electron in the first and second excited states of hydrogen atom, respectively. According to the Bohr's model of an atom, the ratio $T_1:T_2$ is:

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

Ans. (3)

$$\text{Sol. } E \propto \frac{1}{n^2}$$

$$\text{Hence, } \frac{T_1}{T_2} = \frac{9}{4}$$

17. Two objects of mass 10 kg and 20 kg respectively are connected to the two ends of a rigid rod of length 10 m with negligible mass. The distance of the center of mass of the system from the 10 kg mass is :

- (1) $\frac{20}{3}$ m
(2) 10 m

- (3) 5 m

- (4) $\frac{10}{3}$ m

Ans. (1)

$$\text{Sol. } x = \frac{2}{3} \times 10 = \frac{20}{3} \text{ m}$$

18. When light propagates through a material medium of relative permittivity ϵ_r and relative permeability μ_r , the velocity of light, v is given by: (c - velocity of light in vacuum)

$$(1) v = \sqrt{\frac{\mu_r}{\epsilon_r}}$$

$$(2) v = \sqrt{\frac{\epsilon_r}{\mu_r}}$$

$$(3) v = \frac{c}{\sqrt{\epsilon_r \mu_r}}$$

$$(4) v = c$$

Ans. (3)

$$\text{Sol. } v = \frac{c}{\sqrt{\mu_r \epsilon_r}}$$

19. Two resistors of resistance, 100Ω and 200Ω are connected in parallel in an electrical circuit. The ratio of the thermal energy developed in 100Ω to that in 200Ω in a given time is :

- (1) 2:1
(2) 1:4
(3) 4:1
(4) 1:2

Ans. (1)

$$\text{Sol. } P = \frac{V^2}{R}$$

$$\frac{P_{100}}{P_{200}} = \frac{R_{200}}{R_{100}} = 2:1$$

20. If the initial tension on a stretched string is doubled, then the ratio of the initial and final speeds of a transverse wave along the string is:

- (1) $\sqrt{2}:1$
(2) $1:\sqrt{2}$
(3) 1:2
(4) 1:1

Ans. (2)

$$\text{Sol. } v = \sqrt{\frac{T}{\mu}}$$

So when tension is doubled, v becomes $\sqrt{2}$ times.

Hence, ratio = $1:\sqrt{2}$

21. A light ray falls on a glass surface of refractive index $\sqrt{3}$, at an angle 60° . The angle between the refracted and reflected rays would be:

- (1) 60°
- (2) 90°
- (3) 120°
- (4) 30°

Ans. (2)

Sol. Brewster's law $\tan 60^\circ = \sqrt{3}$

22. The ratio of the radius of gyration of a thin uniform disc about an axis passing through its centre and normal to its plane to the radius of gyration of the disc about its diameter is:

- (1) $\sqrt{2}:1$
- (2) $4:1$
- (3) $1:\sqrt{2}$
- (4) $2:1$

Ans. (1)

Sol. $\frac{MR^2}{2} = I$ (about its axis through the centre)

$$K_1 = \frac{R}{\sqrt{2}}$$

$$\frac{MR^2}{4} = I' \text{ (about its diameter)}$$

$$K_2 = \frac{R}{2}$$

$$\frac{K_1}{K_2} = \sqrt{2}$$

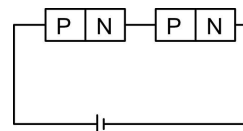
23. The energy that will be ideally radiated by a 100 kW transmitter in 1 hour is:

- (1) $30 \times 10^4 \text{ J}$
- (2) $36 \times 10^5 \text{ J}$
- (3) $1 \times 10^5 \text{ J}$
- (4) $36 \times 10^7 \text{ J}$

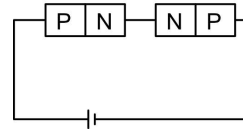
Ans. (4)

Sol. Energy radiated = $100 \times 10^3 \times 3600 = 36 \times 10^7$

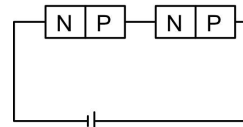
24.



(a)



(b)



(c)

In the given circuits (a), (b) and (c), the potential drop across

- (1) Circuit (b) only
- (2) Circuit (c) only
- (3) Both circuits (a) and (c)
- (4) Circuit (a) only

Ans. (3)

Sol. In the circuit (a) and (c) the potential drop across the two p-n junctions are equal, since both are in forward bias.

25. Plane angle and solid angle have :

- (1) Dimensions but no units
- (2) No units and no dimensions
- (3) Both units and dimensions
- (4) Units but no dimensions

Ans. (4)

Sol. Plane angle and solid angle have units but no dimensions.

26. If a soap bubble expands, the pressure inside the bubble:

- (1) increases
- (2) remains the same
- (3) is equal to the atmosphere pressure
- (4) decreases

Ans. (4)

Sol. $P \propto \frac{1}{r}$ $r \uparrow$ $P \downarrow$

27. A body of mass 60 g experiences a gravitational force of 3.0 N, when placed at a particular point. The magnitude of the gravitational field intensity at that point is

- (1) 50 N/kg
- (2) 20 N/kg
- (3) 180 N/kg
- (4) 0.05 N/kg

Ans. (1)

Sol. $E = \frac{F}{m} = \frac{3}{60 \times 10^{-3}} = \frac{3000}{60} = 50 \text{ N/kg}$

28. **Statement I** : Biot-Savart's law gives us the expression for the magnetic field strength of an infinitesimal current element (Idl) of a current carrying conductor only.

Statement II : Biot-Savart's law is analogous to Coulomb's inverse square law of charge q , with the former being related to the field produced by a scalar source, Idl while the latter being produced by a vector source, q .

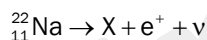
In light of above statements choose the most appropriate answer from the options given below:

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

Ans. (2)

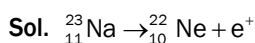
Sol. Statement I is correct, Statement II is wrong because Idl is a vector source while in case of coulomb law, charge is a scalar source.

29. In the given nuclear reaction, the element X is:



- (1) ${}_{10}^{23}\text{Ne}$
- (2) ${}_{10}^{22}\text{Ne}$
- (3) ${}_{12}^{22}\text{Mg}$
- (4) ${}_{11}^{23}\text{Na}$

Ans. (2)



30. A long solenoid of radius 1 mm has 100 turns per mm. If 1 A current flows in the solenoid, the magnetic field strength at the centre of the solenoid is:

- (1) $12.56 \times 10^{-2} \text{ T}$
- (2) $12.56 \times 10^{-4} \text{ T}$
- (3) $6.28 \times 10^{-4} \text{ T}$
- (4) $6.28 \times 10^{-2} \text{ T}$

Ans. (1)

Sol. $B = \mu_0 ni = 4\pi \times 10^{-7} \times \frac{100}{10^{-3}} \times 1 = 12.56 \times 10^{-2} \text{ T}$

31. As the temperature increases, the electrical resistance:

- (1) decreases for both conductors and semiconductors
- (2) increases for conductors but decreases for semiconductors

- (3) decreases for conductors but increases for semiconductors
- (4) increases for both conductors and semiconductors

Ans. (2)

Sol. In case of conductor, resistance increases while it decreases in case of semiconductor.

32. The ratio of the distances travelled by a freely falling body in the 1st, 2nd, 3rd and 4th second:

- (1) 1 : 4 : 9 : 16
- (2) 1 : 3 : 5 : 7
- (3) 1 : 1 : 1 : 1
- (4) 1 : 2 : 3 : 4

Ans. (2)

Sol. Distance travelled in n^{th} second = $\frac{g}{2}(2n-1)$

$$S_1 : S_2 : S_3 : S_4 = 1 : 3 : 5 : 7$$

33. A copper wire of length 10 m and radius $(10^{-2} / \sqrt{\pi}) \text{ m}$ has electrical resistance of 10Ω . The current density in the wire for an electric field strength of 10 (V/m) is:

- (1) 10^6 A/m^2
- (2) 10^{-5} A/m^2
- (3) 10^5 A/m^2
- (4) 10^4 A/m^2

Ans. (3)

Sol. $J = \frac{EI}{RA} = 10^5 \text{ A/m}^2$

34. Match List-I with List-II:

List - I (Electromagnetic waves)		List - II (Wavelength)	
a) AM radio waves		i) 10^{-10} m	
b) Microwaves		ii) 10^2 m	
c) Infrared radiations		iii) 10^{-2} m	
d) X-rays		iv) 10^{-4} m	
	(a) (b) (c) (d)		
(1)	iii ii i iv		
(2)	iii iv ii i		
(3)	ii iii iv i		
(4)	iv iii ii i		

Ans. (3)

Sol. Option (3)

35. When two monochromatic lights of frequency, ν and $\frac{\nu}{2}$ are incident on a photoelectric metal, their stopping

potential becomes $\frac{V_s}{2}$ and V_s respectively. The threshold frequency for this metal is:

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

Ans. (3)

SECTION - B

36. Given below are two statements : One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): The stretching of a spring is determined by the shear modulus of the material of the spring.

Reason (R): A coil spring of copper has more tensile strength than a steel spring of same dimensions. In the light of the above statements, choose the most appropriate answer from the options given below :

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

Ans. (2)

Sol. Option (2)

37. Two pendulums of length 121 cm and 100 cm start vibrating in phase. At some instant, the two are at their mean position in the same phase. The minimum number of vibrations of the shorter pendulum after which the two are again in phase at the mean position is :

- (1) 9
- (2) 10
- (3) 8
- (4) 11

Ans. (4)

Sol. $(n+1)T_1 = nT_2$

$$\frac{n+1}{n} = \frac{T_2}{T_1} = \sqrt{\frac{l_2}{l_1}} = \sqrt{\frac{121}{100}} = \frac{11}{10}$$

$$n = 10$$

smaller oscillate $10 + 1 = 11$

38. The area of a rectangular field (in m^2) of length 55.3 m and breadth 25 m after rounding off the value for correct significant digits is :

- (1) 1382
- (2) 1382.5
- (3) 14×10^2
- (4) 138×10^1

Ans. (3)

Sol. Area = $55.3 \times 25 = 1382 = 14 \times 10^2 m^2$

39. A ball is projected with a velocity, 10 ms^{-1} , at an angle of 60° with the vertical direction. Its speed at the highest point of its trajectory will be:

- (1) $5\sqrt{3} \text{ ms}^{-1}$
- (2) 5 ms^{-1}
- (3) 10 ms^{-1}
- (4) Zero

Ans. (1)

Sol. $u \cos \theta = 10 \cos 30^\circ = 5\sqrt{3} \text{ m/s}$

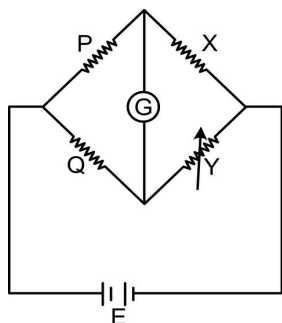
40. Match List-I with List-II

	List - I	List - II
a)	Gravitational constant (G)	i) $[L^2T^{-2}]$
b)	Gravitational potential energy	ii) $[M^{-1}L^3T^{-2}]$
c)	Gravitational potential	iii) $[LT^{-2}]$
d)	Gravitational intensity	iv) $[ML^2T^{-2}]$
	(a) (b) (c) (d)	
(1)	ii iv i iii	
(2)	ii iv iii i	
(3)	iv ii i iii	
(4)	ii i iv iii	

Ans. (1)

Sol. Option (1)

41. A wheatstone bridge is used to determine the value of unknown resistance X by adjusting the variable resistance Y as shown in the figure. For the most precise measurement of X , the resistances P and Q :



- (1) should be approximately equal and are small
- (2) should be very large and unequal
- (3) do not play any significant role
- (4) should be approximately equal to $2X$

Ans. (1)

Sol. Option (1)

42. From Ampere's circuital law for a long straight wire of circular cross-section carrying a steady current, the variation of magnetic field in the inside and outside region of the wire is:

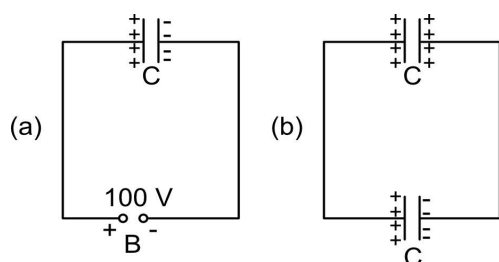
- (1) a linearly increasing function of distance upto the boundary of the wire and then linearly decreasing for the outside region.
- (2) a linearly increasing function of distance r upto the boundary of the wire and then decreasing one with $1/r$ dependence for the outside region.
- (3) a linearly decreasing function of distance upto the boundary of the wire and then a linearly increasing one for the outside region
- (4) uniform and remains constant for both the regions.

Ans. (2)

Sol. $B \propto r$ ($r \leq R$)

$$B \propto \frac{1}{r} \quad (r \geq R)$$

43. A capacitor of capacitance $C=900$ pF is charged fully by 100 V battery B as shown in figure (a). Then it is disconnected from the battery and connected to another uncharged capacitor of capacitance $C=900$ pF as shown in figure (b). The electrostatic energy stored by the system (b) is:



- (1) 3.25×10^{-6} J
- (2) 2.25×10^{-6} J
- (3) 1.5×10^{-6} J
- (4) 4.5×10^{-6} J

Ans. (2)

$$\text{Sol. } U = \frac{(9 \times 10^{-10} \times 10^2)^2}{2 \times 18 \times 10^{-10}} = 2.25 \times 10^{-6} \text{ J}$$

44. The volume occupied by the molecules contained in 4.5 kg water at STP, if the intermolecular forces vanish away is :

- (1) 5.6×10^3 m³
- (2) 5.6×10^{-3} m³
- (3) 5.6 m³
- (4) 5.6×10^6 m³

Ans. (3)

Sol. Each mole will occupy 22.4×10^{-3} m³

$$\text{No. of moles} = \frac{4500}{18}$$

$$\text{Volume} = 22.4 \times 10^{-3} \times \frac{4500}{18} = 5.6 \text{ m}^3$$

45. A nucleus of mass number 189 splits into two nuclei having mass number 125 and 64 . The ratio of radius of two daughter nuclei respectively is :

- (1) 4:5
- (2) 5:4
- (3) 25:16
- (4) 1:1

Ans. (2)

$$\text{Sol. } \frac{r_1}{r_2} = \left(\frac{125}{64} \right)^{1/3} = \frac{5}{4}$$

46. A big circular coil of 1000 turns and average radius 10 m is rotating about its horizontal diameter at 2 rad s^{-1} . If the vertical component of earth's magnetic field at that place is 2×10^{-5} T and electrical resistance of the coil is 12.56Ω , then the maximum induced current in the coil will be:

- (1) 1.5 A
- (2) 1 A
- (3) 2 A
- (4) 0.25 A

Ans. (2)

$$\text{Sol. } I_{\max} = \frac{nAB\omega}{R} = \frac{1000 \times \pi \times 10^2 \times 2 \times 10^{-5} \times 2}{12.56} = 1 \text{ A}$$

47. A series LCR circuit with inductance 10 H, capacitance $10 \mu\text{F}$, resistance 50Ω is connected to an ac source of voltage, $V=200 \sin(100 t)$ volt. If the resonant frequency of the LCR circuit is ν_0 and the frequency of the ac source is ν , then:

(1) $\nu_0 = \nu = \frac{50}{\pi}$ Hz

(2) $\nu_0 = \frac{50}{\pi}$ Hz, $\nu = 50$ Hz

(3) $\nu = 100$ Hz; $\nu_0 = \frac{100}{\pi}$ Hz

(4) $\nu_0 = \nu = 50$ Hz

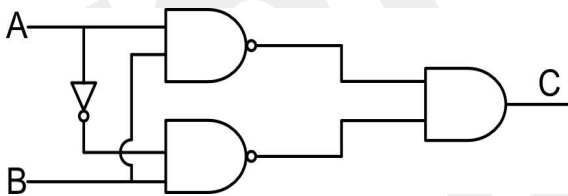
Ans. (1)

Sol. $V = 200 \sin(100 t)$

$$\nu = \frac{50}{\pi}$$

$$\nu = \frac{1}{2\pi} \times \frac{1}{\sqrt{LC}} = \frac{1}{2\pi} \times \frac{1}{\sqrt{10 \times 10^{-5}}} = \frac{100}{2\pi}$$

48.



The truth table for the given logic circuit is :

A	B	C
0	0	1
0	1	0
1	0	0
1	1	1

(1)

A	B	C
0	0	1
0	1	0
1	0	1
1	1	0

(2)

A	B	C
0	0	0
0	1	1
1	0	0
1	1	1

(3)

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

(4)

Ans. (2)

Sol. $(\overline{A}B)(\overline{A}\overline{B})$

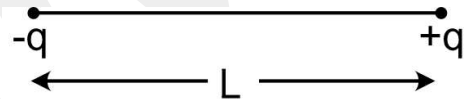
$$(\overline{A} + \overline{B})(A + \overline{B})$$

$$A\overline{B} + \overline{A}\overline{B} + \overline{B}$$

$$\overline{B}(A + 1) + \overline{A}\overline{B}$$

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

49. Two point charges $-q$ and $+q$ are placed at a distance of L , as shown in the figure.



The magnitude of electric field intensity at a distance R ($R \gg L$) varies as :

(1) $\frac{1}{R^3}$

(2) $\frac{1}{R^4}$

(3) $\frac{1}{R^6}$

(4) $\frac{1}{R^2}$

Ans. (1)

Sol. For dipole $E \propto \frac{1}{r^3}$

50. Two transparent media A and B are separated by a plane boundary. The speed of light in those media are 1.5×10^8 m/s and 2.0×10^8 m/s, respectively. The critical angle for a ray of light for these two media is:

(1) $\sin^{-1}(0.750)$

(2) $\tan^{-1}(0.500)$

(3) $\tan^{-1}(0.750)$

(4) $\sin^{-1}(0.500)$

Ans. (1)

Sol. $\sin \theta_c = \frac{\mu_1}{\mu_2} = \frac{1.5}{2} = 0.75$

$$\theta_c = \sin^{-1}(0.75)$$

CHEMISTRY

51. Match the List-I with List-II

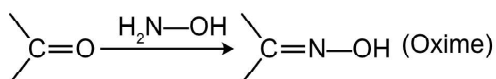
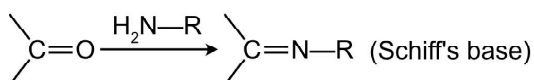
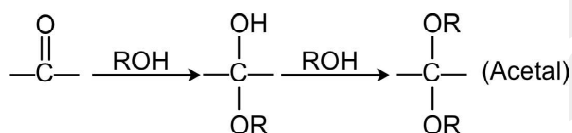
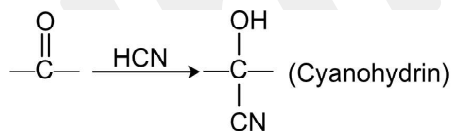
List - I	List - II
(Products formed)	(Reaction of carbonyl compound with)
a) Cyanohydrin	i) NH_2OH
b) Acetal	ii) RNH_2
c) Schiff's base	iii) alcohol
d) Oxime	iv) HCN

Choose the correct answer from the options given below :

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

Ans. (3)

Sol:



52. Given below are two statements:

Statement I : The boiling points of the following hydrides of group 16 elements increases in the order $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$.

Statement II : The boiling points of these hydrides increase with increase in molar mass.

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

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

Ans. (1)

Sol: $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{O}$

From H_2S to H_2Te B.P increases with its Molecular weight, but in H_2O , highest B.P is due to H-bond.

53. Which one is not correct mathematical equation for Dalton's Law of partial pressure? Here p = total pressure of gaseous mixture

(1) $p = n_1 \frac{RT}{V} + n_2 \frac{RT}{V} + n_3 \frac{RT}{V}$

(2) $p_i = X_i p$, where p_i = partial pressure of i^{th} gas
 X_i = mole fraction of i^{th} gas in gaseous mixture

(3) $p_i = X_i p_i^0$, where X_i = mole fraction of i^{th} gas in gaseous mixture

 p_i^0 = pressure of i^{th} gas in pure state

(4) $p = p_1 + p_2 + p_3$

Ans. (3)

Sol: Represents Raoult's law.

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

Assertion (A) : In a particular point defect, an ionic solid is electrically neutral, even if few of its cations are missing from its unit cells.

Reason (R) : In an ionic solid, Frenkel defect arises due to dislocation of cation from its lattice site to interstitial site, maintaining overall electrical neutrality.

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

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

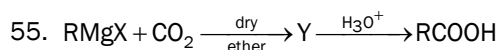
(2) (A) is correct but (R) is not correct

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

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

Ans. (4)

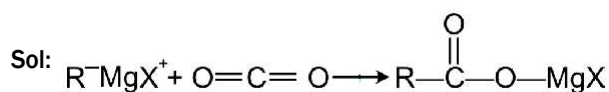
Sol: In Point defect the overall crystal maintains electrical neutrality.



What is Y in the above reaction?

- (1) $\text{R}_3\text{CO}^-\text{Mg}^+\text{X}$
- (2) RCOO^-X^+
- (3) $(\text{RCOO})_2\text{Mg}$
- (4) $\text{RCOO}^-\text{Mg}^+\text{X}$

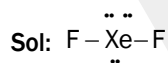
Ans. (4)




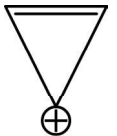

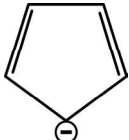
56. Amongst the following which one will have maximum 'lone pair - lone pair' electron repulsions?

- (1) IF_5
- (2) SF_4
- (3) XeF_2
- (4) ClF_3

Ans. (3)



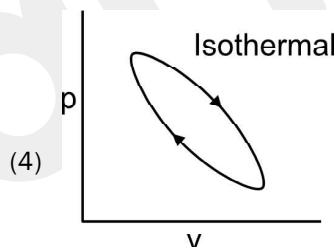
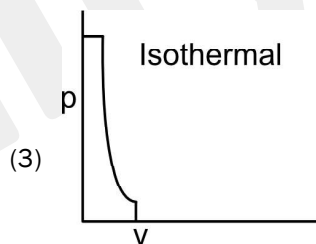
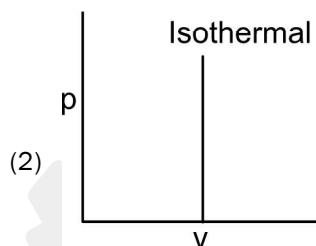
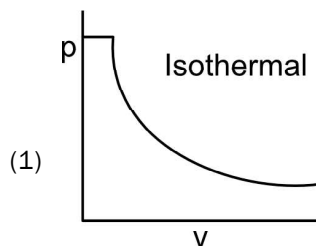
57. Which compound amongst the following is not an aromatic compound?

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

Ans. (3)

Sol: It is non planar as sp^3 Carbon is present.

58. Which of the following p - V curve represents maximum work done?



Ans. (1)

Sol: $W = P\Delta V$

59. Which of the following statement is not correct about diborane?

- (1) The four terminal B-H bonds are two centre two electron bonds
- (2) The four terminal Hydrogen atoms and the two Boron atoms lie in one plane.
- (3) Both the Boron atoms are sp^2 hybridised
- (4) There are two 3-centre-2-electron bonds

Ans. (3)

Sol: Boron atom is sp^3 Hybridized.

60. Given below are two statements:

Statement I : The acidic strength of monosubstituted nitrophenol is higher than phenol because of electron withdrawing nitro group.

Statement II : o-nitrophenol, m-nitrophenol and p-nitrophenol will have same acidic strength as they have one nitro group attached to the phenolic ring.

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

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

Ans. (2)

Sol: Acidic strength \propto EWG

EWG = Electron Withdrawing Group.

61. Which amongst the following is **incorrect** statement?

- (1) C_2 molecule has four electrons in its two degenerate π molecular orbitals
- (2) H_2^+ ion has one electron.
- (3) O_2^+ ion is diamagnetic
- (4) The bond orders of O_2^+ , O_2 , O_2^- and O_2^{2-} are 2.5, 2, 1.5 and 1, respectively.

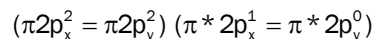
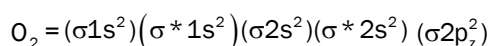
Ans. (3)

Sol: (1) $C_2 = (\sigma 1s^2)(\sigma^* 1s^2)(\sigma 2s^2)(\sigma^* 2s^2)(\pi 2p_x^2 = \pi 2p_y^2)$

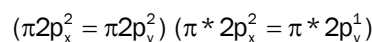
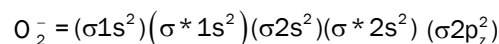
C_2 molecule has 4 electrons in its two degenerate π molecular orbitals.

- (2) $H_2^+ = \sigma 1s^1$ H_2^+ ion has 1 electron.
- (3) $O_2^+ = (\sigma 1s^2)(\sigma^* 1s^2)(\sigma 2s^2)(\sigma^* 2s^2)(\sigma 2p_z^2)$
 $(\pi 2p_x^2 = \pi 2p_y^2)$ ($\pi^* 2p_x^1 = \pi^* 2p_y^0$)
 O_2^+ is a paramagnetic
- (4) $O_2^+ = (\sigma 1s^2)(\sigma^* 1s^2)(\sigma 2s^2)(\sigma^* 2s^2)(\sigma 2p_z^2)$
 $(\pi 2p_x^2 = \pi 2p_y^2)$ ($\pi^* 2p_x^1 = \pi^* 2p_y^0$)

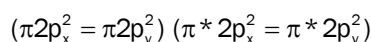
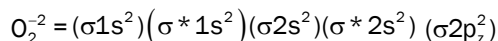
$$\text{Bond order} = \frac{10-5}{2} = \frac{5}{2} = 2.5$$



$$\text{Bond order} = \frac{10-6}{2} = \frac{4}{2} = 2$$



$$\text{Bond order} = \frac{10-7}{2} = \frac{3}{2} = 1.5$$



$$\text{Bond order} = \frac{10-8}{2} = 1$$

62. In one molal solution that contains 0.5 mole of a solute, there is

- (1) 500 g of solvent
- (2) 100 mL of solvent
- (3) 1000 g of solvent
- (4) 500 mL of solvent

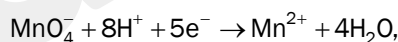
Ans. (1)

Sol: $m = \frac{\text{moles of solute}}{\text{mass of solvent (kg)}}$

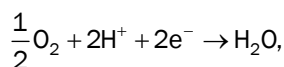
$$1 = \frac{0.5}{a}$$

$$\therefore \text{mass of solvent (a)} = 0.5 \text{ kg} = 500 \text{ g.}$$

63. Given below are half cell reactions:



$$E_{Mn^{2+}/MnO_4^-}^{\circ} = -1.510 \text{ V}$$



$$E_{O_2/H_2O}^{\circ} = +1.223 \text{ V}$$

Will the permanganate ion, MnO_4^- liberate O_2 from water in the presence of an acid?

- (1) No, because $E_{\text{cell}}^{\circ} = -0.287 \text{ V}$
- (2) Yes, because $E_{\text{cell}}^{\circ} = +2.733 \text{ V}$
- (3) No, because $E_{\text{cell}}^{\circ} = -2.733 \text{ V}$
- (4) Yes, because $E_{\text{cell}}^{\circ} = +0.287 \text{ V}$

Ans. (4)

Sol: $E_{\text{Cell}} = E_{\text{cathode}}^{\circ} - E_{\text{Anode}}^{\circ}$

$$= E_{MnO_4^-/Mn^{2+}}^{\circ} - E_{O_2/H_2O}^{\circ}$$

$$= 1.51 - 1.223 = 0.287.$$

64. Identify the incorrect statement from the following.

- (1) All the five 4d orbitals have shapes similar to the respective 3d orbitals.
- (2) In an atom, all the five 3d orbitals are equal in energy in free state.
- (3) The shapes of d_{xy} , d_{yz} , and d_{zx} orbitals are similar to each other; and $d_{x^2-y^2}$ and d_{z^2} are similar to each other.
- (4) All the five 5d orbitals are different in size when compared to the respective 4d orbitals.

Ans. (3)

Sol: The shape of d_{xy} , d_{yz} , d_{zx} = dumbbell

$d_{x^2-y^2}$ = dumbbell

d_{z^2} = dumbbell shape with a doughnut - s h a p e d electroncloud in the center.

65. At 298K, the standard electrode potentials of $\text{Cu}^{2+} / \text{Cu}$, $\text{Zn}^{2+} / \text{Zn}$, $\text{Fe}^{2+} / \text{Fe}$ and Ag^+ / Ag are 0.34 V, -0.76 V, -0.44 V and 0.80 V, respectively.

On the basis of standard electrode potential predict

Which of the following reaction can not occur?

- (1) $\text{CuSO}_4(\text{aq}) + \text{Fe}(\text{s}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s})$
- (2) $\text{FeSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Fe}(\text{s})$
- (3) $2\text{CuSO}_4(\text{aq}) + 2\text{Ag}(\text{s}) \rightarrow 2\text{Cu}(\text{s}) + \text{Ag}_2\text{SO}_4(\text{aq})$
- (4) $\text{CuSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu}(\text{s})$

Ans. (3)

Sol: 'Ag' has high S.R.P, So it oxidises by 'Cu' but not reduced.

66. Match List-I with List-II.

List - I (Hydrides)	List - II (Nature)
a) MgH_2	i) Electron precise
b) GeH_4	ii) Electron deficient
c) B_2H_6	iii) Electron rich
d) HF	iv) Ionic

Choose the correct answer from the options given below:

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

Ans. (4)

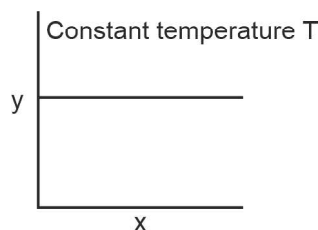
Sol: MgH_2 is ionic hydride

GeH_4 has exact 8 electrons in Octet

B_2H_6 is electron Deficient

HF is electron Rich hydride

67. The given graph is a representation of kinetics of a reaction



The y and x axes for zero and first order reactions, respectively are

- (1) zero order (y = concentration and x = time), first order (y = rate constant and x = concentration)
- (2) zero order (y = rate and x = concentration), first order ($y = t_{1/2}$ and x = concentration)
- (3) zero order (y = rate and x = concentration), first order (y = rate and $x = t_{1/2}$)
- (4) zero order (y = concentration and x = time), first order ($y = t_{1/2}$ and x = concentration)

Ans. (2)

Sol: For a zero order reaction rate is independent of concentration of reactant.

For a first order reaction $t_{1/2}$ is independent of initial concentration of reactant

68. Given below are two statements:

Statement I : In the coagulation of a negative sol, the flocculating power of the three given ions is in the order-
 $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$

Statement II : In the coagulation of a positive sol, the flocculating power of the three given salts is in the order-
 $\text{NaCl} > \text{Na}_2\text{SO}_4 > \text{Na}_3\text{PO}_4$

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

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

Ans. (2)

Sol: Greater the positive charge, greater will be flocculation power.

Flocculation power \propto charge.

While coagulating positive sols, negative charge must be high.

69. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : ICl is more reactive than I₂.

Reason (R) : I-Cl bond is weaker than I-I bond.

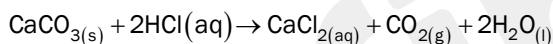
In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
- (2) (A) is correct but (R) is not correct.
- (3) (A) is not correct but (R) is correct.
- (4) Both (A) and (R) are correct but (R) is the correct explanation of (A).

Ans. (4)

Sol: Interhalogens are more reactive than halogens expect F₂ because the bond energy in interhalogen compound is weak.

70. What mass of 95% pure CaCO₃ will be required to neutralise 50 mL of 0.5 M HCl solution according to the following reaction?

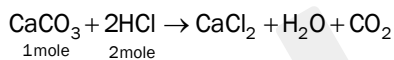


[Calculate up to second place of decimal point]

- (1) 1.32 g
- (2) 3.65 g
- (3) 9.50 g
- (4) 1.25 g

Ans. (1)

Sol:



$$\begin{array}{ccc} 1\text{mole} & 2\text{mole} & \\ ? & \frac{0.5}{20} & \end{array}$$

$$\text{No. of moles of CaCO}_3 = \frac{1}{80}$$

$$\text{Wt. of 100\% CaCO}_3 = \frac{1}{80} \times 100 = 1.25$$

$$\text{Wt. of 95\% CaCO}_3 = 1.3157 \approx 1.32 \text{ g}$$

71. Which statement regarding polymer is **not correct**?

- (1) Fibers possess high tensile strength
- (2) Thermoplastic polymers are capable of repeatedly softening and hardening on heating and cooling respectively.
- (3) Thermosetting polymers are reusable.
- (4) Elastomers have polymer chains held together by weak intermolecular forces.

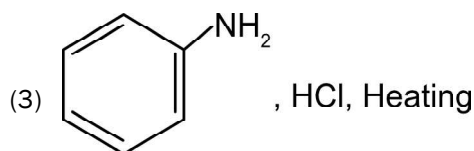
Ans. (3)

Sol: Thermosetting polymers are not reusable, as they have

permanent chemical change.

72. Which of the following sequence of reactions is suitable to synthesize chlorobenzene?

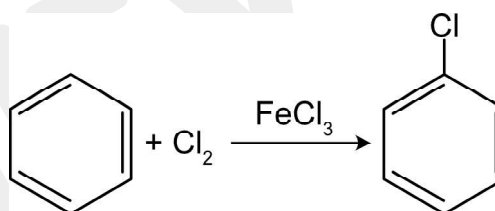
- (1) Phenol, NaNO₂, HCl, CuCl



- (4) Benzene, Cl₂, anhydrous FeCl₃

Ans. (4)

Sol:



73. Match List-I with List-II.

List - I	List - II
a) Li	i) absorbent for carbon dioxide
b) Na	ii) electrochemical cells
c) KOH	iii) coolant in fast breeder reactors
d) Cs	iv) photoelectric cell

Choose the correct answer from the options given below:

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

Ans. (3)

Sol: Li used in electrochemical cells

Na used as coolant in fast breeder reactors

KOH absorbs CO₂ to form K₂CO₃.

Cs used in photo electric cell due to low I.E.

74. The incorrect statement regarding enzymes is:

- (1) Like chemical catalysts enzymes reduce the activation energy of bio processes.
- (2) Enzymes are polysaccharides.
- (3) Enzymes are very specific for a particular reaction and substrate.
- (4) Enzymes are biocatalysts.

Ans. (2)

Sol: Enzymes are poly-peptides, made up of poly Amino acids.

75. Match List-I with List-II.

List - I (Drug Class)	List - II (Drug molecule)
a) Antacids	i) Salvarsan
b) Antihistamines	ii) Morphine
c) Analgesics	iii) Cimetidine
d) Antimicrobial	iv) Seldane

Choose the correct answer from the options given below:

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

Ans. (1)

Sol:

Seldane	-	Antihistamine
Cimetidine	-	Antacids
Morphine	-	Analgesics
Salvarsan	-	Antimicrobial

76. Identify the incorrect statement from the following

- (1) The oxidation number of K in KO_2 is +4.
- (2) Ionisation enthalpy of alkali metals decreases from top to bottom in the group.
- (3) Lithium is the strongest reducing agent among the alkali metals.
- (4) Alkali metals react with water to form their hydroxides.

Ans. (1)

Sol: Alkali metals always show only +1 oxidation state.

77. Gadolinium has a low value of third ionisation enthalpy because of

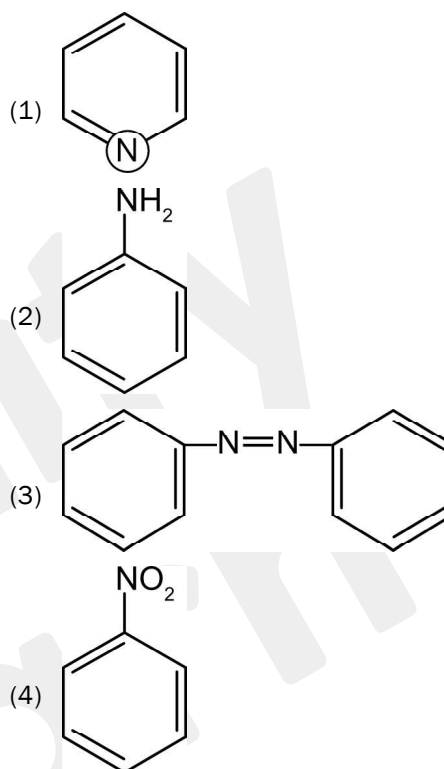
- (1) high exchange enthalpy

- (2) high electronegativity
- (3) high basic character
- (4) small size

Ans. (1)

Sol: $4f^7 \rightarrow$ subshell high exchange enthalpy.

78. The Kjeldhal's method for the estimation of nitrogen can be used to estimate the amount of nitrogen in which one of the following compounds?



Ans. (2)

Sol: Kjeldhal method is not applicable to compounds containing nitrogen in nitro and azo groups and nitrogen present in the ring (e.g. pyridine) as nitrogen of these compounds does not change to ammonium sulphate under these conditions.

79. The pH of the solution containing 50 mL each of 0.10 M sodium acetate and 0.01 M acetic acid is

[Given pK_a of $CH_3COOH = 4.57$]

- (1) 3.57
- (2) 4.57
- (3) 2.57
- (4) 5.57

Ans. (4)

Sol: $pH = pK_a + \log_{10} \frac{[acid]}{[salt]}$

$$pH = 4.57 + \log_{10} \left(\frac{50 \times 0.1}{0.01 \times 50} \right)$$

$$pH = 4.57 + 1 = 5.57$$

80. Given below are two statements:

Statement I :

The boiling points of aldehydes and ketones are higher than hydrocarbons of comparable molecular masses because of weak molecular association in aldehydes and ketones due to dipole - dipole interactions.

Statement II :

The boiling points of aldehydes and ketones are lower than the alcohols of similar molecular masses due to the absence of H-bonding

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

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

Ans. (4)

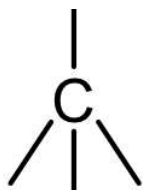
Sol: Carbonyl compounds of comparable molar mass donot show hydrogen bonding, hence boiling point is lesser than alcohols.

81. Choose the correct statement :

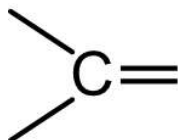
- (1) Diamond is covalent and graphite is ionic.
- (2) Diamond is sp^3 hybridised and graphite is sp^2 hybridized.
- (3) Both diamond and graphite are used as dry lubricants.
- (4) Diamond and graphite have two dimensional network.

Ans. (2)

Sol:



Diamond has sp^3 carbon and tetrahedral shape.



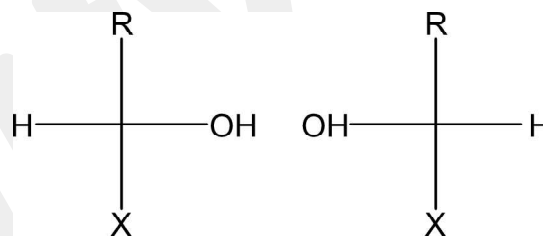
Graphite has sp^2 carbon with Hexagonal rings (due to delocalised electron).

82. The **incorrect** statement regarding chirality is:

- (1) The product obtained by S_N2 reaction of haloalkane having chirality at the reactive site shows inversion of configuration.
- (2) Enantiomers are superimposable mirror images on each other.
- (3) A racemic mixture shows zero optical rotation.
- (4) S_N1 reaction yields 1 : 1 mixture of both enantiomers.

Ans. (2)

Sol: Enatiomers are non-superimposable mirror images



83. The IUPAC name of an element with atomic number 119 is

- (1) unnilennium
- (2) unununnium
- (3) ununoctium
- (4) ununennium

Ans. (4)

Sol: 1 = un

9 = enn

∴ The IUPAC name ununennium.

84. The IUPAC name of the complex -

$[Ag(H_2O)_2][Ag(CN)_2]$ is:

- (1) diaquasilver (II) dicyanidoargentate (II)
- (2) dicyanidosilver (I) diaquaargentate (I)
- (3) diaquasilver (I) dicyanidoargentate (I)
- (4) dicyanidosilver (II) diaquaargentate (II)

Ans. (3)

Sol: Ag in first complex as silver (+ve oxidation state)

Ag in second complex as Argentate (-ve oxidation state).

85. Given below are two statements:

Statement I : Primary aliphatic amines react with HNO_2 to give unstable diazonium salts.

Statement II : Primary aromatic amines react with HNO_2 to form diazonium salts which are stable even above 300 K.

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

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

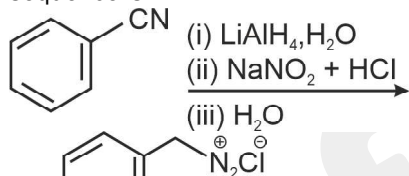
Ans. (2)

Sol: $\text{R}-\overset{\oplus}{\text{N}}\equiv\text{N Cl}^-$, unstable

$\text{Ar}-\overset{\oplus}{\text{N}}\equiv\text{N Cl}^-$, unstable at 27°C but stable at 0°C .

SECTION - B

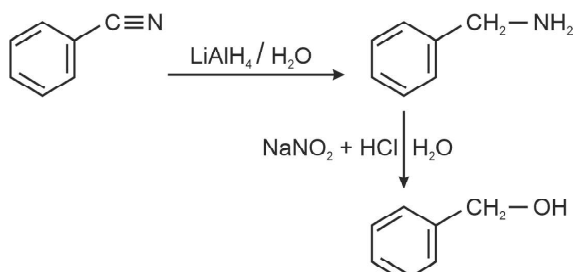
86. The product formed from the following reaction sequence is



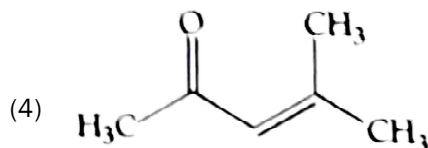
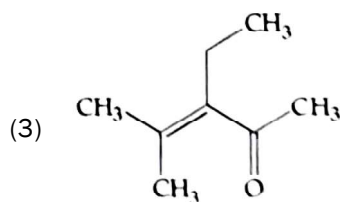
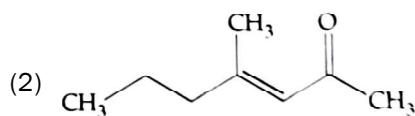
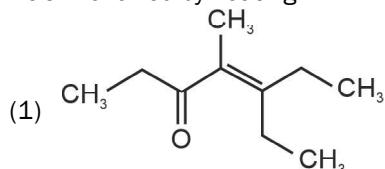
- (1)
- (2)
- (3)
- (4)

Ans. (3)

Sol:

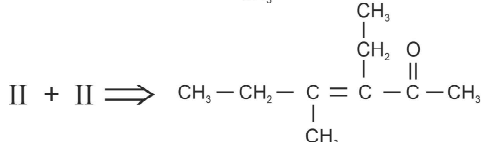
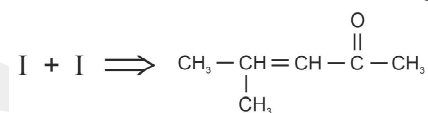
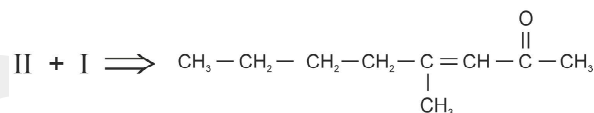
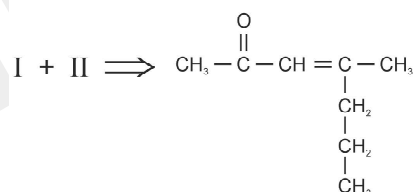
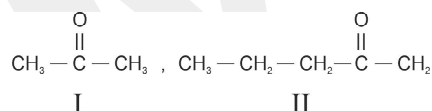


87. Which one of the following is not formed when acetone reacts with 2-pentanone in the presence of dilute NaOH followed by heating?



Ans. (1)

Sol:



88. The pollution due to oxides of sulphur gets enhanced due to the presence of :

- (a) particulate matter
- (b) ozone
- (c) hydrocarbons
- (d) hydrogen peroxide

Choose the most appropriate answer from the options given below

- (1) (a), (b), (d) only
- (2) (b), (c), (d) only
- (3) (a), (c), (d) only
- (4) (a), (d) only

Ans. (1)

Sol: $\text{SO}_2 + \text{O}_3 \rightarrow \text{SO}_3 + \text{O}_2$

$\text{SO}_2 + \text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{SO}_4$

Particulate matter.

89. $3O_2(g) \rightleftharpoons 2O_3(g)$ for the above reaction at 298 K, K_c is found to be 3.0×10^{-59} . If the concentration of O_2 at equilibrium is 0.040 M then concentration of O_3 in M is

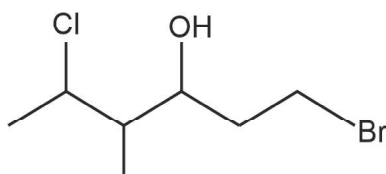
- (1) 1.9×10^{-63}
- (2) 2.4×10^{31}
- (3) 1.2×10^{21}
- (4) 4.38×10^{-32}

Ans. (4)

Sol: $K_c = \frac{[O_3]^2}{[O_2]^3}$

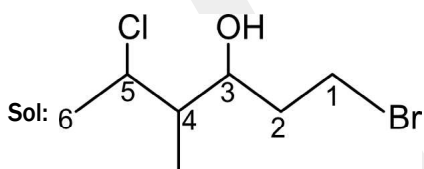
$$[O_3] = \sqrt{K_c [O_2]^3} = 4.38 \times 10^{-32}$$

90. The correct IUPAC name of the following compound is:



- (1) 6-bromo-2-chloro-4-methylhexan-4-ol
- (2) 1-bromo-4-methyl-5-chlorohexan-3-ol
- (3) 6-bromo-4-methyl-2-chlorohexan-4-ol
- (4) 1-bromo-5-chloro-4-methylhexan-3-ol

Ans. (4)



91. In the neutral or faintly alkaline medium, $KMnO_4$ oxidises iodide into iodate. The change in oxidation state of manganese in this reaction is from

- (1) +6 to +4
- (2) +7 to +3
- (3) +6 to +5
- (4) +7 to +4

Ans. (4)

Sol: In faintly alkaline medium $KMnO_4$ will be reduced to MnO_2 , therefore change in oxidation state will be +7 to +4.

92. The order of energy absorbed which is responsible for the color of complexes.

- (A) $[Ni(H_2O)_2(en)_2]^{2+}$
- (B) $[Ni(H_2O)_4(en)]^{2+}$ and

(C) $[Ni(en)_3]^{2+}$

is

- (1) (C) > (B) > (A)
- (2) (C) > (A) > (B)
- (3) (B) > (A) > (C)
- (4) (A) > (B) > (C)

Ans. (2)

Sol: $E_{\text{absorbed}} = C > A > B$

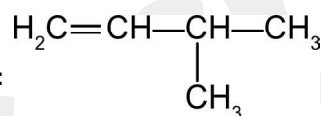
$$[Ni(en)_3]^{2+} > [Ni(H_2O)_2(en)_2]^{2+} > [Ni(H_2O)_4(en)]^{2+}$$

Number of bidentate ligands are decreases, then its crystal field stabilisation energy decreases. Hence E_{absorbed} also decreases.

93. Compound X on reaction with O_3 followed by Zn/H_2O gives formaldehyde and 2-methyl propanal as products. The compound X is:

- (1) 2-Methylbut-1-ene
- (2) 2-Methylbut-1-ene
- (3) Pent-2-ene
- (4) 3-Methylbut-1-ene

Ans. (4)



94. Given below are two statements

Statement I:

In Lucas test, primary, secondary and tertiary alcohols are distinguished on the basis of their reactivity with conc. $HCl + ZnCl_2$, known as Lucas reagent.

Statement II :

Primary alcohols are most reactive and immediately produce turbidity at room temperature on reaction with Lucas reagent.

In the light of the above statements, choose the most appropriate answer from the option given below.

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

Ans. (2)

Sol: Tertiary alcohols can form stable carbocation and react fast and give white turbidity with Lucas reagent. Primary alcohols do not react with Lucas reagent.

95. A 10.0 L flask contains 64 g of oxygen at 27° C. (Assume O₂ gas is behaving ideally). The pressure inside the flask in bar is

(Given R = 0.0831 L bar K⁻¹ mol⁻¹)

- (1) 498.6
- (2) 49.8
- (3) 4.9
- (4) 2.5

Ans. (3)

Sol: PV = nRT

$$P \times 10 = \frac{64}{32} \times 0.0831 \times 300$$

$$P = 4.986 \text{ atm}$$

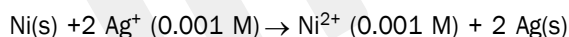
96. If radius of second Bohr orbit of the He⁺ ion is 105.8 pm, what is the radius of third Bohr orbit of Li²⁺ ion?

- (1) 15.87 pm
- (2) 1.587 pm
- (3) 158.7A°
- (4) 158.7 pm

Ans. (4)

Sol: $r = \frac{r_H \times n^2}{Z}$ pm.

97. Find the emf of the cell in which the following reaction takes place at 298 K



(Given that $E_{\text{cell}}^{\circ} = 10.5 \text{ V}$, $\frac{2.303 RT}{F} = 0.059$ at 298 K)

- (1) 1.385 V
- (2) 0.9615 V
- (3) 1.05 V
- (4) 1.0385 V

Ans. (2)

Sol: 2 is correct answer if $E_{\text{cell}}^{\circ} = 1.05 \text{ V}$ (from the given data there no answer).

$$E = 1.05 - \frac{0.0591}{2} \log \frac{10^{-3}}{(10^{-3})^2}$$

$$= 0.9615 \text{ V.}$$

98. Copper crystallises in fcc unit cell with cell edge length of 3.608×10^{-8} cm. The density of copper is 8.92 g cm^{-3} . Calculate the atomic mass of copper.

- (1) 31.55 u
- (2) 60 u
- (3) 65 u
- (4) 63.1 u

Ans. (4)

Sol: $d = \frac{A \times Z}{N_0 \times a^3}$

99. Match List-I with List-II

List - I (Ores)	List - II (Composition)
a) Haematite	i) Fe ₃ O ₄
b) Magnetite	ii) ZnCO ₃
c) Calamine	iii) Fe ₂ O ₃
d) Kaolinite	iv) [Al ₂ (OH) ₄ Si ₂ O ₅]

Choose the correct answer from the options given below

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

Ans. (1)

Sol:

Haematite - Fe₂O₃

Magnetite - Fe₃O₄

Calamine - ZnCO₃

Kaolinite - [Al₂(OH)₄Si₂O₅]

100. For a first order reaction A → Products, initial concentration of A is 0.1 M, which becomes 0.001 M after 5 minutes. Rate constant for the reaction in min⁻¹ is

- (1) 0.9212
- (2) 0.4606
- (3) 0.2303
- (4) 1.3818

Ans. (1)

Sol: $K = \frac{2.303}{t} \log \frac{a}{a-x}$

$$K = \frac{2.303}{5} \log \frac{0.1}{0.001} = 0.9212$$

$$A = \frac{(3.608 \times 10^{-8})^3 \times 6.02 \times 10^{23} \times 8.92}{4}$$

$$A = 63.1 \text{ u.}$$

BOTANY
SECTION - A

101. Given below are two statements:

Statement I : The primary CO_2 acceptor in C_4 plants is phosphoenolpyruvate and is found in the mesophyll cells.

Statement II : Mesophyll cells of C_4 plants lack RuBisCo enzyme.

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

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

Ans. (4)

Sol. The primary CO_2 acceptor in C_4 plant is PEP and is found in the mesophyll cells. Mesophyll cells of C_4 plants lack RuBisCO enzyme.

102. Given below are two statements : one is labelled as Assertion (A) and the other is : labelled as reason(R).

Assertion (A) : Polymerase chain reaction is used in DNA amplification

Reason (R) : The ampicillin resistant gene is used as a selectable marker to check transformation

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

- (1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (2) (A) is correct but (R) is not correct
- (3) (A) is not correct but (R) is correct
- (4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Ans. (1)

Sol. Polymerase chain reaction is used in DNA amplification. The ampicillin resistant gene is used as a selectable marker to check transformation. Here both assertion and reason is correct but the reason is not correct explanation of the assertion.

103. The gaseous plant growth regulator is used in plants to

- (1) promote root growth and root hair formation to increase the absorption surface
- (2) help overcome apical dominance
- (3) kill dicotyledonous weeds in the fields
- (4) speed up the malting process

Ans. (1)

Sol. Gaseous plant growth regulator is ethylene which promotes root growth and root hair formation to increase the absorption surface.

104. In old trees the greater part of secondary xylem is dark brown and resistant to insect attack due to :

- (a) secretion of secondary metabolites and their deposition in the lumen of vessels.
- (b) deposition of organic compounds like tannins and resins in the central layers of stem.
- (c) deposition of suberin and aromatic substances in the outer layer of stem.
- (d) deposition of tannins, gum, resin and aromatic substances in the peripheral layers of stem.
- (e) presence of parenchyma cells, functionally active xylem elements and essential oils.

Choose the correct answer from the options given below:

- (1) (c) and (d) Only
- (2) (d) and (e) Only
- (3) (b) and (d) Only
- (4) (a) and (b) Only

Ans. (4)

Sol. In old trees the greater part of secondary xylem is dark brown and resistant to insect attack due to secretion of secondary metabolites and their deposition in lumen of vessels and the deposition of organic compounds like tannins and resins in central layers of stem.

105. Read the following statements and choose the set of correct statements :

- (a) Euchromatin is loosely packed chromatin
- (b) Heterochromatin is transcriptionally active
- (c) Histone octamer is wrapped by negatively charged DNA in nucleosome
- (d) Histones are rich in lysine and arginine
- (e) A typical nucleosome contains 400 bp of DNA helix

Choose the correct answer from the options given below:

- (1) (a),(c),(d) Only
- (2) (b), (e) Only
- (3) (a),(c),(e) only
- (4) (b), (d), (e) Only

Ans. (1)

Sol. Heterochromatin is transcriptionally inactive.

A typical nucleosome contains 200 of DNA helix.

106. The process of translation of mRNA to proteins begins as soon as:

- (1) The larger subunit of ribosome encounters mRNA
- (2) Both the subunits join together to bind with mRNA
- (3) The tRNA is activated and the larger subunit of ribosome encounters mRNA
- (4) The small subunit of ribosome encounters mRNA

Ans. (4)

Sol. The process of translation of mRNA to protein synthesis begins as soon as the smaller sub-unit of ribosome encounters mRNA.

107. Identify the correct set of statements:

- (a) The leaflets are modified into pointed hard thorns in *Citrus* and *Bougainvillea*
- (b) Axillary buds form slender and spirally coiled tendrils in cucumber and pumpkin
- (c) Stem is flattened and fleshy in *Opuntia* and modified to perform the function of leaves
- (d) *Rhizophora* shows vertically upward growing roots that help to get oxygen for respiration
- (e) Subaerially growing stems in grasses and strawberry help in vegetative propagation

Choose the correct answer from the options given below

- (1) (a) and (d) Only
- (2) (b), (c), (d) and (e) Only
- (3) (a), (b), (d) and (e) Only
- (4) (b) and (c) Only

Ans. (2)

Sol. The pointed, hard thorns in *Citrus* and *Bougainvillea* are modified axillary buds.

108. Which one of the following statement is not **true** regarding gel electrophoresis technique?

- (1) The separated DNA fragments are stained by using ethidium bromide.
- (2) The presence of chromogenic substrate gives blue coloured DNA bands on the gel.
- (3) Bright orange coloured bands of DNA can be observed in the gel when exposed to UV light .
- (4) The process of extraction of separated DNA strands from gel is called elution.

Ans. (2)

Sol. The presence of chromogenic substrate gives white coloured DNA bands on the gel.

109. Hydrocolloid carrageen is obtained from :

- (1) Phaeophyceae and Rhodophyceae
- (2) Rhodophyceae only

(3) Phaeophyceae only

(4) Chlorophyceae and Phaeophyceae

Ans. (2)

Sol. Hydrocolloid carrageen is obtained from Rhodophyceae members.

110. Which one of the following statements cannot be connected to Predation?

- (1) It might lead to extinction of a species
- (2) Both the interacting species are negatively impacted
- (3) It is necessitated by nature to maintain the ecological balance
- (4) It helps in maintaining species diversity in a community

Ans. (2)

Sol. In predation, only one species (predator) benefits while the other (prey) is harmed. Both interacting species are negatively impacted in case of competition.

111. Which one of the following is not true regarding the release of energy during ATP synthesis through chemiosmosis? It involves :

- (1) Breakdown of electron gradient
- (2) Movement of protons across the membrane to the stroma
- (3) Reduction of NADP to NADPH₂ on the stroma side of the membrane
- (4) Breakdown of proton gradient

Ans. (1)

Sol. Breakdown of electron gradient is not true regarding the release of energy during ATP synthesis through chemiosmosis.

112. The appearance of recombination nodules on homologous chromosomes during meiosis characterizes:

- (1) Bivalent
- (2) Sites at which crossing over occurs
- (3) Terminalization
- (4) Synaptonemal complex

Ans. (2)

Sol. The appearance of recombination nodules is the sites at which crossing over occurs between non-sister chromatids of the homologous chromosomes during meiosis-I.

113. Match List - I with List - II.

List - I	List - II
(a) Manganese	(i) Activates the enzyme catalase
(b) Magnesium	(ii) Required for pollen germination
(c) Boron	(iii) Activates enzymes of respiration
(d) Iron	(iv) Functions in splitting of water during photosynthesis

Choose the correct answer from the options given below:

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

Ans. (1)

Sol. Manganese: Splitting of water to liberate oxygen during photosynthesis.

Magnesium: Activates the enzymes of respiration

Boron: Pollen germination.

Iron : Activates catalase enzyme

114. Which of the following is not observed during apoplastic pathway ?

- (1) The movement does not involve crossing of cell membrane
- (2) The movement is aided by cytoplasmic streaming
- (3) Apoplast is continuous and does not provide any barrier to water movement.
- (4) Movement of water occurs through intercellular spaces and wall of the cells.

Ans. (2)

Sol. Cytoplasmic streaming does not aid in apoplastic movement.

115. DNA polymorphism forms the basis of :

- (1) DNA finger printing
- (2) Both genetic mapping and DNA finger printing

(3) Translation

(4) Genetic mapping

Ans. (2)

Sol. DNA polymorphism forms the basis of genetic mapping and DNA finger printing.

116. Habitat loss and fragmentation, over exploitation, alien species invasion and co-extinction are causes for:

- (1) Competition
- (2) Biodiversity loss
- (3) Natality
- (4) Population explosion

Ans. (2)

Sol. Habitat loss and fragmentation, over-exploitation, invasion of alien species and, co-extinctions are the four major causes of biodiversity loss (evil quartet).

117. The flowers are Zygomorphic in :

- (a) Mustard
- (b) Gulmohar
- (c) Cassia
- (d) Datura
- (e) Chilly

Choose the correct answer from the options given below:

- (1) (b), (c) Only
- (2) (d), (e) Only
- (3) (c), (d), (e) Only
- (4) (a),(b),(c) only

Ans. (1)

Sol. When a flower can be divided into two similar halves only in one particular vertical plane, it is zygomorphic, e.g., pea, gulmohur, bean, Cassia.

118. Which one of the following plants does not show plasticity ?

- (1) Coriander
- (2) Buttercup
- (3) Maize
- (4) Cotton

Ans. (3)

Sol. Maize do not show plasticity.

119. The device which can remove particulate matter present in the exhaust from a thermal power plant is :

- (1) Incinerator
- (2) Electrostatic Precipitator
- (3) Catalytic Converter
- (4) STP

Ans. (2)

Sol. Electrostatic precipitator is a widely used filter for removing particulate matter from the exhaust of thermal power plants.

120. "Girdling Experiment" was performed by Plant Physiologists to identify the plant tissue through which.

- (1) food is transported
- (2) for both water and food transportation
- (3) osmosis is observed
- (4) water is transported

Ans. (1)

Sol. "Girdling experiment" was performed by plant physiologist to identify the plant tissue through which food is transported.

121. Production of Cucumber has increased manifold in recent years. Application of which of the following phytohormones has resulted in this increased yield as the hormone is known to produce female flowers in the plants:

- (1) Gibberellin
- (2) Ethylene
- (3) Cytokinin
- (4) ABA

Ans. (2)

Sol. Increase in yield of cucumber is due to ethylene.

122. Given below are two statements :

Statement-I : Cleistogamous flowers are invariably autogamous

Statement-II : Cleistogamy is disadvantageous as there is no chance for cross pollination

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

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

Ans. (4)

Sol. Cleistogamous flowers are closed flowers and hence they are invariably autogamous. It is a disadvantageous as there is no chance for cross pollination.

123. Exoskeleton of arthropods is composed of:

- (1) Cellulose
- (2) Chitin
- (3) Glucosamine
- (4) Cutin

Ans. (2)

Sol. In arthropods, exoskeleton is composed of chitin, which is present in the form of plates called sclerites. These sclerites are joined by soft, flexible arthrodial membrane.

124. Which of the following is incorrectly matched?

- (1) *Ulothrix* - Mannitol
- (2) *Porphyra* - Floridian Starch
- (3) *Volvox* - Starch
- (4) *Ectocarpus* - Fucoxanthin

Ans. (1)

Sol. *Ulothrix* is a green algae and hence the reserve food material is starch.

125. Given below are two statements :

Statement I : Decomposition is a process in which the detritus is degraded into simpler substances by microbes.

Statement II : Decomposition is faster if the detritus is rich in lignin and chitin In the light of the above statements, choose the correct answer from the options given below :

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

Ans. (2)

Sol. Decomposition is a process in which detritus is degraded into simpler substances by microbes. In a particular climatic condition, decomposition rate is slower if detritus is rich in lignin and chitin, and quicker, if detritus is rich in nitrogen and water-soluble substances like sugars.

126. Which one of the following plants shows vexillary aestivation and diadelphous stamens?

- (1) *Pisum sativum*
- (2) *Allium cepa*
- (3) *Solanum nigrum*
- (4) *Colchicum autumnale*

Ans. (1)

Sol. Vexillary aestivation and diadelphous stamen is seen in Fabaceae members example *Pisum sativum* (Garden pea).

127. Read the following statements about the vascular bundles:

- (a) In roots, xylem and phloem in a vascular bundle are arranged in an alternate manner along the different radii.
- (b) Conjoint closed vascular bundles do not possess cambium
- (c) In open vascular bundles, cambium is present in between xylem and phloem
- (d) The vascular bundles of dicotyledonous stem between xylem and phloem
- (e) In monocotyledonous root, usually there are more than six xylem bundles present

Choose the correct answer from the options given below

- (1) (b), (c), (d) and (e) Only
- (2) (a), (b), (c) and (d) Only
- (3) (a), (c), (d) and (e) Only
- (4) (a), (b) and (d) Only

Ans. (0)

Sol. All statements are correct.

128. Which one of the following produces nitrogen fixing nodules on the roots of *Alnus*?

- (1) *Frankia*
- (2) *Rhodospirillum*
- (3) *Beijerinckia*
- (4) *Rhizobium*

Ans. (1)

Sol. The microbe, *Frankia*, produces nitrogen-fixing nodules on the roots of nonleguminous plants e.g., *Alnus*.

129. Given below are two statements :

Statement I : Mendel studied seven pairs of contrasting traits in pea plants and proposed the Laws of Inheritance

Statement II : Seven characters examined by Mendel in his experiment on pea plants were seed shape and colour, flower colour, pod shape and colour, flower position and stem height

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

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

Ans. (4)

Sol. Mendel studied seven pairs of contrasting traits in pea plant and proposed the laws of inheritance. Seven characters examined by Mendel in his experiment on pea plants were seed shape, seed colour, flower colour, pod shape, pod colour, flower position and stem height.

130. Which of the following is not a method of ex situ conservation ?

- (1) National Parks
- (2) Micropropagation
- (3) Cryopreservation
- (4) In vitro fertilization

Ans. (1)

Sol. In *ex situ* conservation, threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care. Zoological parks, botanical gardens, *in vitro fertilisation*, micropropagation and cryopreservation serve this purpose.

National parks are an example of *in situ* conservation. *In situ* conservation is the process of protecting organisms in their natural habitat. Biosphere reserves, national parks, sanctuaries and sacred groves are a part of *in-situ* conservation.

131. XO type of sex determination can be found in

- (1) Birds
- (2) Grasshoppers
- (3) Monkeys
- (4) *Drosophila*

Ans. (2)

Sol. XX-XO type of sex determination is seen in orthopteran insects (e.g., grasshoppers, cockroaches) and hemipteran insects (e.g., bugs).

132. What amount of energy is released from glucose during lactic acid fermentation

- (1) More than 18%
- (2) About 10%
- (3) Less than 7%
- (4) Approximately 15%

Ans. (3)

Sol. Less than 7% of energy is released from glucose during lactic acid fermentation.

133. Identify the incorrect statement related to Pollination :

- (1) Pollination by wind is more common amongst abiotic pollination
- (2) Flowers produce foul odours to attract flies and beetles to get pollinated
- (3) Moths and butterflies are the most dominant pollinating agents among insects
- (4) Pollination by water is quite rare in flowering plants

Ans. (3)

Sol. Bees are the most dominant pollinating agents among insects.

134. What is the net gain of ATP when each molecule of glucose is converted to two molecules of pyruvic acid ?

- (1) Six
- (2) Two
- (3) Eight
- (4) Four

Ans. (2)

Sol. Net gain of ATP when one molecule of glucose is partially oxidized to 2 molecules of pyruvic acid is two.

135. Which one of the following never occurs during mitotic cell division?

- (1) Movement of centrioles towards opposite poles
- (2) Pairing of homologous chromosomes
- (3) Coiling and condensation of the chromatids
- (4) Spindle fibres attach to kinetochores of chromosomes

Ans. (2)

Sol. Pairing of homologous chromosomes occurs during meiosis and not during mitosis.

SECTION - B

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

Assertion (A): Mendel's law of Independent assortment does not hold good for the genes that are located closely on the same chromosome.

Reason (R) : Closely located genes assort independently. In the light of the above statements, choose the correct answer from the options given below:

- (1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (2) (A) is correct but (R) is not correct
- (3) (A) is not correct but (R) is correct
- (4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Ans. (2)

Sol. Mendel's Law of Independent assortment does not hold good for the genes that are located closely on the same chromosomes. Closely located genes cannot be assorted independently. Hence assertion is correct but the reason is incorrect.

137. If a geneticist uses the blind approach for sequencing the whole genome of an organism, followed by assignment of function to different segments, the methodology adopted by him is called as :

- (1) Gene mapping
- (2) Expressed sequence tags
- (3) Bioinformatics
- (4) Sequence annotation

Ans. (4)

Sol. In the human genome project, the blind approach of simply sequencing the whole set of genome that contained all the coding and non-coding sequence, and later assigning different regions in the sequence with functions is referred to as sequence annotation.

138. The anatomy of springwood shows some peculiar features. Identify the correct set of statements about springwood.

- (a) It is also called as the earlywood
- (b) In spring season cambium produces xylem elements with narrow vessels
- (c) It is lighter in colour
- (d) The springwood along with autumnwood shows alternate concentric rings forming annual rings
- (e) It has lower density

Choose the correct answer from the options given below:

- (1) (a), (c), (d) and (e) Only
- (2) (a), (b) and (d) Only
- (3) (c), (d) and (e) Only
- (4) (a), (b), (d) and (e) Only

Ans. (1)

Sol. In spring season cambium produces xylem elements with broad vessels.

139. While explaining interspecific interaction of population, (+) sign is assigned for beneficial interaction, (-) sign is assigned for detrimental interaction and (0) for neutral interaction. Which of the following interactions can be assigned (+) for one species and (-) for another species involved in the interaction?

- (1) Amensalism
- (2) Commensalism
- (3) Competition
- (4) Predation

Ans. (4)

Sol. In predation and parasitism, only one species is benefitted (+) whereas other species is harmed (-).

	Species A	Species B
Mutualism	+	+
Competition	-	-
Predation	+	-
Parasitism	+	-
Commensalism	+	0
Amensalism	-	0

140. Which one of the following will accelerate phosphorus cycle?

- (1) Volcanic activity
- (2) Weathering of rocks
- (3) Rain fall and storms
- (4) Burning of fossil fuels

Ans. (2)

Sol. The natural reservoir of phosphorus is rock, which contains phosphorus in the form of phosphates. When rocks are **weathered**, these phosphates are dissolved in soil solution.

141. The entire fleet of buses in Delhi were converted to CNG from diesel. In reference to this, which one of the following statements is false?

- (1) The same diesel engine is used in CNG buses making the cost of conversion low
- (2) It is cheaper than diesel
- (3) It can not be adulterated like diesel
- (4) CNG burns more efficiently than diesel

Ans. (1)

Sol. CNG buses use a different engine compared to diesel buses.

Under the direction of the Supreme Court the government switched the entire fleet of public transport buses from diesel to compressed natural gas (CNG) by the end of 2002 because:

- CNG burns most efficiently, unlike petrol or diesel, in the automobiles.
- CNG is very efficient and very little of is left unburnt.
- CNG is cheaper than petrol or diesel.

CNG cannot be siphoned off by thieves and adulterated like petrol or diesel.

142. Match List - I with List - II

List-I	List-II
(a) Metacentric chromosome	(i) Centromere situated close to the end forming one extremely short and one very long arms
(b) Acrocentric chromosome	(ii) Centromere at the terminal end
(c) Sub-metacentric chromosome	(iii) Centromere in the middle forming two equal arms of chromosomes
(d) Telocentric chromosome	(iv) Centromere slightly away from the middle forming one shorter arm and one longer arm

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

Ans. (4)

Sol. The metacentric chromosome has middle centromere forming two equal arms of the chromosome. The sub-metacentric chromosome has centromere slightly away from the middle of the chromosome resulting into one shorter arm and one longer arm. In case of acrocentric chromosome the centromere is situated close to its end forming one extremely short and one very long arm, whereas the telocentric chromosome has a terminal centromere.

143. Match the plant with the kind of life cycle it exhibits:

List-I	List-II
(a) <i>Spirogyra</i>	(i) Dominant diploid sporophyte vascular plant, with highly reduced male or female gametophyte
(b) Fern	(ii) Dominant haploid free-living gametophyte
(c) <i>Funaria</i>	(iii) Dominant diploid sporophyte alternating with reduced gametophyte called prothallus
(d) <i>Cycas</i>	(iv) Dominant haploid leafy gametophyte alternating with partially dependent multicellular sporophyte

Choose the correct answer from the options given below:

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

Ans. (1)

Sol. *Spirogyra*- Dominant haploid free living gametophyte.

Fern- Dominant diploid sporophyte alternating with reduced gametophyte called prothallus.

Funaria- Dominant haploid leafy gametophyte alternating with partially dependent, multicellular sporophyte.

Cycas- Dominant diploid sporophyte, vascular plant with highly reduced male or female gametophyte.

144. Which of the following occurs due to the presence of autosomal dominant trait?

- (1) Myotonic dystrophy
- (2) Haemophilia
- (3) Thalassemia
- (4) Sickle cell anaemia

Ans. (1)

Sol. Myotonic dystrophy is an autosomal dominant trait. Haemophilia is X-linked recessive disorder. Thalassemia and sickle-celled anaemia are autosomal recessive disorders.

145. Transposons can be used during which one of the following ?

- (1) Gene silencing
- (2) Autoradiography
- (3) Gene sequencing
- (4) Polymerase Chain Reaction

Ans. (1)

Sol. Transposons can be used during gene silencing.

146. What is the role of large bundle sheath cells found around the vascular bundles in C_4 plants?

- (1) To increase the number of chloroplast for the operation of Calvin cycle
- (2) To enable the plant to tolerate high temperature
- (3) To protect the vascular tissue from high light intensity
- (4) To provide the site for photorespiratory pathway

Ans. (1)

Sol. The bundle sheath cells may form several layers around the vascular bundles; they are characterized by having a large number of chloroplasts, thick walls impervious to gaseous exchange and no intercellular spaces.

147. Read the following statements on lipids and find out correct set of statements :

- (a) Lecithin found in the plasma membrane is a glycolipid
- (b) Saturated fatty acids possess one or more C=C bonds
- (c) Gingly oil has lower melting point, hence remains as oil in winter
- (d) Lipids are generally insoluble in water but soluble in some organic solvents
- (e) When fatty acid is esterified with glycerol, monoglycerides are formed

Choose the correct answer from the options given below:

- (1) (a), (d) and (e) only
- (2) (c), (d) and (e) only
- (3) (a), (b) and (d) only
- (4) (a), (b) and (c) only

Ans. (2)

Sol. Lecithin in plasma membrane is a phospholipid. Saturated fatty acids possess C—C bonds.

148. In the following palindromic base sequences of DNA, which one can be cut easily by particular restriction enzyme?

- (1) 5' GAATTC 3'; 3' CTTAAG 5'
- (2) 5' CTCAGT 3'; 3' GAGTCA 5'
- (3) 5' GTATTC 3'; 3' CATAAG 5'
- (4) 5' GATACT 3'; 3' CTATGA 5'

Ans. (1)

Sol. Palindromic base sequence of DNA which can be cut easily by restriction enzyme is 5' GAATTC 3'; 3' CTTAAG 5'

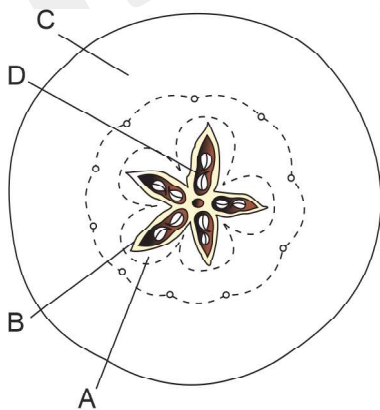
149. Addition of more solutes in a given solution will :

- (1) lower its water potential
- (2) make its water potential zero
- (3) not affect the water potential at all
- (4) raise its water potential

Ans. (1)

Sol. Addition of more solutes in a given solution will lower its water potential.

150. Which part of the fruit, labelled in the given figure makes it a false fruit?



- (1) B → Endocarp
- (2) C → Thalamus
- (3) D → Seed
- (4) A → Mesocarp

Ans. (2)

Sol. As thalamus is involved in fruit formation. Therefore, it is a false fruit.

ZOOLOGY

SECTION - A

151. A dehydration reaction links two glucose molecules to produce maltose. If the formula for glucose is $C_6H_{12}O_6$ then what is the formula for maltose?

- (1) $C_{12}H_{24}O_{12}$
- (2) $C_{12}H_{22}O_{11}$
- (3) $C_{12}H_{24}O_{11}$
- (4) $C_{12}H_{20}O_{10}$

Ans. (2)

Sol. The formula for maltose is $C_{12}H_{22}O_{11}$.

152. Which of the following statements with respect to Endoplasmic Reticulum is **incorrect**?

- (1) SER is devoid of ribosomes
- (2) In prokaryotes only RER are present
- (3) SER are the sites for lipid synthesis
- (4) RER has ribosomes attached to ER

Ans. (2)

Sol. In prokaryotes membrane bound cell organelles are absent.

153. Given below are two statements:

Statement I : The coagulum is formed of network of threads called thrombins.

Statement II : Spleen is the graveyard of erythrocytes.

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

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

Ans. (3)

Sol. Coagulum is formed of network of threads called fibrins (not thrombins). Spleen is the graveyard of erythrocytes.

154. Given below are two statements :

Statement I : Fatty acids and glycerols cannot be absorbed into the blood.

Statement II : Specialized lymphatic capillaries called lacteals carry chylomicrons into lymphatic vessels and ultimately into the blood.

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

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

Ans. (4)

Sol. Fatty acids and glycerol being insoluble, cannot be absorbed into the blood. They are first incorporated into small droplets called micelles which move into the intestinal mucosa. They are re-formed into very small protein coated fat globules called the chylomicrons which are transported into the lymph vessels (lacteals) in the villi. These lymph vessels ultimately release the absorbed substances into the blood stream.

155. Which of the following is **not** the function of conducting part of respiratory system?

- (1) Inhaled air humidified
- (2) Temperature of inhaled air is brought to body temperature
- (3) Provides surface for diffusion of O_2 and CO_2
- (4) It clears inhaled air from foreign particles

Ans. (3)

Sol. Exchange part is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric air. The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature.

156. Identify the asexual reproductive structure associated with *Penicillium* :

- (1) Conidia
- (2) Gemmules
- (3) Buds
- (4) Zoospores

Ans.(1)

Sol. Asexual reproductive structures associated with *Penicillium* are conidia.

157. Given below are two statements:

Statement I : The release of sperms into the seminiferous tubules is called spermiation.

Statement II : Spermiogenesis is the process of formation of sperms from spermatogonia.

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

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

Ans.(2)

Sol. The release of sperms into the seminiferous tubules is called spermiation. Spermiogenesis is the process of the formation of spermatozoa from spermatids.

158. In the taxonomic categories which hierarchical arrangement in ascending order is **correct** in case of animals?

- (1) Kingdom, Class, Phylum, Family, Order, Genus, Species
- (2) Kingdom, Order, Class, Phylum, Family, Genus, Species
- (3) Kingdom, Order, Phylum, Class, Family, Genus, Species
- (4) Kingdom, Phylum, Class, Order, Family, Genus, Species

Ans. (4)

Sol. Correct hierarchical arrangement in ascending order of taxonomic categories in animal taxonomy is: Kingdom → Phylum → Class → Order → Family → Genus → Species

159. Tegmina in cocroach, arises from :

- (1) Mesothorax
- (2) Metathorax
- (3) Prothorax and Mesothorax
- (4) Prothorax

Ans. (1)

Sol. The cockroach has two pairs of wings. The forewings (tegmina) present on the mesothorax and the hindwings present on the metathorax. The prothorax lacks wings.

160. Which of the following functions is **not** performed by secretions from salivary glands?

- (1) Digestion of complex carbohydrates
- (2) Lubrication of oral cavity
- (3) Digestion of disaccharides
- (4) Control bacterial population in mouth

Ans. (3)

Sol. Digestion of disaccharides is brought about by disaccharidases present in the intestinal juice. Salivary amylase digests about 30% of starch (a polysaccharide) into maltose (a disaccharide).

161. Breeding crops with higher levels of vitamins and minerals or higher proteins and healthier fats is called:

- (1) Bio-remediation
- (2) Bio-fortification
- (3) Bio-accumulation
- (4) Bio-magnification

Ans. (2)

Sol. Breeding crops with higher levels of vitamins and minerals, or higher protein and healthier fats – is the most practical means to improve public health is called bio-fortification.

162. If '8' *Drosophila* in a laboratory population of '80' died during a week, the death rate in the population is _____ individuals per *Drosophila* per week

- (1) 10
- (2) 1.0
- (3) zero
- (4) 0.1

Ans. (4)

Sol. Per capita death rate (d) = No. of deaths/ total population size.

$$d = 8/80 = 0.1$$

163. Select the **incorrect** statement with reference to mitosis:

- (1) Spindle fibres attach to centromere of chromosomes.
- (2) Chromosomes decondense at telophase.
- (3) Splitting of centromere occurs at anaphase.
- (4) All the chromosomes lie at the equator at metaphase.

Ans. (1)

Sol. Small disc-shaped structures at the surface of the centromeres are called kinetochores. These structures serve as the sites of attachment of spindle fibres (formed by the spindle fibres) to the chromosomes that are moved into position at the centre of the cell.

164. Regarding Meiosis, which of the statements is incorrect?

- (1) DNA replication occurs in S phase of Meiosis-II
- (2) Pairing of homologous chromosomes and recombination occurs in Meiosis-I
- (3) Four haploid cells are formed at the end of Meiosis-II
- (4) There are two stages in Meiosis, Meiosis-I and II

Ans. (1)

Sol. DNA replication do not occur in S phase of Meiosis-II

165. In gene therapy of Adenosine Deaminase (ADA) deficiency, the patient requires periodic infusion of genetically engineered lymphocytes because :

- (1) Gene isolated from marrow cells producing ADA is introduced into cells at embryonic stages.
- (2) Lymphocytes from patient's blood are grown in culture, outside the body.
- (3) Genetically engineered lymphocytes are not immortal cells.
- (4) Retroviral vector is introduced into these lymphocytes.

Ans. (3)

Sol. In gene therapy of ADA deficiency, the patient requires periodic infusion of genetically engineered lymphocytes because they are not immortal cells.

166. Which of the following statements are true for spermatogenesis but do not hold true for Oogenesis?

- (a) It results in the formation of haploid gametes
- (b) Differentiation of gamete occurs after the completion of meiosis
- (c) Meiosis occurs continuously in a mitotically dividing stem cell population
- (d) It is controlled by the Luteinising hormone (LH) and Follicle Stimulating Hormone (FSH) secreted by the anterior pituitary
- (e) It is initiated at puberty

Choose the most appropriate answer from the options given below:

- (1) (b) and (c) only
- (2) (b), (d) and (e) only
- (3) (b), (c) and (e) only
- (4) (c) and (e) only

Ans. (3)

Sol. (a) In both spermatogenesis and oogenesis, haploid gametes are formed.

(b) Differentiation of spermatids to spermatozoa (spermiogenesis) occurs only during spermatogenesis. The spermatozoon is morphologically much different from the spermatid. Oogenesis does not involve such morphological differentiation of the ovum.

(c) Meiosis is continuous during spermatogenesis. During oogenesis meiosis begins during embryonic stage and gets arrested at prophase-I. It resumes only after puberty. So, meiosis is discontinuous during oogenesis while it is continuous during spermatogenesis.

(d) Spermatogenesis is controlled by FSH and androgens (but not directly by LH). Oogenesis is also controlled by FSH only. LH stimulates ovulation but not oogenesis. Thus (d) does not hold good for both spermatogenesis and oogenesis.

(e) Spermatogenesis is initiated at puberty whereas oogenesis is initiated during embryonic stage itself.

167. In which of the following animals, digestive tract has additional chambers like crop and gizzard?

- (1) *Bufo*, *Balaenoptera*, *Bangarus*
- (2) *Catla*, *Columba*, *Crocodylus*
- (3) *Pavo*, *Psittacula*, *Corvus*
- (4) *Corvus*, *Columba*, *Chameleon*

Ans. (3)

Sol. The digestive tract has two additional chambers, the crop and the gizzard, in birds (e.g., *Pavo*, *Psittacula*, *Corvus*).

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

Assertion (A): Osteoporosis is characterised by decreased bone mass and increased chances of fractures.

Reason (R) : Common cause of osteoporosis is increased levels of estrogen.

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

- (1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (2) (A) is correct but (R) is not correct
- (3) (A) is not correct but (R) is correct
- (4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Ans.(2)

Sol. Osteoporosis is an age-related disorder characterised by decreased bone mass and increased chances of fractures. Decreased levels of estrogen is a common cause.

169. Which of the following is present between the adjacent bones of the vertebral column?

- (1) Cartilage
- (2) Areolar tissue
- (3) Smooth muscle
- (4) Intercalated discs

Ans. (1)

Sol. The adjacent vertebrae of the vertebral column are separated by intervertebral discs made up of fibrous cartilage.

170. Detritivores breakdown detritus into smaller particles. This process is called :

- (1) Fragmentation
- (2) Humification
- (3) Decomposition
- (4) Catabolism

Ans. (1)

Sol. Detritivores like earthworm breakdown detritus into smaller particles. This process is called fragmentation. Catabolism is breakdown detritus into smaller particles by releasing of enzymes by bacteria and fungi. Humification is the formation of a dark-coloured amorphous substance called humus. Mineralisation is the degradation of humus into minerals by microbes.

171. Lippe's loop is a type of contraceptive used as :

- (1) Vault barrier
- (2) Non-Medicated IUD
- (3) Copper releasing IUD
- (4) Cervical barrier

Ans. (2)

Sol. Lippe's loop is a non-medicated IUD, it increases phagocytosis of sperms within the uterus.

172. *In-situ* conservation refers to :

- (1) Conserve only high risk species
- (2) Conserve only endangered species
- (3) Conserve only extinct species
- (4) Protect and conserve the whole ecosystem

Ans. (4)

Sol. *In situ* conservation is the process of protecting an animal species in its natural habitat. It protects and conserves the whole ecosystem. When we conserve and protect the whole ecosystem, its biodiversity at all levels is protected. For example, we save the entire forest to save the tiger.

173. Identify the microorganism which is responsible for the production of an immunosuppressive molecule cyclosporin A :

- (1) *Clostridium butylicum*
- (2) *Aspergillus niger*
- (3) *Streptococcus cerevisiae*
- (4) *Trichoderma polysporum*

Ans. (4)

Sol. Cyclosporin A that is used as an immunosuppressive agent in organ-transplant patients is produced by the fungus *Trichoderma polysporum*.

174. In an *E.coli* strain *i* gene gets mutated and its product can not bind the inducer molecule. If growth medium is provided with lactose, what will be the outcome?

- (1) z, y, a genes will be transcribed
- (2) z, y a genes will not be translated
- (3) RNA polymerase will bind the promoter region
- (4) Only z gene will get transcribed

Ans. (2)

Sol. In an *E.coli* strain *i* gene gets mutated and its product cannot bind the inducer molecule. If growth medium is provided with lactose then z, y, a genes will not be translated.

175. Natural selection where more individuals acquire specific character value other than the mean character value, leads to :

- (1) Directional change
- (2) Disruptive change
- (3) Random change
- (4) Stabilising change

Ans. (1)

Sol. In directional natural selection, more individuals acquire value other than the mean character value. It involves elimination of individuals at one extreme of the phenotypic distribution and the mean value gradually shifts in the other direction. For example the evolution of long-necked giraffes from short-necked ancestors involved directional selection.

176. Given below are two statements :

Statement I : Restriction endonucleases recognise specific sequence to cut DNA known as palindromic nucleotide sequence.

Statement II : Restriction endonucleases cut the DNA strand a little away from the centre of the palindromic site.

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

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

Ans. (4)

Sol. Each restriction endonuclease recognises a specific palindromic nucleotide sequences in the DNA. Restriction enzymes cut the strand of DNA a little away from the centre of the palindrome sites, but between the same two bases on the opposite strands.

177. Under normal physiological conditions in human being every 100 ml of oxygenated blood can deliver _____ ml of O₂ to the tissues.

- (1) 5 ml
- (2) 4 ml
- (3) 10 ml
- (4) 2 ml

Ans. (1)

Sol. In human being, every 100 ml of oxygenated blood can deliver 5ml of O₂ to the tissues under normal physiological conditions.

178. If the length of a DNA molecule is 1.1 metres, what will be the approximate number of base pairs?

- (1) 6.6 x 10⁹ bp
- (2) 3.3 x 10⁶ bp
- (3) 6.6 x 10⁶ bp
- (4) 3.3 x 10⁹ bp

Ans. (4)

Sol. If the length of DNA molecule is 1.1 metres, then the approximate number of base pairs would be 3.3x 10⁹ bp.

179. Which of the following is a **correct** match for disease and its symptoms?

- (1) Tetany-high Ca²⁺ level causing rapid spasms.
- (2) Myasthenia gravis - Genetic disorder resulting in weakening and paralysis of skeletal muscle
- (3) Muscular dystrophy - An auto immune disorder causing progressive degeneration of skeletal muscle
- (4) Arthritis - Inflamed joints

Ans. (4)

Sol. Arthritis is the inflammation in the joints. Tetany is due to **low** blood calcium levels. Myasthenia gravis is an **autoimmune** disorder. Muscular dystrophy is a **genetic** disorder.

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

Assertion (A): All vertebrates are chordates but all chordates are not vertebrates.

Reason (R) : Notochord is replaced by vertebral column in the adult vertebrates.

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

- (1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (2) (A) is correct but (R) is not correct
- (3) (A) is not correct but (R) is correct
- (4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Ans. (4)

Sol. All vertebrates are chordates because they possess a notochord at least at some time during their life. All chordates are not vertebrates because protochordates have notochord but lack a vertebral column. Therefore, A and R are true and R is the correct explanation of A.

181. Given below are two statements :

Statement I : Mycoplasma can pass through less than 1 micron filter size.

Statement II : Mycoplasma are bacteria with cell wall

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

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

Ans. (2)

Sol. Mycoplasma is an exception to kingdom monera as they do not have cell wall.

182. Nitrogenous waste is excreted in the form of pellet or paste by :

- (1) *Salamandra*
- (2) *Hippocampus*
- (3) *Pavo*
- (4) *Ornithorhynchus*

Ans. (3)

Sol. Reptiles, birds, land snails and insects are uricotelic animals and excrete nitrogenous wastes as uric acid in the form of pellet or paste with a minimum loss of water. *Pavo* (peacock) is a bird.

183. Given below are two statements:

Statement I : Autoimmune disorder is a condition where body defense mechanism recognizes its own cells as foreign bodies.

Statement II : Rheumatoid arthritis is a condition where body does not attack self cells.

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

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

Ans. (2)

Sol. Autoimmune disorder is a condition where body defense mechanism recognises its own cells as foreign bodies. Rheumatoid arthritis is an autoimmune disorder in which body attacks its own self cells.

184. At which stage of life the oogenesis process initiated?

- (1) Embryonic development stage
- (2) Birth
- (3) Adult
- (4) Puberty

Ans. (1)

Sol. Oogenesis is initiated during the embryonic development stage when a couple of million gamete

mother cells (oogonia) are formed within each foetal ovary; no more oogonia are formed and added after birth. These cells start division and enter prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes.

185. Which of the following is **not** a connective tissue?

- (1) Adipose tissue
- (2) Cartilage
- (3) Neuroglia
- (4) Blood

Ans. (3)

Sol. Neuroglia are the supporting cells of the nervous tissue. They protect and support neurons. Neuroglia make up more than one-half the volume of neural tissue in our body. Adipose tissue is a loose connective tissue. Cartilage is a skeletal tissue (a type of connective tissue). Blood is a fluid connective tissue.

SECTION - B

186. Select **incorrect** statement regarding synapses:

- (1) Electrical current can flow directly from one neuron into the other across the electrical synapse.
- (2) Chemical synapses use neurotransmitters
- (3) Impulse transmission across a chemical synapse is always faster than that across an electrical synapse.
- (4) The membranes of presynaptic and postsynaptic neurons are in close proximity in an electrical synapse.

Ans. (3)

Sol. Impulse transmission across an electrical synapse is always **faster** than across chemical synapse.

187. Match List - I with List - II

List - I	List - II
a) Bronchioles	i) Dense Regular Connective Tissue
b) Goblet cell	ii) Loose Connective Tissue
c) Tendons	iii) Glandular Tissue
d) Adipose Tissue	iv) Ciliated Epithelium

Choose the correct answer from the options given below:

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

Ans. (4)

Sol. Bronchioles	-	Ciliated Epithelium
Goblet cell	-	Glandular tissue
Tendons	-	Dense regular connective tissue
Adipose tissue	-	Loose connective tissue

188. Select the **incorrect** statement with respect to acquired immunity.

- (1) Anamnestic response is elicited on subsequent encounters with the same pathogen.
- (2) Anamnestic response is due to memory of first encounter.
- (3) Acquired immunity is non-specific type of defense present at the time of birth.
- (4) Primary response is produced when our body encounters a pathogen for the first time.

Ans. (3)

Sol. Non-specific type of defence present at the time of birth is termed **innate** immunity. Acquired immunity is gained by individual during their lifetime, when they interact with pathogen.

189. Ten *E.coli* cells with ^{15}N -dsDNA are incubated in medium containing ^{14}N nucleotide. After 60 minutes, how many *E.coli* cells will have DNA totally free from ^{15}N ?

- (1) 40 cells
- (2) 60 cells
- (3) 80 cells
- (4) 20 cells

Ans. (2)

Sol. Initially we have $^{15}\text{N}^{15}\text{N}$.

After 1st generation in medium containing N^{14} nucleotide we will get, 2 $^{15}\text{N}^{14}\text{N}$ DNA

After 2nd generation in medium containing N^{14} nucleotide we will get, 2 $^{15}\text{N}^{14}\text{N}$ DNA and 4 $^{14}\text{N}^{14}\text{N}$ DNA

After 3rd generation in medium containing N^{14} nucleotide we will get, 2 $^{15}\text{N}^{14}\text{N}$ DNA and 6 $^{14}\text{N}^{14}\text{N}$ DNA.

190. Statements related to human Insulin are given below : Which statement(s) is / are correct about genetically engineered Insulin?

- (a) Pro-hormone insulin contain extra stretch of C-peptide
- (b) A-peptide and B-peptide chains of insulin were produced separately in *E.coli*, extracted and combined by creating disulphide bond between them.
- (c) Insulin used for treating Diabetes was extracted from Cattles and Pigs
- (d) Pro-hormone Insuline needs to be processed for converting into a mature and functional hormone.
- (e) Some patients develop allergic reactions to the foreign insulin.

Choose the most appropriate answer from the options given below:

- (1) (b) only
- (2) (c) and (d) only
- (3) (c), (d) and (e) only
- (4) (a), (b) and (d) only

Ans. (1)

Sol. Chains A and B are produced separately, extracted, and combined by creating disulphide bonds to form human insulin through genetic engineering. Insulin extracted from cattle and pigs is not genetically engineered. Genetically engineered insulin is produced by combining chain A and chain B, without the production of proinsulin. Patients do not develop allergic reaction to genetically engineered insulin.

191. Match List - I with List - II with respect to methods of Contraception and their respective actions.

List - I	List - II
(a) Diaphragms	(i) Inhibit ovulation and Implantation
(b) Contraceptive Pills	(ii) Increase phagocytosis of sperm within Uterus
(c) Intra Uterine Devices	(iii) Absence of Menstrual cycle and ovulation following parturition
(d) Lactational Amenorrhea	(iv) They cover the cervix blocking the entry of sperms

Choose the correct answer from the options given below:

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

Ans. (1)

Sol. Diaphragms	– They cover the cervix blocking the entry of sperms.
Contraceptive pills	– Inhibit ovulation and implantation
Intra uterine devices	– Increase phagocytosis of sperm within uterus
Lactational amenorrhea	– Absence of Menstrual cycle and ovulation following parturition

192. The recombination frequency between the genes a & c is 5%, b & c is 15%, b & d is 9%, a & b is 20%, c & d is 24% and a & d is 29%. What will be the sequence of these genes on a linear chromosomes?

- (1) d, b, a, c
- (2) a, b, c, d
- (3) a, c, b, d
- (4) a, d, b, c

Ans. (3)

Sol. Recombination frequency is equal to the distance between the genes.

Distance between a & c is 5%, b & c is 15%, b & d is 9%, a & b is 20%, c & d is 24% and a & d is 29%. Then the sequence of these genes on a linear chromosome will be a, c, b, d.

193. Which of the following are **not** the effects of Parathyroid hormone?

- (a) Stimulates the process of bone resorption
- (b) Decreases Ca^{2+} by level in blood
- (c) Reabsorption of Ca^{2+} by renal tubules
- (d) Decreases the absorption of Ca^{2+} from digested food
- (e) Increases metabolism of carbohydrates

Choose the most appropriate answer from the options given below:

- (1) (b), (d) and (e) only
- (2) (a) and (e) only
- (3) (b) and (c) only
- (4) (a) and (c) only

Ans. (1)

Sol. Parathyroid hormone increases blood calcium level by stimulating bone resorption, promoting absorption of calcium from GI tract and promoting reabsorption of calcium from renal tubules. It **increases** Ca^{2+} level in the blood. It promotes the formation of calcitriol which **increases** the absorption of Ca^{2+} from digested food. It has no role in the regulation of metabolism of carbohydrates.

194. Which of the following is correct statements?

- (1) Bacteria are exclusively heterotrophic organisms
- (2) Slime moulds are saprophytic organisms classified under Kingdom Monera.
- (3) Mycoplasma have DNA, Ribosome and cell wall
- (4) Cyanobacteria are a group of autotrophic organisms classified under Kingdom Monera.

Ans. (4)

Sol. Cyanobacteria are group of autotrophic organisms classified under kingdom monera.

195. Given below are two statements

Statement - I: In a scrubber the exhaust from the thermal plant is passed through the electric wires to charge the dust particles

Statement - II: Particulate matter (PM_{2.5}) can not be removed by scrubber but can be removed by an electrostatic precipitator.

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

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

Ans. (3)

Sol. The exhaust is passed through electrode wires in a catalytic converter but not in a scrubber. Particulate matter (PM 2.5) can be removed effectively by electrostatic precipitators but not scrubbers. Scrubbers remove gases like sulphur dioxide effectively.

196. Which of the following statements is **not** true?

- (1) Sweet potato and potato is an example of analogy
- (2) Homology indicates common ancestry
- (3) Flippers of penguins and dolphins are a pair of homologous organs
- (4) Analogous structures are a result of convergent evolution

Ans. (3)

Sol. Flippers of penguins and dolphins are a pair of **analogous** organs that evolved due to convergent evolution.

197. Which of the following is **not** a desirable feature of a cloning vector?

- (1) Presence of a marker gene
- (2) Presence of single restriction enzyme site
- (3) Presence of two or more recognition sites
- (4) Presence of origin of replication

Ans. (3)

Sol. Presence of more than one recognition sites within the vector will generate several fragments, which will complicate the gene cloning.

198. Match List-I with List-II.

List - I (Biological Molecules)	List - II (Biological functions)
(a) Glycogen	(i) Hormone
(b) Globulin	(ii) Biocatalyst
(c) Steroids	(iii) Antibody
(d) Thrombin	(iv) Storage product

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

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

Ans. (3)

Sol. Glycogen - Storage product
 Globulin - Antibody
 Steroids - Hormone
 Thrombin - Biocatalyst

199. If a colour blind female marries a man whose mother was also colour blind, what are the chances of her progeny having colour blindness?

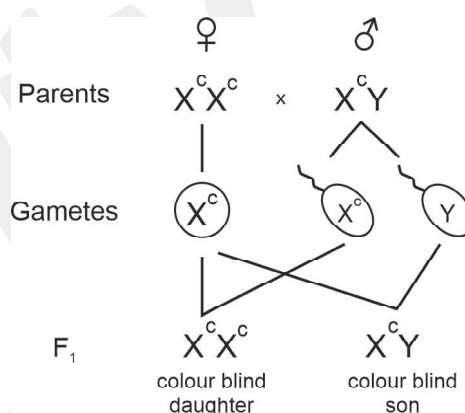
- (1) 50%
- (2) 75%
- (3) 100%
- (4) 25%

Ans. (3)

Sol. X^cX^c - X^cY - Parents genotype

X^cX^c - X^cX^c - X^cY - X^cY - F1 Generation

100% progeny will be colourblind



200. Which one of the following statements is **correct**?

- (1) The tricuspid and the bicuspid valves open due to the pressure exerted by the simultaneous contraction of the atria
- (2) Blood moves freely from atrium to the ventricle during joint diastole.
- (3) Increased ventricular pressure causes closing of the semilunar valves.
- (4) The atrio-ventricular node (AVN) generates an action potential to stimulate atrial contraction

Ans. (2)

Sol. During joint diastole stage AV valves open and passive filling of ventricle occurs. The tricuspid and the bicuspid valves open due to the fall in the **ventricular** pressure during the joint diastole itself (not during atrial systole). Increased ventricular pressure causes closing of the **atrioventricular** (bicuspid and tricuspid) valves. Atrial contraction is stimulated by the action potentials generated by the **SA** node.