

**A1****BHO**

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Answers & Solutions

Time : 3 hrs. 20 Min.

for

M.M. : 720

NEET (UG)-2023 (Phase-2)

Important Instructions :

1. 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.**
2. Each question carries **4 marks**. For each correct response, the candidate will get **4 marks**. For every wrong response **1 mark** shall be deducted from the total scores. The maximum marks are **720**.
3. Use **Blue / Black Ball point Pen only** for writing particulars on these page / marking responses on Answer Sheet.
4. Rough work is to be done in the space provided for this purpose in the Test Booklet only.
5. On completion of the test, the candidate must handover the Answer Sheet to the Invigilator before leaving the Room / Hall. The candidates are allowed to take away this Test Booklet with them.
6. The CODE for this Booklet is **A1**.
7. 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. Use of white fluid for correction is **NOT** permissible on the Answer Sheet.
8. Each candidate must show on-demand his/her Admission Card to the Invigilator.
9. No candidate, without special permission of the Centre Superintendent or Invigilator, would leave his/her seat.
10. Use of Electronic/Manual Calculator is prohibited.
11. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.
12. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.
13. The candidates will write the Correct Test Booklet Code as given in the Test Booklet / Answer Sheet in the Attendance Sheet.

PHYSICS

SECTION-A

1. Two particles A and B initially at rest, move towards each other under mutual force of attraction. At an instance when the speed of A is v and speed of B is $3v$, the speed of centre of mass is

- (1) v (2) $4v$
(3) $2v$ (4) Zero

Answer (4)

Sol. Only internal force is acting on the system. Therefore $\vec{F}_{\text{ext}} = 0$. It is also given that the initial velocity of COM is zero, therefore it will remain at rest.

2. On the basis of electrical conductivity, which one of the following material has the smallest resistivity?

- (1) Glass (2) Silicon
(3) Germanium (4) Silver

Answer (4)

Sol. Silver is the only metal among the given materials, hence its resistivity will be the least.

3. A charge $Q \mu\text{C}$ is placed at the centre of a cube. The flux coming out from any one of its faces will be (in SI unit)

- (1) $\frac{Q}{6\epsilon_0} \times 10^{-3}$ (2) $\frac{Q}{6\epsilon_0} \times 10^{-6}$
(3) $\frac{Q}{\epsilon_0} \times 10^{-6}$ (4) $\frac{2Q}{3\epsilon_0} \times 10^{-3}$

Answer (2)

Sol. According to Gauss law, total electric flux through a closed surface is

$$\phi_{\text{net}} = \frac{q}{\epsilon_0}$$

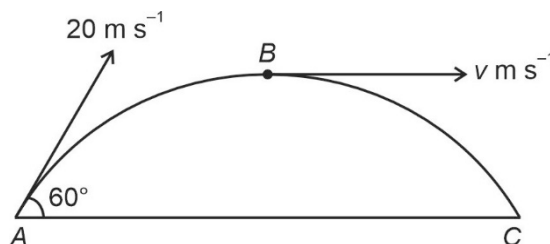
\therefore Total electric flux through the cube is

$$\phi_T = \frac{Q \times 10^{-6}}{\epsilon_0}$$

Since charge is placed at the centre of the cube, therefore flux through each face is same.

$$\text{Hence, } \phi = \frac{1}{6} \phi_T = \frac{1}{6} \times \frac{Q \times 10^{-6}}{\epsilon_0}$$

4. A ball is projected from point A with velocity 20 m s^{-1} at an angle 60° to the horizontal direction. At the highest point B of the path (as shown in figure), the velocity $v \text{ m s}^{-1}$ of the ball will be



- (1) Zero (2) 10
(3) 20 (4) $10\sqrt{3}$

Answer (2)

Sol. At the highest point of a projectile, vertical component of velocity becomes zero.

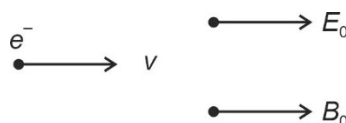
$$\text{Therefore at point } B, v = 20\cos 60^\circ = 20 \times \frac{1}{2} = 10 \text{ m/s}$$

5. A uniform electric field and a uniform magnetic field are acting along the same direction in a certain region. If an electron is projected in the region such that its velocity is pointed along the direction of fields, then the electron

- (1) Speed will decrease (2) Speed will increase
(3) Will turn towards right of direction of motion (4) Will turn towards left of direction of motion

Answer (1)

Sol. Given condition is shown in figure



Force due to magnetic field is given by

$$F_m = qvB \sin \theta$$

$$\text{Here } \theta = 0 \Rightarrow F_m = 0$$

Force due to electric field is

$$\vec{F}_e = q\vec{E}$$

$$\text{Here, } \vec{F}_e = -e\vec{E}$$

\therefore Force due to electric field will be opposite to the direction of motion.

Hence its speed will decrease.

6. A certain wire A has resistance 81Ω . The resistance of another wire B of same material and equal length but of diameter thrice the diameter of A will be

- (1) 729Ω (2) 243Ω
(3) 81Ω (4) 9Ω

Answer (4)

Sol. We know that, $R = \frac{\rho l}{A}$, where $A = \frac{\pi}{4}d^2$

$$\Rightarrow 81 = \frac{\rho \times l}{\frac{\pi}{4}d^2}, \text{ also, } R' = \frac{\rho \times l}{\frac{\pi}{4} \times (3d)^2} = \frac{\rho l}{\frac{\pi}{4} \times 9d^2}$$

$$\Rightarrow R' = \frac{R}{9} = \frac{81}{9} = 9 \Omega$$

7. The amount of elastic potential energy per unit volume (in SI unit) of a steel wire of length 100 cm to stretch it by 1 mm is (if Young's modulus of the wire = $2.0 \times 10^{11} \text{ N m}^{-2}$)

- (1) 10^7 (2) 10^5
(3) 10^{11} (4) 10^{17}

Answer (2)

Sol. We know that, elastic potential energy per unit volume = $\frac{1}{2} \times \text{Stress} \times \text{Strain}$

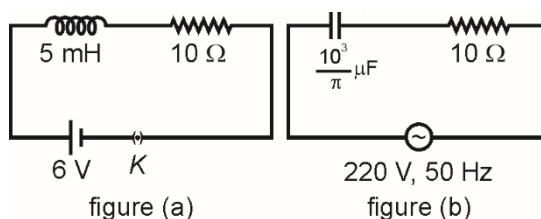
Also, $Y = \frac{\text{Stress}}{\text{Strain}}$

\Rightarrow Elastic potential energy per unit volume = $\frac{1}{2} \times \text{Young's modulus} \times (\text{Strain})^2$

$$= \frac{1}{2} \times 2 \times 10^{11} \times \left[\frac{1}{1000} \right]^2$$

$$= \frac{1}{2} \times 2 \times 10^{11} \times 10^{-6} = 10^5 \text{ (J/m}^3\text{)}$$

8. If Z_1 and Z_2 are the impedances of the given circuits (a) and (b) as shown in figures, then choose the correct option.



- (1) $Z_1 = Z_2$ (2) $Z_1 > Z_2$
(3) $Z_1 < Z_2$ (4) $Z_1 + Z_2 = 20 \Omega$

Answer (3)

Sol. $Z_1 = R = 10 \Omega$ [as, D.C. voltage is supplied]

$$Z_2 = \sqrt{R^2 + (X_C)^2} = \sqrt{(10)^2 + \left[\frac{1}{2 \times \pi \times 50 \times \frac{10^3}{\pi} \times 10^{-6}} \right]^2}$$

$$\Rightarrow Z_2 = \sqrt{(10)^2 + (10)^2} = 10\sqrt{2}$$

$$\Rightarrow Z_2 > Z_1 \text{ or } Z_1 < Z_2$$

9. The ground state energy of hydrogen atom is -13.6 eV . The energy needed to ionize hydrogen atom from its second excited state will be

- (1) 1.51 eV (2) 3.4 eV
(3) 13.6 eV (4) 6.8 eV

Answer (1)

Sol. We know that total energy of electron in hydrogen atom is given by $E_n = \frac{-13.6}{n^2}$

Also, total energy of electron in second excited state = $\frac{-13.6}{(3)^2} = -1.51 \text{ eV}$

\Rightarrow Ionization energy or energy required to ionize hydrogen atom from its second excited state = 1.51 eV

10. The mechanical quantity, which has dimensions of reciprocal of mass (M^{-1}) is
- | | |
|----------------------|---|
| (1) Torque | (2) Gravitational constant |
| (3) Angular momentum | (4) Coefficient of thermal conductivity |

Answer (2)

Sol. We know that, $F = \frac{GM_1M_2}{r^2}$

$$\Rightarrow [G] = \frac{[F][r^2]}{[M_1][M_2]} = \frac{[MLT^{-2}][L^2]}{[M][M]}$$

$$\Rightarrow [G] = [M^{-1} L^3 T^{-2}]$$

i.e., gravitational constant is mechanical quantity which has dimensions of reciprocal of mass (M^{-1})

11. A p-type extrinsic semiconductor is obtained when Germanium is doped with
- | | |
|--------------|-----------------|
| (1) Arsenic | (2) Boron |
| (3) Antimony | (4) Phosphorous |

Answer (2)

Sol. To make a p-type semiconductor, an intrinsic semiconductor is doped with an intrinsic impurity which has 3 valence electrons in its outer orbit.

For example – Gallium, Indium, Boron, Aluminium.

So, correct answer is option (2).

12. The viscous drag acting on a metal sphere of diameter 1 mm, falling through a fluid of viscosity 0.8 Pa s with a velocity of 2 m s⁻¹ is equal to
- | | |
|----------------------------|---------------------------|
| (1) 1.5×10^{-3} N | (2) 20×10^{-3} N |
| (3) 15×10^{-3} N | (4) 30×10^{-3} N |

Answer (3)

Sol. Viscous drag acting on sphere is given by

$$F_v = 6\pi\eta rv$$

$$= 6 \times \frac{22}{7} \times 0.8 \times \frac{10^{-3}}{2} \times 2$$

$$= 15.08 \times 10^{-3} \text{ N}$$

$$\approx 15 \times 10^{-3} \text{ N}$$

13. The maximum power is dissipated for an ac in a/an
- | | |
|-----------------------|------------------------|
| (1) Inductive circuit | (2) Capacitive circuit |
| (3) Resistive circuit | (4) LC circuit |

Answer (3)

$$\text{Sol. } P = V_{\text{rms}} I_{\text{rms}} \cos\phi$$

In purely resistive circuit voltage and current are in same phase therefore phase difference is zero.

So, $\cos\phi = 1$

\therefore Power dissipated is maximum.

14. According to Gauss law of electrostatics, electric flux through a closed surface depends on
- (1) The shape of the surface
 - (2) The volume enclosed by the surface
 - (3) The area of the surface
 - (4) The quantity of charges enclosed by the surface

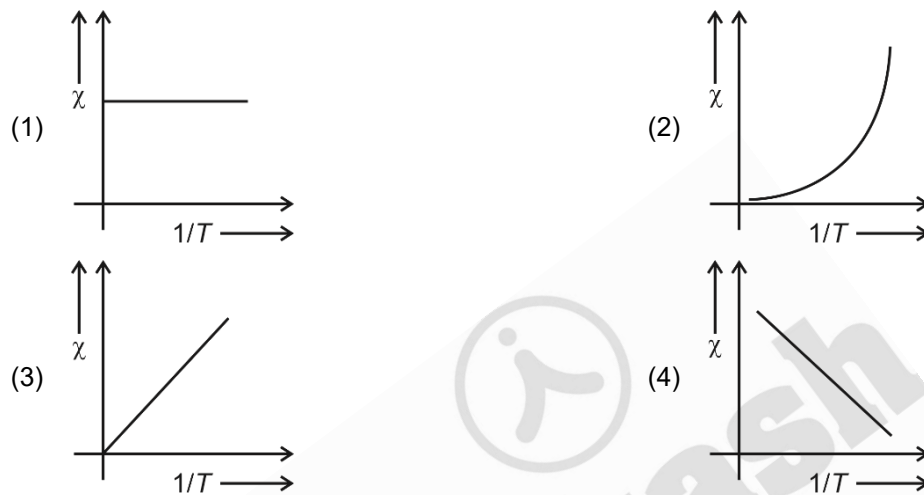
Answer (4)

Sol. According to Gauss' law

$$\phi = \oint \vec{E} \cdot d\vec{s} = \frac{q_{\text{enclosed}}}{\epsilon_0}$$

\therefore Flux depends on quantity of charges enclosed by surface.

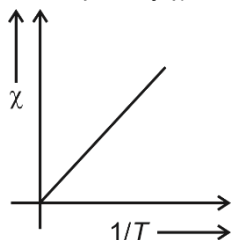
15. The variation of susceptibility (χ) with absolute temperature (T) for a paramagnetic material is represented as:



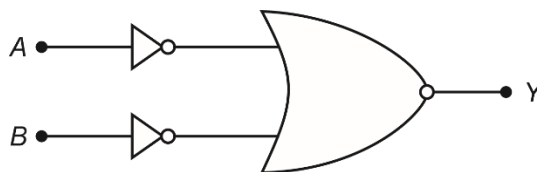
Answer (3)

Sol. Curie law $\chi_m \propto \frac{1}{T}$ (Paramagnetic)

Susceptibility χ varies inversely with absolute temperature.



16. The given circuit is equivalent to



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

Answer (2)

Sol.

A	B	\bar{A}	\bar{B}	$X = \bar{A} + \bar{B}$	$Y = \bar{X}$
0	0	1	1	1	0
1	1	0	0	0	1
0	1	1	0	1	0
1	0	0	1	1	0

The output of the truth table represents AND gate.

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

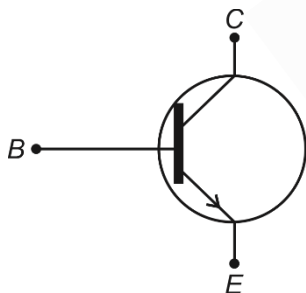
Method 2:

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

$$Y = \overline{\overline{A}} \cdot \overline{\overline{B}} = AB$$

AND gate

17.



The above figure shows the circuit symbol of a transistor. Select the correct statements given below:

- (A) The transistor has two segments of p-type semiconductor separated by a segment of n-type semiconductor.
- (B) The emitter is of moderate size and heavily doped.
- (C) The central segment is thin and lightly doped.
- (D) The emitter base junction is reverse biased in common emitter amplifier circuit.
- (1) (A) and (B) (2) (B) and (C)
- (3) (C) and (D) (4) (A) and (D)

Answer (2)

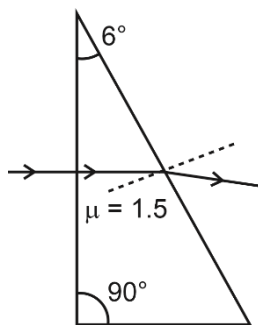
Sol. The given transistor represents a n-p-n transistor so statement (A) is eliminated.

Emitter is of moderate size and heavily doped and central segment is thin and lightly doped.

So, statements (B) and (C) are correct.

Emitter base junction is forward biased.

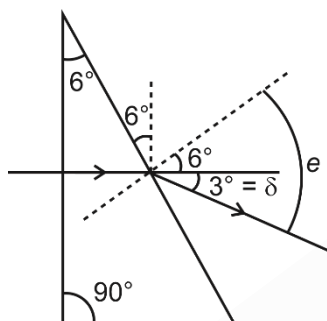
18. A horizontal ray of light is incident on the right-angled prism with prism angle 6° . If the refractive index of the material of the prism is 1.5, then the angle of emergence will be



- (1) 4° (2) 6°
(3) 9° (4) 10°

Answer (3)

Sol.



Deviation produced by a thin prism

$$\delta = (\mu - 1)A = \left(\frac{3}{2} - 1\right)6^\circ = 3^\circ$$

$$\text{Angle of emergence} = e = 6^\circ + 3^\circ = 9^\circ$$

19. A particle moves with a velocity $(5\hat{i} - 3\hat{j} + 6\hat{k}) \text{ ms}^{-1}$ horizontally under the action of constant force $(10\hat{i} + 10\hat{j} + 20\hat{k}) \text{ N}$. The instantaneous power supplied to the particle is:

- (1) 100 W (2) 140 W
(3) 200 W (4) Zero

Answer (2)

Sol. Instantaneous power is given by

$$P = \vec{F} \cdot \vec{V}$$

$$P = [10\hat{i} + 10\hat{j} + 20\hat{k}] \cdot [5\hat{i} - 3\hat{j} + 6\hat{k}] \text{ W}$$

$$= [50 - 30 + 120] \text{ W} = 140 \text{ W}$$

20. The maximum kinetic energy of the emitted photoelectrons in photoelectric effects is independent of:

- (1) Frequency of incident radiation (2) Wavelength of incident radiation
(3) Work function of material (4) Intensity of incident radiation

Answer (4)

Sol. By photoelectric equation

$$KE_{\max} = hf - \phi_0$$

$$KE_{\max} = \frac{hc}{\lambda} - \frac{hc}{\lambda_0}$$

KE_{\max} is independent of intensity of incident radiation.

21. The diameter of a spherical bob, when measured with vernier callipers yielded the following values: 3.33 cm, 3.32 cm, 3.34 cm, 3.33 cm and 3.32 cm.

The mean diameter to appropriate significant figures is:

- (1) 3.33 cm (2) 3.32 cm
(3) 3.328 cm (4) 3.3 cm

Answer (1)

Sol. Mean diameter = $\frac{[3.33 \text{ cm} + 3.32 \text{ cm} + 3.34 \text{ cm} + 3.33 \text{ cm} + 3.32 \text{ cm}]}{5}$

$$= 3.328 \text{ cm}$$

After rounding off to 2 decimal places.

Final mean diameter = 3.33 cm

22. Which of the following statement is **not** true?

- (1) Pressure is a vector quantity (2) Relative density is a scalar quantity
(3) Coefficient of viscosity is a scalar quantity (4) Surface tension is a scalar quantity

Answer (1)

Sol. Pressure is scalar quantity

So, option (1) is the correct answer

23. The position of a particle is given by

$$\vec{r}(t) = 4t\hat{i} + 2t^2\hat{j} + 5\hat{k}$$

where t is in seconds and r in metre. Find the magnitude and direction of velocity $v(t)$, at $t = 1$ s, with respect to x -axis.

- (1) $3\sqrt{2} \text{ ms}^{-1}$, 30° (2) $3\sqrt{2} \text{ ms}^{-1}$, 45°
(3) $4\sqrt{2} \text{ ms}^{-1}$, 45° (4) $4\sqrt{2} \text{ ms}^{-1}$, 60°

Answer (3)

Sol. $\vec{r}(t) = (4t\hat{i} + 2t^2\hat{j} + 5\hat{k}) \text{ m}$

$$\frac{d\vec{r}(t)}{dt} = 4\hat{i} + 4t\hat{j} \Big|_{t=1} \text{ ms}^{-1}$$

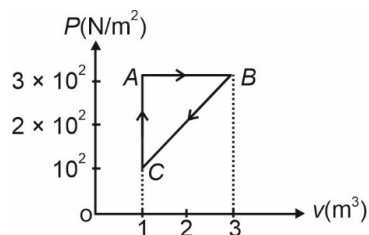
$$\vec{v} = 4\hat{i} + 4\hat{j} \text{ ms}^{-1}$$

$$|\vec{v}| = \sqrt{4^2 + 4^2} = 4\sqrt{2} \text{ ms}^{-1}$$

$$\tan \phi = \frac{v_y}{v_x} = \frac{4}{4} = 1$$

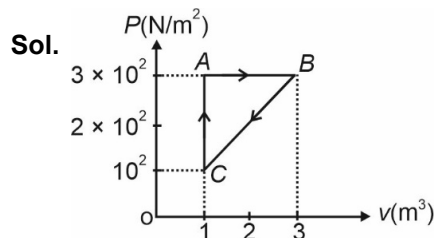
$$\phi = 45^\circ$$

24. For the given cycle, the work done during isobaric process is:



- (1) 400 J
(2) 600 J
(3) 200 J
(4) Zero

Answer (2)



Work done in isobaric (AB) process

$$= P \Delta V$$

$$= 3 \times 10^2 [2] \text{ J} = 600 \text{ J}$$

25. The de Broglie wavelength associated with an electron, accelerated by a potential difference of 81 V is given by:

- (1) 1.36 nm
(2) 0.136 nm
(3) 13.6 nm
(4) 136 nm

Answer (2)

Sol. We know, for an electron

$$\text{De Broglie wavelength, } \lambda = \frac{12.27}{\sqrt{V}} \text{ \AA}$$

$$\lambda = \frac{12.27}{\sqrt{81}} = \frac{12.27}{9} \text{ \AA}$$

$$\lambda = 1.36 \text{ \AA} \text{ or } 0.136 \text{ nm}$$

26. The 4th overtone of a closed organ pipe is same as that of 3rd overtone of an open pipe. The ratio of the length of the closed pipe to the length of the open pipe is:

- (1) 9 : 8
(2) 7 : 9
(3) 8 : 9
(4) 9 : 7

Answer (1)

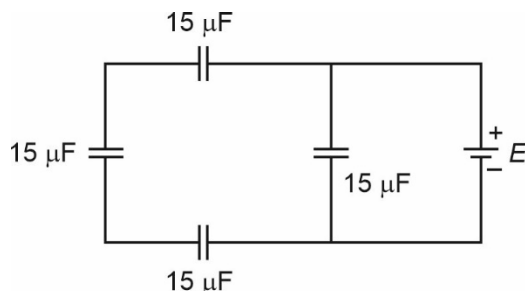
Sol. 4th overtone for closed organ pipe → 9th harmonic

3rd overtone for open organ pipe → 4th harmonic

$$9 \left(\frac{V}{4l_c} \right) = 4 \left(\frac{V}{2l_o} \right)$$

$$\frac{l_c}{l_o} = \frac{9}{8}$$

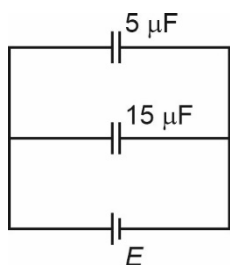
27. The equivalent capacitance of the arrangement shown in figure is



- (1) $25 \mu\text{F}$ (2) $20 \mu\text{F}$
 (3) $30 \mu\text{F}$ (4) $15 \mu\text{F}$

Answer (2)

Sol. We know that the circuit can be modified as



$$\therefore C_{\text{net}} = 15 + 5 = 20 \mu\text{F}$$

28. ϵ_0 and μ_0 are the electric permittivity and magnetic permeability of free space respectively. If the corresponding quantities of a medium are $2\epsilon_0$ and $1.5\mu_0$ respectively, the refractive index of the medium will nearly be

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

Answer (4)

Sol. We know

$$\text{Refractive index} = \frac{\sqrt{\mu\epsilon}}{\sqrt{\mu_0\epsilon_0}}$$

$$= \frac{\sqrt{(1.5)\mu_0(2)\epsilon_0}}{\sqrt{\mu_0\epsilon_0}}$$

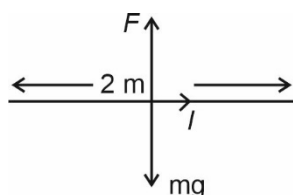
$$= \sqrt{3}$$

29. A long straight wire of length 2 m and mass 250 g is suspended horizontally in a uniform horizontal magnetic field of 0.7 T. The amount of current flowing through the wire will be ($g = 9.8 \text{ ms}^{-2}$)

- (1) 2.75 A (2) 1.75 A
 (3) 2.45 A (4) 2.25 A

Answer (2)

Sol.



we know

$$F = mg$$

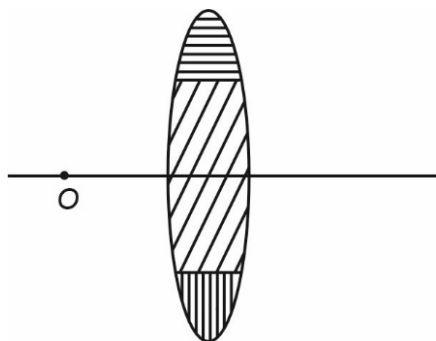
$$I \ell B = mg$$

$$I = \frac{mg}{\ell B} = \frac{250 \times 10^{-3} \times 9.8}{(2)(0.7)}$$

$$I = 1750 \times 10^{-3} \text{ A}$$

$$I = 1.75 \text{ A}$$

30. A lens is made up of 3 different transparent media as shown in figure. A point object O is placed on its axis beyond $2f$. How many real images will be obtained on the other side?



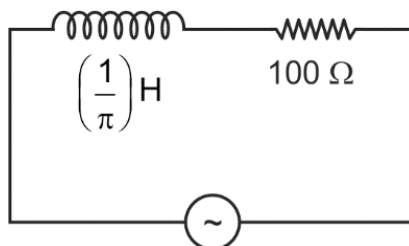
- (1) No image will be formed
(2) 3
(3) 2
(4) 1

Answer (2)

Sol. Since all three medium will form individual real images at different points on the other side of lens (as object distance is more than $2f$)

\therefore Number of real images formed = 3.

31. An ac source is connected in the given circuit. The value of ϕ will be



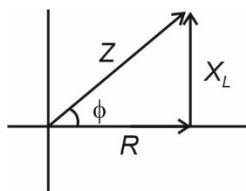
$$V = 220 \sin(100\pi t + \phi) \text{ volt}$$

- (1) 30°
(2) 45°
(3) 60°
(4) 90°

Answer (2*)

Sol. $X_L = \omega L$

$$X_L = 100 \pi \times \frac{1}{\pi} = 100 \Omega$$



$$\tan \phi = \frac{X_L}{R} = \frac{100}{100} = 1$$

$$\phi = 45^\circ$$

32. A bullet of mass m hits a block of mass M elastically. The transfer of energy is the maximum, when

- (1) $M \ll m$ (2) $M \gg m$
 (3) $M = m$ (4) $M = 2m$

Answer (3)

Sol. During elastic collision between two equal masses, the velocity of the two bodies gets interchanged so if one body is at rest, energy transfer will be maximum for $M = m$

$$m_1 = m_2 = m \text{ (say)}$$

33. The escape velocity of a body on the earth surface is 11.2 km/s. If the same body is projected upward with velocity 22.4 km/s, the velocity of this body at infinite distance from the centre of the earth will be

- (1) 11.2 km/s (2) $11.2\sqrt{3}$ km/s
 (3) $11.2\sqrt{2}$ km/s (4) Zero

Answer (2)

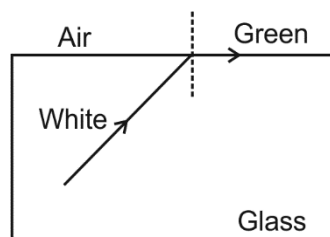
Sol. $V'^2 = V^2 - Ve^2$

$$V' = \sqrt{V^2 - Ve^2}$$

$$= \sqrt{(22.4)^2 - (11.2)^2}$$

$$V' = 11.2\sqrt{3} \text{ km/s}$$

34.



Which set of colours will come out in air for a situation shown in figure?

- (1) Orange, Red and Violet (2) Blue, Green and Yellow
 (3) Yellow, Orange and Red (4) All

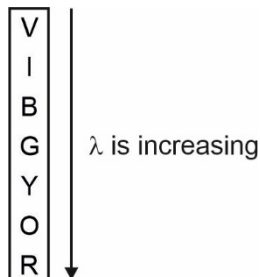
Answer (3)

Sol. We know,

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

Also $\mu \propto \frac{1}{\lambda}$

Thus $\sin i_c \propto \lambda$



Therefore, for higher value of λ critical angle will be more
Hence Yellow, Orange and Red will come out to air.

35. The wavelength of Lyman series of hydrogen atom appears in

- | | |
|------------------------|-------------------------|
| (1) Ultraviolet region | (2) Infrared region |
| (3) Visible region | (4) Far infrared region |

Answer (1)

Sol. The wavelength of Lyman series of hydrogen atom appears in Ultraviolet region.

SECTION-B

36. A particle is executing uniform circular motion with velocity \vec{v} and acceleration \vec{a} . Which of the following is true?

- | |
|--|
| (1) \vec{v} is a constant; \vec{a} is a constant |
| (2) \vec{v} is not a constant; \vec{a} is a constant |
| (3) \vec{v} is a constant; \vec{a} is not a constant |
| (4) \vec{v} is not a constant; \vec{a} is not a constant |

Answer (4)

Sol. \vec{v} is not a constant; \vec{a} is not a constant

In uniform circular motion \vec{v} keeps changing at every instant while magnitude of a remains same but its direction keeps changing.

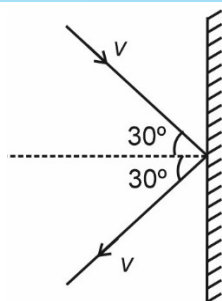
Thus \vec{a} is also not constant.

37. A 1 kg object strikes a wall with velocity 1 ms^{-1} at an angle of 60° with the wall and reflects at the same angle. If it remains in contact with wall for 0.1 s, then the force exerted on the wall is

- | | |
|----------------------------|----------------------------|
| (1) $10\sqrt{3} \text{ N}$ | (2) $20\sqrt{3} \text{ N}$ |
| (3) $30\sqrt{3} \text{ N}$ | (4) Zero |

Answer (1)

Sol.



$$F = \frac{\Delta p}{\Delta t}$$

$$\Delta p = 2mv \cos 30^\circ$$

$$= 2 \times 1 \times \frac{\sqrt{3}}{2} = \sqrt{3}$$

$$F = \frac{\sqrt{3}}{0.1} = 10\sqrt{3} \text{ N}$$

38. A simple pendulum oscillating in air has a period of $\sqrt{3}$ s. If it is completely immersed in non-viscous liquid, having density $\left(\frac{1}{4}\right)^{\text{th}}$ of the material of the bob, the new period will be

(1) 2 s

(2) $\frac{\sqrt{3}}{2}$ s

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

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

Answer (1)**Sol.** Time period of simple pendulum

$$T = 2\pi \sqrt{\frac{l}{g_{\text{eff}}}}$$

$$\sqrt{3} = 2\pi \sqrt{\frac{l}{g}}$$

After immersed in liquid

$$Mg_{\text{eff}} = Mg - \frac{Mg}{\frac{\rho_s}{\rho_l}}$$

$$Mg_{\text{eff}} = Mg - \frac{Mg}{4} = \frac{3Mg}{4}$$

$$g_{\text{eff}} = \frac{3g}{4}$$

$$T_1 = 2\pi \sqrt{\frac{l}{\frac{3g}{4}}} = \left(2\pi \sqrt{\frac{l}{g}}\right) \times \frac{2}{\sqrt{3}}$$

$$T_1 = \frac{2T}{\sqrt{3}} = 2 \text{ s}$$

39. An object is mounted on a wall. Its image of equal size is to be obtained on a parallel wall with the help of a convex lens placed between these walls. The lens is kept at distance x in front of the second wall. The required focal length of the lens will be

- (1) $\frac{x}{2}$
- (2) $\frac{x}{4}$
- (3) Less than $\frac{x}{4}$
- (4) More than $\frac{x}{4}$ but less than $\frac{x}{2}$

Answer (1)

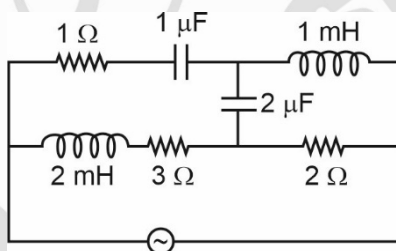
Sol. Height of image of object equal to height of object for convex lens.

If object is placed at $2f$

$$2f = x$$

$$f = \frac{x}{2}$$

40. For very high frequencies, the effective impedance of the circuit (shown in the figure) will be



- (1) 1Ω
- (2) 3Ω
- (3) 4Ω
- (4) 6Ω

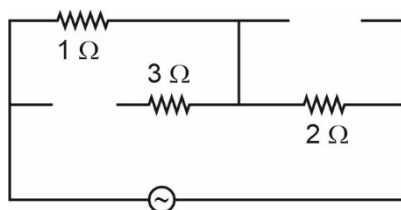
Answer (2)

Sol. $X_L = \omega L$

$$X_C = \frac{1}{\omega C}$$

at very high frequency

$$X_C = 0, X_L = \infty$$



$$Z = (1 + 2) \Omega = 3 \Omega$$

41. A copper wire of radius 1 mm contains 10^{22} free electrons per cubic metre. The drift velocity for free electrons when 10 A current flows through the wire will be (Given, charge on electron = 1.6×10^{-19} C)

- (1) $\frac{6.25}{\pi} \text{ m s}^{-1}$
 (2) $\frac{6.25 \times 10^5}{\pi} \text{ m s}^{-1}$
 (3) $\frac{6.25 \times 10^4}{\pi} \text{ m s}^{-1}$
 (4) $\frac{6.25}{\pi} \times 10^3 \text{ m s}^{-1}$

Answer (4)

Sol. $V_d = \frac{i}{neA}$

$$V_d = \frac{10}{10^{22} \times 1.6 \times 10^{-19} \times \pi (10^{-3})^2}$$

$$V_d = \frac{10}{1.6\pi \times 10^{-3}}$$

$$= \frac{6.25}{\pi} \times 10^3 \text{ m/s}$$

42. A container of volume 200 cm³ contains 0.2 mole of hydrogen gas and 0.3 mole of argon gas. The pressure of the system at temperature 200 K ($R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$) will be

- (1) $4.15 \times 10^5 \text{ Pa}$ (2) $4.15 \times 10^6 \text{ Pa}$
 (3) $6.15 \times 10^5 \text{ Pa}$ (4) $6.15 \times 10^4 \text{ Pa}$

Answer (2)

Sol. We know that

$$PV = nRT$$

$$P_1 = \frac{n_1}{V} RT$$

$$P_2 = \frac{n_2}{V} RT$$

$$P_{\text{net}} = P_1 + P_2$$

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

$$= (0.2 + 0.3) \times \frac{8.3 \times 200}{200 \times 10^{-6}}$$

$$= 8.3 \times 0.5 \times 10^6 = 4.15 \times 10^6 \text{ Pa}$$

43. A constant torque of 100 N m turns a wheel of moment of inertia 300 kg m² about an axis passing through its centre. Starting from rest, its angular velocity after 3 s is

- (1) 10 rad/s (2) 15 rad/s
 (3) 1 rad/s (4) 5 rad/s

Answer (3)

Sol. About fixed axis \rightarrow Torque $= I \alpha$

$$\alpha = \frac{100}{300}$$

$$\alpha = \frac{1}{3} \text{ rad/s}^2$$

for constant α

$$\Rightarrow \omega_i = 0$$

$$\omega_f = \omega_i + \alpha t$$

at $t = 3 \text{ s}$

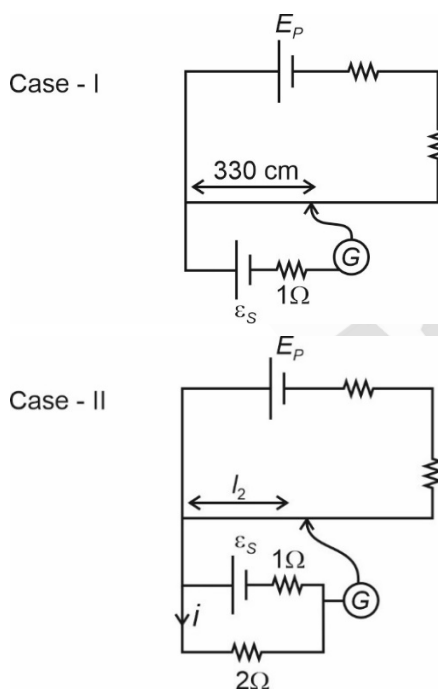
$$\omega_f = \frac{1}{3} \times 3 = 1 \text{ rad/s}$$

44. The emf of a cell having internal resistance 1Ω is balanced against a length of 330 cm on a potentiometer wire. When an external resistance of 2Ω is connected across the cell, the balancing length will be

- (1) 115 cm (2) 332 cm
(3) 220 cm (4) 330 cm

Answer (3)

Sol.



For case - I

$$\Rightarrow \epsilon_s = \phi \times 330$$

$$\Rightarrow \phi = \frac{\epsilon_s}{330} \left(\frac{V}{\text{cm}} \right) \dots (1)$$

For case - II

$$\Rightarrow i \times 2 = \phi l_2$$

$$\Rightarrow \frac{\epsilon_s}{3} \times 2 = \frac{\epsilon_s}{330} \times l_2 \text{ [From equation 1]}$$

$$\Rightarrow l_2 = 220 \text{ cm}$$

45. If R is the radius of the earth and g is the acceleration due to gravity on the earth surface. Then the mean density of the earth will be

- (1) $\frac{3g}{4\pi RG}$
- (2) $\frac{4\pi G}{3gR}$
- (3) $\frac{\pi RG}{12g}$
- (4) $\frac{3\pi R}{4gG}$

Answer (1)

Sol. Acceleration due to gravity on the earth surface $g = \frac{GM}{R^2}$

$$g = \frac{G \frac{4}{3} \pi R^3 \rho}{R^2}$$

$$g = G \frac{4}{3} \pi R \rho$$

$$\Rightarrow \rho = \frac{3g}{4G\pi R}$$

46. If a conducting sphere of radius R is charged. Then the electric field at a distance r ($r > R$) from the centre of the sphere would be, (V = potential on the surface of the sphere)

- (1) $\frac{RV}{r^2}$
- (2) $\frac{V}{r}$
- (3) $\frac{rV}{R^2}$
- (4) $\frac{R^2V}{r^3}$

Answer (1)

Sol. For $r > R$,

$$\text{Electric field } E = \frac{Kq}{r^2} \dots (1)$$

$$\text{and potential at surface of sphere } V = \frac{Kq}{R}$$

\therefore From equation (1)

$$V = \frac{Er^2}{R}$$

$$\Rightarrow E = \frac{RV}{r^2}$$

47. To produce an instantaneous displacement current of 2 mA in the space between the parallel plates of a capacitor of capacitance $4 \mu\text{F}$, the rate of change of applied variable potential difference $\left(\frac{dV}{dt}\right)$ must be

- (1) 200 V/s (2) 400 V/s
(3) 800 V/s (4) 500 V/s

Answer (4)

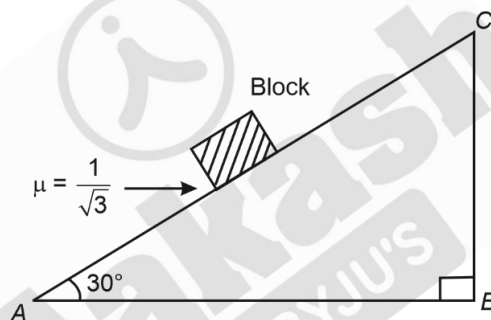
Sol. Displacement current $i_d = c \frac{dV}{dt}$

$$\Rightarrow 2 \times 10^{-3} = 4 \times 10^{-6} \times \frac{dV}{dt}$$

$$\Rightarrow \frac{2 \times 10^{-3}}{4 \times 10^{-6}} = \frac{dV}{dt}$$

$$\Rightarrow \frac{dV}{dt} = 500 \text{ V/s}$$

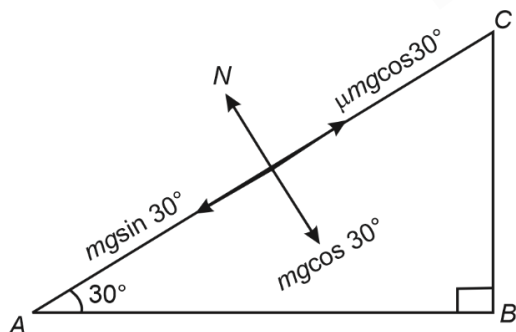
48. A block of mass 2 kg is placed on an inclined rough surface AC (as shown in figure) of coefficient of friction μ . If $g = 10 \text{ ms}^{-2}$, the net force (in N) on the block will be



- (1) 10 (2) 20
(3) $10\sqrt{3}$ (4) Zero

Answer (4)

Sol.



$$\Rightarrow (F_{\text{net}})_H = mg \sin 30^\circ - \mu mg \cos 30^\circ$$

$$= \frac{mg}{2} - \frac{1}{\sqrt{3}} mg \cdot \frac{\sqrt{3}}{2}$$

$$F_{\text{net}} = 0$$

49. An emf is generated by an ac generator having 100 turn coil, of loop area 1 m^2 . The coil rotates at a speed of one revolution per second and placed in a uniform magnetic field of 0.05 T perpendicular to the axis of rotation of the coil. The maximum value of emf is

- (1) 62.8 V
- (2) 6.28 V
- (3) 3.14 V
- (4) 31.4 V

Answer (4)

Sol. Maximum value of emf generated by an ac generator is given by

$$\begin{aligned}
 \varepsilon_0 &= NBA\omega \\
 &= 100 \times 0.05 \times 1 \times 2\pi \\
 &= 31.415 \text{ V} \\
 &\approx 31.4 \text{ V}
 \end{aligned}$$

50. The angular momentum of an electron moving in an orbit of hydrogen atom is $1.5 \left(\frac{h}{\pi} \right)$. The energy in the same orbit is nearly

- (1) -1.3 eV
- (2) -1.4 eV
- (3) -1.5 eV
- (4) -1.6 eV

Answer (3)

Sol. Angular momentum of electron moving in n^{th} orbit of hydrogen atom

$$L = \frac{nh}{2\pi} \quad \dots \text{ (I)}$$

$$\text{Given, } L = 1.5 \frac{h}{\pi} \quad \dots \text{ (II)}$$

Hence, $n = 3$

Now, energy of electron in 3^{rd} orbit

$$\begin{aligned}
 E &= \frac{-13.6 \times z^2}{n^2} \\
 &= \frac{-13.6 \times 1^2}{3^2} \\
 &= -1.51 \text{ eV} \\
 &\approx -1.5 \text{ eV}
 \end{aligned}$$

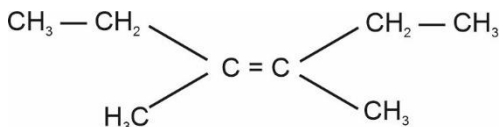
CHEMISTRY

SECTION-A

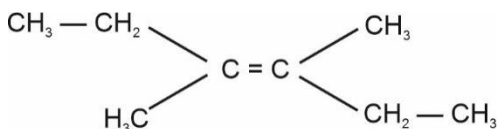
51. Which amongst the following compounds will show geometrical isomerism?
- (1) 2-Methylprop-1-ene (2) 3,4-Dimethylhex-3-ene
(3) Pent-1-ene (4) 2,3-Dimethylbut-2-ene

Answer (2)

Sol. 3,4-Dimethylhex-3-ene will show geometrical isomerism



cis -3,4-Dimethylhex-3-ene



trans-3,4-Dimethylhex-3-ene

52. Select the element (M) whose trihalides cannot be hydrolysed to produce an ion of the form $[\text{M}(\text{H}_2\text{O})_6]^{3+}$.
- (1) Al (2) B
(3) Ga (4) In

Answer (2)

Sol. Boron trihalides cannot be hydrolysed to produce an ion of the form $[\text{B}(\text{H}_2\text{O})_6]^{3+}$ because of absence of *d* orbitals in boron. The maximum covalence of Boron is 4.

53. The correct option for the rate law that corresponds to overall first order reaction is
- (1) Rate = $k[\text{A}]^{1/2} [\text{B}]^2$ (2) Rate = $k [\text{A}]^{-1/2} [\text{B}]^{3/2}$
(3) Rate = $k [\text{A}]^0 [\text{B}]^2$ (4) Rate = $k [\text{A}] [\text{B}]$

Answer (2)

Sol. Rate = $k[\text{A}]^{-\frac{1}{2}} [\text{B}]^{\frac{3}{2}}$

So, order of reaction = $-\frac{1}{2} + \frac{3}{2} = 1$

54. Which one of the following represents all isoelectronic species?
- (1) Na^+ , Mg^{2+} , O^- , F^-
(2) Ca^{2+} , Ar, K^+ , Cl^-
(3) Na^+ , Cl^- , O^- , NO^+
(4) N_2O , N_2O_4 , NO^+ , NO

Answer (2)

Sol. (2) $\text{Ca}^{2+} = 20 - 2 = 18 e^-$

$\text{Ar} = 18 e^-$

$\text{K}^+ = 19 - 1 = 18 e^-$

$\text{Cl}^- = 17 + 1 = 18 e^-$

So, Ca^{2+} , Ar, K^+ and Cl^- are isoelectronic species.

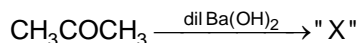
55. Cheilosis occurs due to deficiency of _____.

- (1) Pyridoxamine
- (2) Riboflavin
- (3) Thiamine
- (4) Nicotinamide

Answer (2)

Sol. Cheilosis occurs due to deficiency of vitamin B₂(Riboflavin)

56. Consider the given reaction:

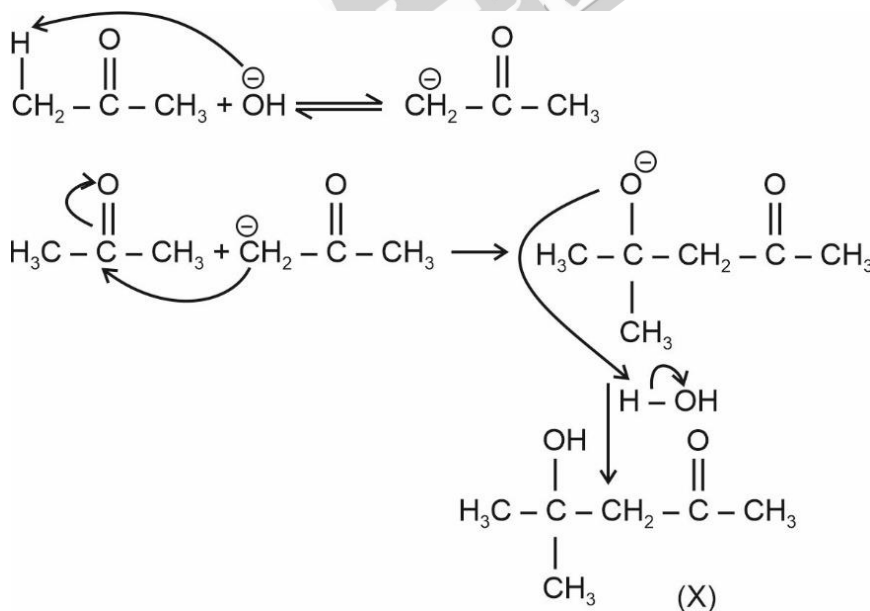


The functional groups present in compound "X" are

- (1) Alcohol and aldehyde
- (2) Alcohol and ketone
- (3) Ketone and double bond
- (4) Double bond and aldehyde

Answer (2)

Sol.



So, the functional group present in compound "X" is alcohol and Ketone.

57. The **correct** option in which the density of argon (Atomic mass = 40) is highest

- (1) 0°C, 4 atm
- (2) 273°C, 4 atm
- (3) STP
- (4) 0°C, 2 atm

Answer (1)

Sol. $PV = nRT$

$$P = \frac{n}{V}RT$$

$$P = \frac{d}{M}RT$$

$$\frac{PM}{RT} = d$$

So, for maximum density P should be maximum and T should be minimum which is in option (1).

58. Reagents which can be used to convert alcohols to carboxylic acids, are

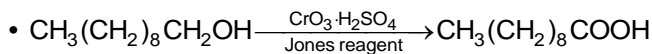
- (A) $\text{CrO}_3 - \text{H}_2\text{SO}_4$
- (B) $\text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4$
- (C) $\text{KMnO}_4 + \text{KOH}/\text{H}_3\text{O}^+$
- (D) Cu, 573 K
- (E) $\text{CrO}_3, (\text{CH}_3\text{CO})_2\text{O}$

Choose the **most appropriate** answer from the options given below.

- (1) (A), (B) and (C) only
- (2) (A), (B) and (E) only
- (3) (B), (C) and (D) only
- (4) (B), (D) and (E) only

Answer (1)

Sol. $\text{R} - \text{CH}_2\text{OH} \xrightarrow[2. \text{H}_3\text{O}^+]{1. \text{alkaline KMnO}_4} \text{R} - \text{COOH}$



• Alcohols can be easily oxidised by $\text{K}_2\text{Cr}_2\text{O}_7$ and CrO_3 in acidic medium.

59. The **correct** order of dipole moments for molecules

NH_3 , H_2S , CH_4 and HF , is

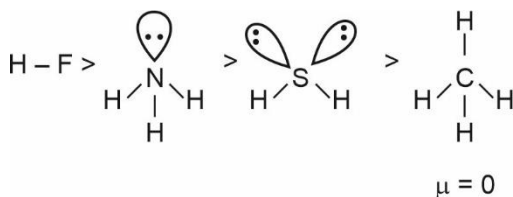
- (1) $\text{NH}_3 > \text{HF} > \text{CH}_4 > \text{H}_2\text{S}$
- (2) $\text{HF} > \text{NH}_3 > \text{H}_2\text{S} > \text{CH}_4$
- (3) $\text{CH}_4 > \text{H}_2\text{S} > \text{NH}_3 > \text{HF}$
- (4) $\text{H}_2\text{S} > \text{NH}_3 > \text{HF} > \text{CH}_4$

Answer (2)

Sol. Fluorine is the most electronegative element.

H-F bond has maximum bond polarity.

Order of dipole moment is



60. Molar conductance of an electrolyte increases with dilution according to the equation:

$$\Lambda_m = \Lambda_m^\circ - A\sqrt{C}$$

Which of the following statements are **true**?

- (A) This equation applies to both strong and weak electrolytes.
- (B) Value of the constant A depends upon the nature of the solvent.
- (C) Value of constant A is same for both BaCl_2 and MgSO_4 .
- (D) Value of constant A is same for both BaCl_2 and $\text{Mg}(\text{OH})_2$.

Choose the **most appropriate** answer from the options given below.

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

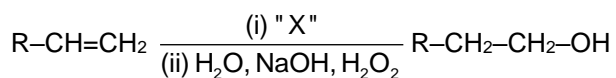
Answer (2)

Sol. $\Lambda_m = \Lambda_m^\circ - A\sqrt{C}$

- For strong electrolytes, Λ_m increases slowly with dilution.
- The value of 'A' depends on the type of electrolyte.
- All electrolytes of particular type have the same value for 'A'

e.g. BaCl_2 and $\text{Mg}(\text{OH})_2 \rightarrow 2 - 1$ electrolytes

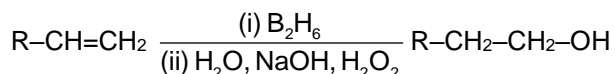
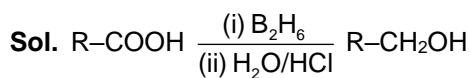
61. $\text{R}-\text{COOH} \xrightarrow[\text{(ii) H}_2\text{O/HCl}]{\text{(i) "X"}} \text{R}-\text{CH}_2\text{OH}$



Identify 'X' in above reactions.

- (1) NaBH_4
- (2) H_2/Pd
- (3) B_2H_6
- (4) LiAlH_4

Answer (3)



- $LiAlH_4$ and $NaBH_4$ cannot reduce $C = C$
- H_2/Pd reduce alkene to alkane

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

Assertion (A) :

Ionisation enthalpy increases along each series of the transition elements from left to right. However, small variations occur.

Reason (R) :

There is corresponding increase in nuclear charge which accompanies the filling of electrons in the inner d-orbitals.

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

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

Answer (1)

Sol. • Due to an increase in nuclear charge which accompanies the filling of the inner d orbitals, there is an increase in ionisation enthalpy along each series of the transition elements, from left to right. However, many small variations occur.

63. Which one of the following statements is **incorrect** related to Molecular Orbital Theory?

- (1) Molecular orbitals obtained from $2p_x$ and $2p_y$ orbitals are symmetrical around the bond axis.
- (2) A π -bonding molecular orbital has larger electron density above and below the internuclear axis.
- (3) The π^* antibonding molecular orbital has a node between the nuclei.
- (4) In the formation of bonding molecular orbital, the two electron waves of the bonding atoms reinforce each other.

Answer (1)

Sol. • According to molecular orbital theory, the sigma (σ) molecular orbitals are symmetrical around the bond-axis while pi (π) molecular orbitals are not symmetrical.

As z-axis is taken as internuclear axis, $2p_x$ and $2p_y$ forms π molecular orbitals, hence these are unsymmetrical around the bond-axis

- 64 Which amongst the following is used in controlling depression and hypertension?

- (1) Equanil
- (2) Prontosil
- (3) Seldane
- (4) Valium

Answer (1)

Sol. Tranquilizers and analgesics are neurologically active drugs.

Equanil is used in controlling depression and hypertension

65 Given below are two statements :

Statement I :

The value of wave function, ψ depends upon the coordinates of the electron in the atom.

Statement II :

The probability of finding an electron at a point within an atom is proportional to the orbital wave function.

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

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

Answer (3)

- Sol.**
- The wave function is a mathematical function whose value depends coordinates of the electron in an atom and does not carry any physical significance. So, Statement I is true.
 - The probability of finding an electron at a point within an atom is proportional to the square of the orbital wave function i.e. $|\psi|^2$ at that point. So, Statement II is false.

66. Match **List-I** with **List-II**.

List-I (Mixtures/Sample)	List-II (Technique used for purification)
(A) Glycerol from spent lye	(I) Steam distillation
(B) Chloroform + Aniline	(II) Fractional distillation
(C) Fractions of crude oil	(III) Distillation under reduced pressure
(D) Aniline + Water	(IV) Distillation

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

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

Answer (3)

- Sol.**
- Chloroform (b.p. 334 K) and aniline (b.p. 457) are easily separated by the technique of distillation as both the liquids having sufficient difference in their boiling points.
 - The fractions of crude oil in petroleum industry is separated using fractional distillation due to less difference in boiling points of liquids.
 - Glycerol can be separated from spent-dye using distillation under reduced pressure.
 - Aniline is separated by steam distillation from aniline-water mixture.

67. Which of the following is **correctly** matched?

- (1) Acidic oxides \Rightarrow Mn_2O_7 , SO_2 , TeO_3
- (2) Amphoteric oxides \Rightarrow BeO , Ga_2O_3 , GeO
- (3) Basic oxides \Rightarrow In_2O_3 , K_2O , SnO_2
- (4) Neutral oxides \Rightarrow CO , NO_2 , N_2O

Answer (1)

- Sol.**
- Mn_2O_7 , SO_2 and TeO_3 are acidic oxides.
 - GeO is distinctly acidic in nature.
 - NO_2 is acidic in nature.

68. The density of 1 M solution of a compound 'X' is 1.25 g mL^{-1} . The **correct** option for the molality of solution is (Molar mass of compound X = 85 g)

- (1) 1.165 m (2) 0.858 m
(3) 0.705 m (4) 1.208 m

Answer (2)

Sol. Relation between Molality (m), Molarity (M) and density (d) is

$$m = \frac{1000M}{1000 \times d - M \times M_{\text{solute}}}$$

M_{solute} denotes molar mass of solute.

$$m = \frac{1000 \times 1}{(1000 \times 1.25) - (1 \times 85)} = \frac{1000}{1250 - 85} = \frac{1000}{1165}$$

$$m = 0.858 \text{ m}$$

69. Given below are two statements:

Statement I:

High density polythene is formed in the presence of catalyst triethylaluminium and titanium tetrachloride.

Statement II:

High density polymers are chemically inert

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

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

Answer (1)

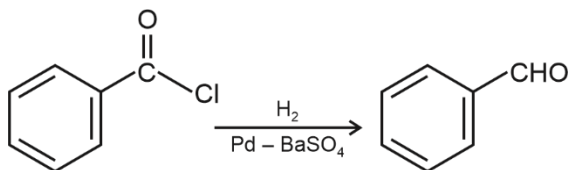
Sol. High density polythene is formed by addition polymerisation of ethene in the presence of catalyst triethyl aluminium and titanium tetrachloride (Ziegler Natta Catalyst).

So, Statement I is correct.

High density polymers are chemically inert.

So, Statement II is also correct.

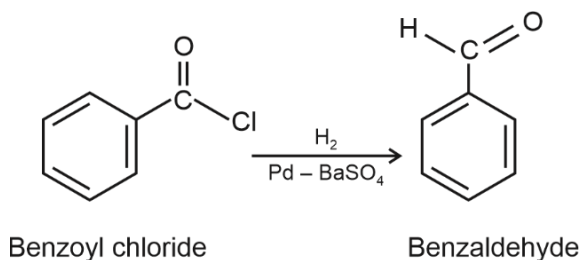
70. The following conversion is known as



- (1) Etard reaction (2) Rosenmund reaction
(3) Stephen reaction (4) Gattermann-Koch reaction

Answer (2)

Sol. Hydrogenation of Acyl chloride in the presence of catalyst palladium on barium sulphate to form aldehyde is known as Rosenmund reaction.



71. Match **List – I** with **List – II**.

List – I (Hydride)	List – II (Type of hydride)
(A) NaH	(I) Electron precise
(B) PH ₃	(II) Saline
(C) GeH ₄	(III) Metallic
(D) LaH _{2.87}	(IV) Electron rich

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

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

Answer (2)**Sol. Hydride****Type of Hydride**

(A) NaH	Saline or Ionic hydride (Generally formed by s-block elements)
(B) PH ₃	Electron rich hydride (Elements of group 15-17 form such hydrides)
(C) GeH ₄	Electron precise (Elements of group 14 form such hydrides)
(D) LaH _{2.87}	Metallic or Non-stoichiometric hydrides (Formed by f block element)

72. **Incorrect** set of quantum numbers from the following is

- (1) $n = 4, l = 2, m_l = -2, -1, 0, +1, +2, m_s = -1/2$
- (2) $n = 5, l = 3, m_l = -3, -2, -1, 0, +1, +2, +3, m_s = +1/2$
- (3) $n = 4, l = 3, m_l = -3, -2, -1, 0, +1, +2, +3, m_s = -1/2$
- (4) $n = 5, l = 2, m_l = -2, -1, +1, +2, m_s = +1/2$

Answer (4)

Sol. For any value of l , m_l value will be $-l$ to $+l$

So for $n = 5$ and $l = 2$: $m_l = -2, -1, 0, +1, +2$ and $m_s = +\frac{1}{2}$ or $-\frac{1}{2}$

Hence, the set $n = 5, l = 2, m_l = -2, -1, +1, +2, m_s = +\frac{1}{2}$ is incorrect

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

Assertion (A):

Lithium and beryllium unlike their other respective group members form compounds with pronounced ionic character.

Reason (R):

Lithium and Magnesium have similar properties due to diagonal relationship.

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

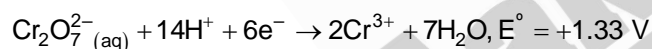
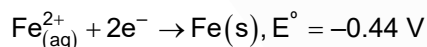
- (1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
- (2) Both **(A)** and **(R)** are true but **(R)** is **not** the correct explanation of **(A)**.
- (3) **(A)** is true but **(R)** is false.
- (4) **(A)** is false but **(R)** is true.

Answer (4)

Sol. Lithium and Beryllium are the first members of their respective groups (i.e. group 1 and 2 respectively). Due to their exceptionally small atomic and ionic sizes they form compounds with covalent character not ionic. Hence, Assertion statement is wrong.

Lithium and Magnesium have similar properties due to diagonal relationship hence, reason statement is correct

74. The **correct** value of cell potential in volt for the reaction that occurs when the following two half cells are connected, is



- (1) +0.01 V
- (2) +0.89 V
- (3) +1.77 V
- (4) +2.65 V

Answer (3)

$$\begin{aligned} \text{Sol. } E_{\text{cell}}^{\circ} &= E_{\text{cathode}} - E_{\text{anode}} \\ &= 1.33 - (-0.44) \\ &= 1.33 + 0.44 = +1.77 \text{ V} \end{aligned}$$

75. An acidic buffer is prepared by mixing:
- (1) Strong acid and its salt with strong base.
 - (2) Strong acid and its salt with weak base.
 - (3) Weak acid and its salt with strong base.
 - (4) Equal volumes of equimolar solutions of weak acid and weak base.
- (The pK_a of acid = pK_b of the base)

Answer (3)

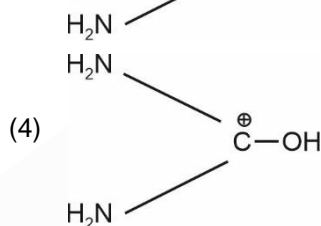
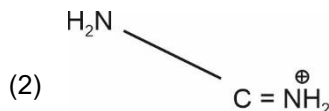
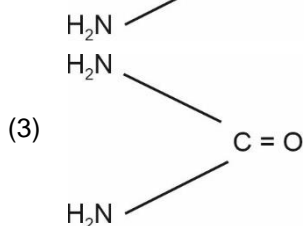
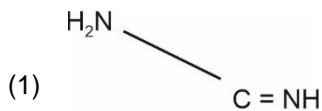
Sol. Acidic buffer is a mixture of weak acid and its conjugate base or salt of that weak acid with another strong base in a molar ratio ranging from $\frac{1}{10}$ to 10

e.g. $\rightarrow \text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$

(Weak acid)

(Salt of weak acid with strong base NaOH)

76. Which amongst the following compounds/species is least basic?

**Answer (4)**

Sol. Amides are not basic in nature because of non availability of lone-pair on nitrogen, protonated amide will be even weaker bases.

77. The **correct** van der Waals equation for 1 mole of a real gas is

(1) $\left(p + \frac{an^2}{V^2}\right)(V^2 - nb) = RT$

(2) $\left(p + \frac{an^2}{V}\right)(V - nb) = nRT$

(3) $\left(p + \frac{a}{V^2}\right)(V - b) = RT$

(4) $\left(p + \frac{V^2}{a}\right)(V - b) = RT$

Answer (3)

Sol. van der Waal equation for n mole gas is

$$\left(p + \frac{an^2}{V^2}\right)(V - nb) = nRT$$

For n = 1 mol

$$\left(p + \frac{a}{V^2}\right)(V - b) = RT$$

78. The E^\ominus values for

$\text{Al}^+/\text{Al} = +0.55 \text{ V}$ and $\text{Tl}^+/\text{Tl} = -0.34 \text{ V}$

$\text{Al}^{3+}/\text{Al} = -1.66 \text{ V}$ and $\text{Tl}^{3+}/\text{Tl} = +1.26 \text{ V}$.

Identify the **incorrect** statement.

(1) Al^+ is unstable in solution.

(2) Tl can be easily oxidised to Tl^+ than Tl^{3+} .

(3) Al is more electropositive than Tl.

(4) Tl^{3+} is a good reducing agent than Tl^{1+} .

Answer (4)

Sol.

- (1) Al^+ is unstable in solution because SRP of Al^+/Al is positive hence, it will get reduced in solution.
- (2) $\text{Ti}/\text{Ti}^+ = +0.34$ (SOP)
 $\text{Ti}/\text{Ti}^{3+} = -1.26$ (SOP)
 Since, SOP $\text{Ti}/\text{Ti}^+ > \text{Ti}/\text{Ti}^{3+}$
 Hence, Ti will get oxidised to Ti^+ easily than Ti^{3+}
- (3) Since Al/Al^{3+} has more SOP than Ti/Ti^+ it will be more electropositive
- (4) Since $\text{Ti}^{3+} + 2\text{e}^- \rightarrow \text{Ti}^+$; $E = \frac{3 \times 1.26 + 0.34}{2}$
 $= +2.04$
 Hence, Ti^{3+} is better oxidising agent not reducing agent

79. Given below are two statements:

Statement I :

Hydrated chlorides and bromides of Ca, Sr and Ba on heating undergo hydrolysis.

Statement II :

Hydrated chlorides and bromides of Be and Mg on heating undergo dehydration.

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

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

Answer (2)

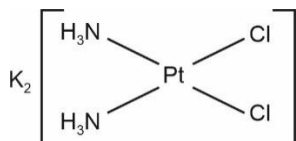
Sol. Since hydrated chlorides and bromides of Ca, Sr and Ba are ionic in nature they will get dehydrated on heating and hydrolysis will not take place, while chloride and bromide of Be and Mg has covalent nature hence, they will get hydrolysed.

80. Which of the following forms a set of a complex and a double salt, respectively?

- (1) $\text{K}_2\text{PtCl}_2 \cdot 2\text{NH}_3$ and $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$
 (2) $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ and $\text{NiCl}_2(\text{H}_2\text{O})_4$
 (3) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{CuCl}_2 \cdot 4\text{NH}_3$
 (4) $\text{PtCl}_2 \cdot 2\text{NH}_3$ and $\text{PtCl}_4 \cdot 2\text{HCl}$

Answer (1)

Sol. $\text{K}_2\text{PtCl}_2 \cdot 2\text{NH}_3$ is complex compound



$\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ is empirical formula of potash alum which is a double salt $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$

81. For a reaction $3A \rightarrow 2B$

The average rate of appearance of B is given by $\frac{\Delta[B]}{\Delta t}$. The **correct** relation between the average rate of appearance of B with the average rate of disappearance of A is given in option

(1) $\frac{-2\Delta[A]}{3\Delta t}$

(2) $\frac{\Delta[A]}{\Delta t}$

(3) $\frac{-\Delta[A]}{\Delta t}$

(4) $\frac{-3\Delta[A]}{2\Delta t}$

Answer (1)

Sol. For reaction, $3A \longrightarrow 2B$

$$\text{Average rate of reaction} = -\frac{1}{3} \frac{\Delta[A]}{\Delta t} = \frac{1}{2} \frac{\Delta[B]}{\Delta t}$$

$$\text{So } \frac{\Delta[B]}{\Delta t} = -\frac{2}{3} \frac{\Delta[A]}{\Delta t}$$

82. For a weak acid HA, the percentage of dissociation is nearly 1% at equilibrium. If the concentration of acid is 0.1 mol L^{-1} , then the **correct** option for its K_a at the same temperature is

(1) 1×10^{-5}

(2) 1×10^{-3}

(3) 1×10^{-4}

(4) 1×10^{-6}

Answer (1)

Sol. $HA \rightleftharpoons H^+ + A^-$

At $t = 0$ C – –

At eq. C – C α C α C α

$$K = \frac{[H^+][A^-]}{[HA]} = \frac{(C\alpha)(C\alpha)}{C(1-\alpha)} = \frac{C\alpha^2}{1-\alpha} = C\alpha^2 \quad (\because \alpha \text{ is very small})$$

$$= 0.1 (0.01)^2 = 1 \times 10^{-5}$$

83. Which of the following is a positively charged sol?

(1) Silver sol

(2) Sb_2S_3 sol

(3) Methylene blue sol

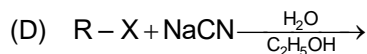
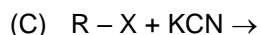
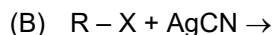
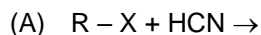
(4) Congo red sol

Answer (3)

Sol. • Methylene Blue sol is a positively charged sol.

• Silver sol, Sb_2S_3 sol and congo red sol are negatively charged sol.

84. Which amongst the following reaction of alkyl halides produces isonitrile as a major products?

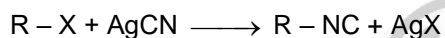


Choose the **most appropriate** answer from the options given below

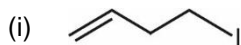
- (1) (B) only
- (2) (A) and (B) only
- (3) (D) only
- (4) (C) and (D) only

Answer (1)

Sol. KCN is predominately ionic and provides cyanide ions in solution. Although both carbon and nitrogen atoms are in a position to donate electron pairs, the attack takes place mainly through carbon atom and not through nitrogen atom since C—C bond is more stable than C—N bond. However, AgCN is mainly covalent in nature and nitrogen is free to donate electron pair forming isocyanide as the major product



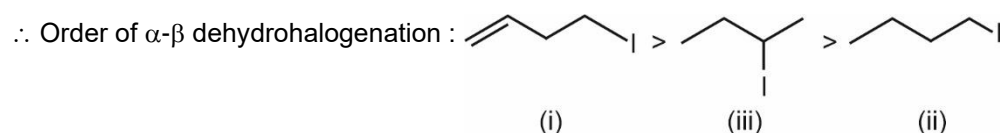
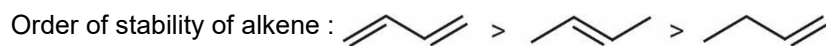
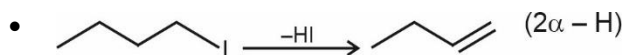
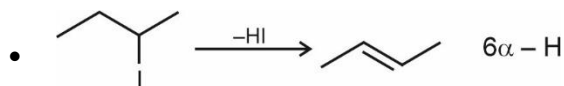
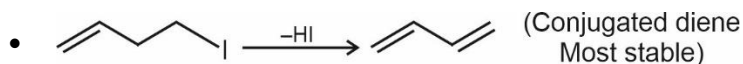
85. The **correct** order for the rate of α , β -dehydrohalogenation for the following compounds is _____.



- (1) (iii) < (ii) < (i)
- (2) (ii) < (iii) < (i)
- (3) (i) < (ii) < (iii)
- (4) (ii) < (i) < (iii)

Answer (2)

Sol. • More is the stability of alkene formed, more will be the rate of α - β dehydrohalogenation



SECTION-B

86. Type of isomerism exhibited by compounds $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$, $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$, $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl} \cdot 2\text{H}_2\text{O}$ and the value of coordination number (CN) of central metal ion in all these compounds, respectively is:

- (1) Ionisation isomerism, CN = 4
- (2) Solvate isomerism, CN = 6
- (3) Geometrical isomerism, CN = 4
- (4) Optical isomerism, CN = 4

Answer (2)

Sol. Solvate isomerism differ by whether or not a solvent molecule is directly bonded to the metal ion or merely present as free solvent molecules in the crystal lattice.

- $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$, $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$ and $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl} \cdot 2\text{H}_2\text{O}$ show solvate isomerism.
- Co-ordination number of Cr = 6

87. Given below are two statements:

Statement I: In an organic compound, when inductive and electromeric effects operate in opposite directions, the inductive effect predominates.

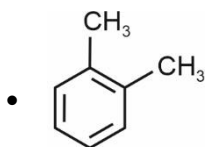
Statement II: Hyperconjugation is observed in o-xylene.

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

- (1) Both **Statement I** and **Statement II** are true.
- (2) Both **Statement I** and **Statement II** are false.
- (3) **Statement I** is true but **Statement II** is false.
- (4) **Statement I** is false but **Statement II** is true.

Answer (4)

Sol. • In an organic compound when inductive and electromeric effects operate in opposite directions, the electromeric effect predominates.



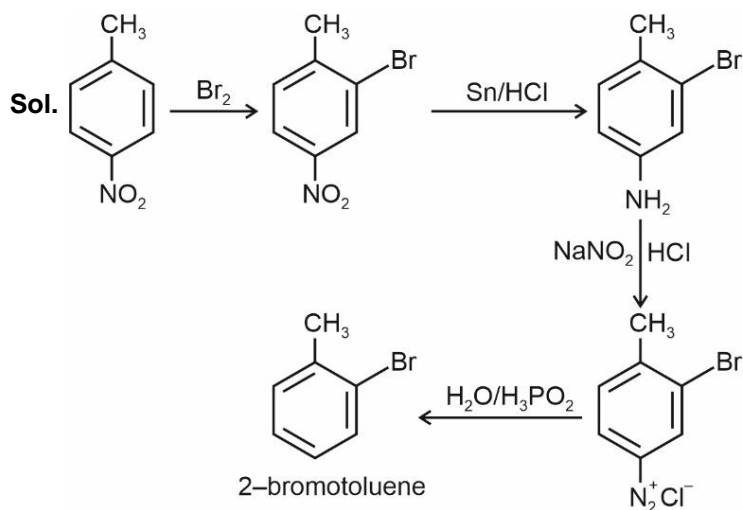
o-xylene

In alkylarene, sp^3 hybridized C – H bonds are present the carbon of which is directly bonded to sp^2 carbon atoms so, hyperconjugation effect is observed in o-xylene.

88. Choose the **correct** sequence of reagents in the conversion of 4-nitrotoluene to 2-bromotoluene.

- (1) Br_2 ; Sn/HCl ; NaNO_2/HCl ; $\text{H}_2\text{O}/\text{H}_3\text{PO}_2$
- (2) Sn/HCl ; Br_2 ; NaNO_2/HCl ; $\text{H}_2\text{O}/\text{H}_3\text{PO}_2$
- (3) NaNO_2/HCl ; Sn/HCl ; Br_2 ; $\text{H}_2\text{O}/\text{H}_3\text{PO}_2$
- (4) Sn/HCl ; NaNO_2/HCl ; Br_2 ; $\text{H}_2\text{O}/\text{H}_3\text{PO}_2$

Answer (1)

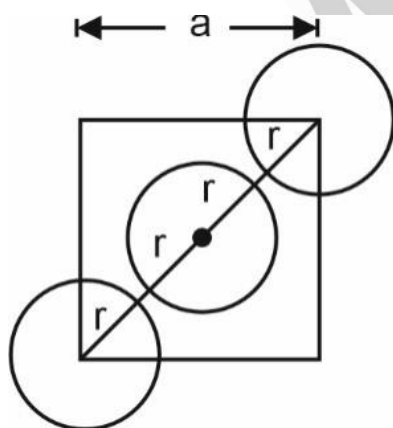


89. How are edge length 'a' of the unit cell and radius 'r' of the sphere related to each other in ccp structure?
(Choose **correct** option for your answer.)

- (1) $a = 4r / \sqrt{3}$
- (2) $a = 2\sqrt{2}r$
- (3) $a = 2r$
- (4) $a = r / 2\sqrt{2}$

Answer (2)

Sol. For a ccp structure,



$$4r = a\sqrt{2}$$

$$\therefore a = \frac{4r}{\sqrt{2}}$$

$$a = 2\sqrt{2}r$$

90. Which statement is **not** true about photochemical smog?
- (1) Photochemical smog occurs in warm, dry and sunny climate.
 - (2) Common components of photochemical smog are ozone, nitric oxide, acrolein, formaldehyde and peroxyacetyl nitrate.
 - (3) Photochemical smog is harmful to humans but has no effect on plants.
 - (4) Plants like Pinus, Juniparus can help in reducing the photochemical smog.

Answer (3)

Sol. • Photochemical smog is harmful to humans as well as plants so option (3) is incorrect.

- Photochemical smog occurs in warm, dry and sunny climate.

91. How many number of tetrahedral voids are formed in 5 mol of a compound having cubic close packed structure? (Choose the **correct** option)
- (1) 3.011×10^{24}
 - (2) 6.022×10^{24}
 - (3) 1.550×10^{24}
 - (4) 3.011×10^{25}

Answer (2)

Sol. As in a ccp unit cell having 'N' number of atoms there are '2N' number of tetrahedral voids, so number of tetrahedral voids formed in a 5 mol of a compound having ccp structure is $5 \times 2 \times 6.022 \times 10^{23} = 6.022 \times 10^{24}$ voids.

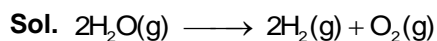
92. The **correct** option for a redox couple is
- (1) Both the reduced and oxidized forms involve same element
 - (2) Cathode and anode together
 - (3) Both are oxidised forms involving same element
 - (4) Both are reduced forms involving same element

Answer (1)

Sol. A redox couple is defined as having together the oxidised and reduced forms of a substance taking part in an oxidation or reduction half reaction.

93. Consider the following reaction:
- $$2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g}) \quad \Delta_r H^\circ = -483.64 \text{ kJ}$$
- What is the enthalpy change for decomposition of one mole of water? (Choose the **right** option).
- (1) 18 kJ
 - (2) 100 kJ
 - (3) 120.9 kJ
 - (4) 241.82 kJ

Answer (4)



$$\Delta H^\circ = 483.64 \text{ kJ}$$

For decomposition of 2 moles of H_2O , enthalpy change = 483.64 kJ

$$\begin{aligned} \text{For decomposition of 1 mole of } \text{H}_2\text{O}, \text{ enthalpy change} &= \frac{483.64}{2} \text{ kJ} \\ &= 241.82 \text{ kJ} \end{aligned}$$

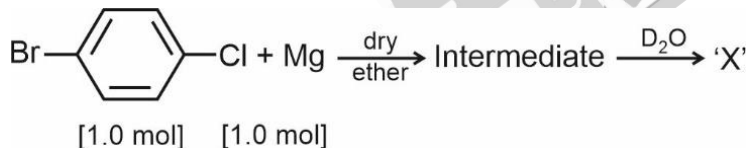
94 The **correct** sequence given below containing neutral, acidic, basic and amphoteric oxide each, respectively, is

- (1) NO , CO_2 , ZnO , CaO
- (2) NO , CO_2 , CaO , ZnO
- (3) NO , ZnO , CO_2 , CaO
- (4) ZnO , NO , CaO , CO_2

Answer (2)

Sol.	Oxides	Chemical Nature
	NO	Neutral
	CO_2	Acidic
	CaO	Basic
	ZnO	Amphoteric

95. Identify 'X' in the following reaction.



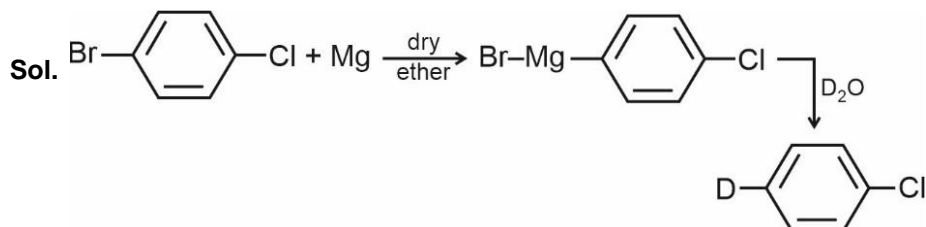
- (1) $\text{D}-\text{C}_6\text{H}_4-\text{D}$

(3) $\text{Cl}-\text{C}_6\text{H}_4-\text{D}$

(2) $\text{D}-\text{C}_6\text{H}_4-\text{Br}$

(4) $\text{DO}-\text{C}_6\text{H}_4-\text{OD}$

Answer (3)



96. Read the following statements and choose the set of **correct** statements:

- (A) Chrome steel is used for cutting tools and crushing machines.
- (B) The fine dust of aluminium is used in paints and lacquers.
- (C) Copper is used for reduction of alcohol.
- (D) Zinc dust is used as a reducing agent in the manufacture of paints.
- (E) Iron is used for galvanising zinc.

Choose the **most appropriate** answer from the options given below:

- (1) (A), (B) and (D) only
- (2) (B), (C) and (D) only
- (3) (D) and (E) only
- (4) (A) and (D) only

Answer (1)

Sol. Chrome steel is used for cutting tools and crushing machines while fine dust of aluminium is used in paints and lacquers.

Zinc dust is a reducing agent for manufacture of dye-stuffs and paints.

So, statements A, B and D are correct.

Copper is used for oxidation of primary and secondary alcohols into aldehydes and ketones respectively at high temperature. So, statement (C) is incorrect.

For galvanisation of iron, zinc is used to prevent iron from corrosion so, statement (E) is also incorrect.

Hence, correct statements are (A), (B) and (D) only.

97. Which amongst the following aqueous solutions of electrolytes will have minimum elevation in boiling point? Choose the **correct** option.

- (1) 0.1 M MgSO_4
- (2) 1 M NaCl
- (3) 0.05 M NaCl
- (4) 0.1 M KCl

Answer (3)

Sol. Solution	Moles of particles in 1 L solution
0.1 M MgSO_4	0.2
1 M NaCl	2
0.05 M NaCl	0.1
0.1 M KCl	0.2

Lesser is the number of particles, lower is the elevation in boiling point

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

Assertion (A) :

Ionisation enthalpies of early actinoids are lower than for early lanthanoids.

Reason (R) :

Electrons are entering $5f$ orbitals in actinoids which experience greater shielding from nuclear charge.

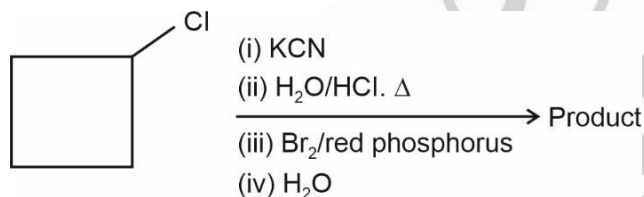
In the light of the above statements, choose the **correct** answer from the options given below:

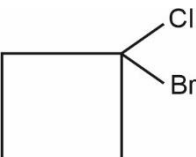
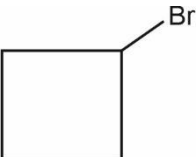
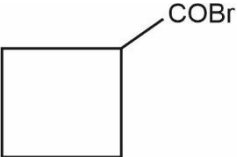
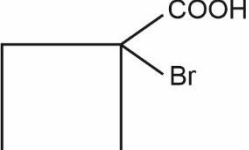
- (1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
- (2) Both **(A)** and **(R)** are true but **(R)** is **not** the correct explanation of **(A)**.
- (3) **(A)** is true but **(R)** is false.
- (4) **(A)** is false but **(R)** is true.

Answer (1)

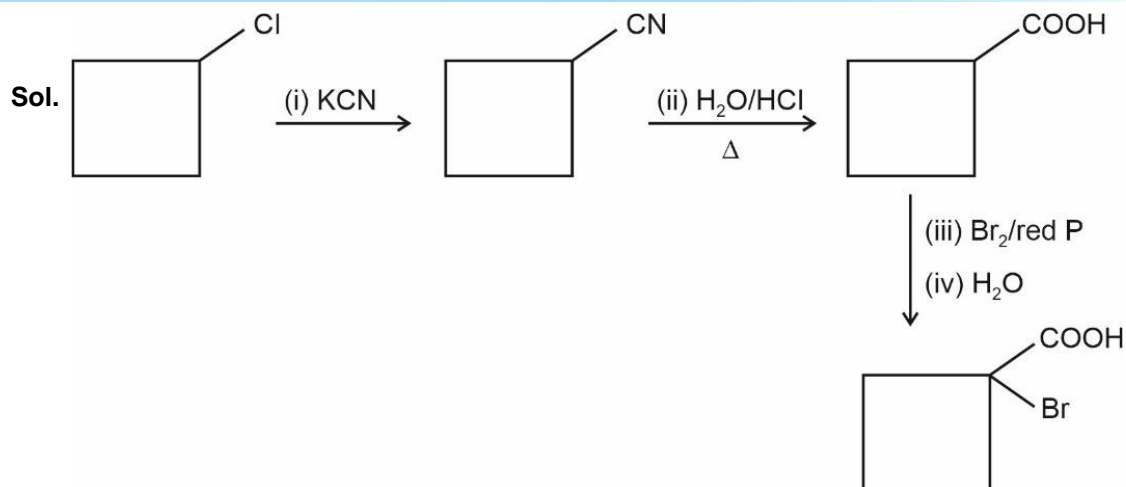
Sol. Ionisation enthalpies of early actinoids are lower than early lanthanoids. This is because $5f$ orbitals will penetrate less into the inner core of electrons. The $5f$ electrons, will be more effectively shielded from the nuclear charge than the $4f$ electrons of corresponding lanthanoids.

99. Identify the product in the following reaction.

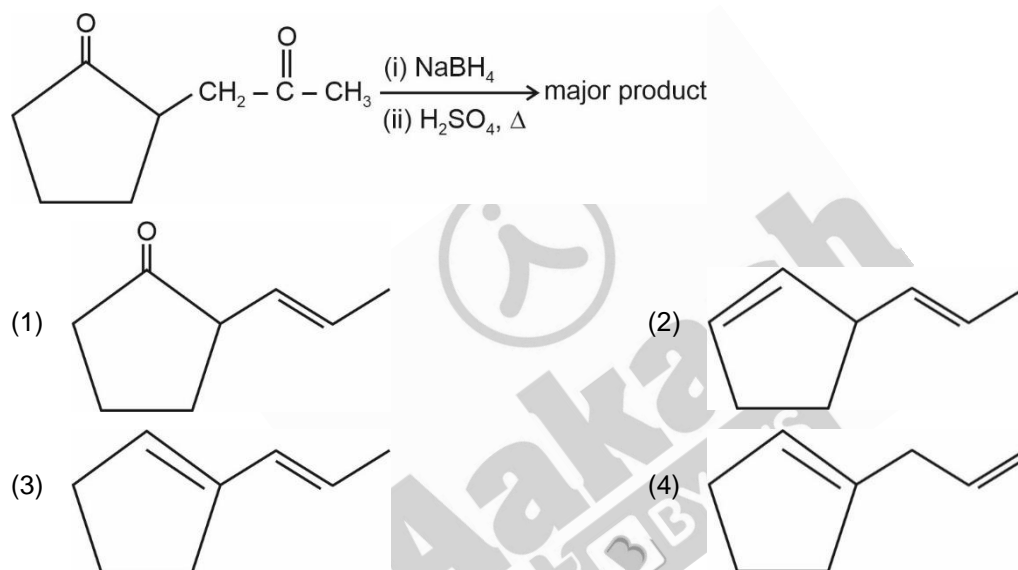


- (1) 
- (2) 
- (3) 
- (4) 

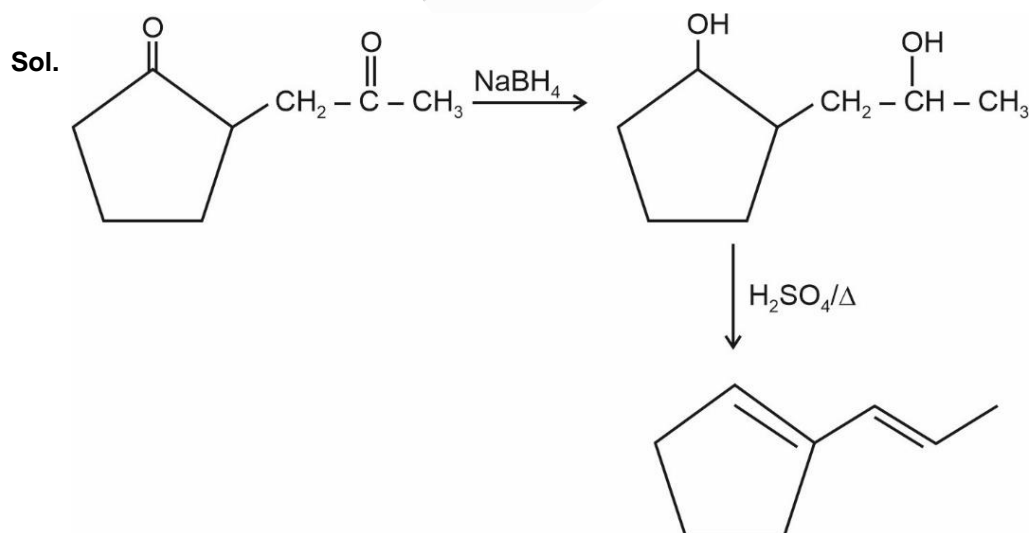
Answer (4)



100. The major product formed in the following conversion is _____ .



Answer (3)



Major product formed will be a conjugated alkene.

BOTANY

SECTION-A

101. Match List-I with List-II

	List-I		List-II
(A)	Chlorophyll a	(I)	Yellow to yellow orange
(B)	Chlorophyll b	(II)	Yellow green
(C)	Xanthophyll	(III)	Blue green
(D)	Carotenoid	(IV)	Yellow

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

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

Answer (3)

Sol. Chlorophyll a appears bright or blue green in the chromatogram

Chlorophyll b appears yellow green in the chromatogram

Xanthophyll appears yellow in the chromatogram

Carotenoid appears yellow to yellow-orange in the chromatogram

102. Doubling of the number of chromosomes can be achieved by disrupting mitotic cell division soon after

- (1) Prophase
- (2) Metaphase
- (3) Anaphase
- (4) Telophase

Answer (2)

Sol. Doubling of chromosomes can be achieved at anaphase, as in this phase the sister chromatids gets separated, since mitotic apparatus is disrupted soon after metaphase, so the answer is option (2).

103. Ligation of foreign DNA at which of the following site will result in loss of tetracycline resistance of pBR322?

- (1) *EcoR* I
- (2) *BamH* I
- (3) *Pst* I
- (4) *Pvu* I

Answer (2)

Sol. Option (2) is the answer because,

In pBR322, the restriction site for *BamH* I is present in *tet*^R gene. Therefore, ligation of a foreign DNA will results in loss of tetracycline resistance and recombinants will be tetracycline sensitive.

Option (1) is not the answer because, In pBR322, the restriction site of *EcoR* I is present outside the region of *amp*^R gene and *tet*^R gene.

Option (3) and (4) are not the answers because, in pBR322, the restriction sites for *Pst* I and *Pvu* I are present in *amp*^R gene. So, ligation of foreign DNA will result in loss of ampicillin resistance and recombinants will be ampicillin sensitive.

104. Which classes of algae possess pigment fucoxanthin and pigment phycoerythrin, respectively?

- (1) Chlorophyceae and Rhodophyceae
- (2) Rhodophyceae and Phaeophyceae
- (3) Phaeophyceae and Chlorophyceae
- (4) Phaeophyceae and Rhodophyceae

Answer (4)

Sol. The prime pigment found in phaeophyceae that gives its members their characteristic colour is xanthophyll pigment, fucoxanthin.

The members of rhodophyceae are commonly called red algae because of the predominance of the red pigment, r-phycoerythrin in their body.

105. Plants offer rewards to animals in the form of pollen and nectar and the animals facilitate the pollination process. This is an example of :

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

Answer (2)

Sol. Plants offers reward in the form of pollen and nectar for pollinators and juicy and nutritious fruits for seeds dispersers. This is a fascinating example of mutualism found in plant-animal relationships.

106. In which of the following sets of families, the pollen grains are viable for months?

- (1) Rosaceae, Liliaceae and Poaceae
- (2) Leguminosae, Solanaceae and Rosaceae
- (3) Solanaceae, Poaceae and Liliaceae
- (4) Brassicaceae, Liliaceae and Poaceae

Answer (2)

Sol. In some members of Rosaceae, Solanaceae, Leguminosae pollen maintain viability for months.

In some cereals like rice and wheat belonging to Poaceae family to pollen loose viability within 30 minutes of their release.

107. The species of plants that plays a vital role in controlling the relative abundance of other species in a community is called _____.

- (1) Exotic species
- (2) Keystone species
- (3) Alien species
- (4) Endemic species

Answer (2)

Sol. A species of plant that play vital role in controlling relative abundance of other species in a community is called keystone species. They are important for overall structure and function of an ecosystem. Exotic species or Alien species are organisms that have been introduced into an area outside their normal distribution. Endemic species exist only in one particular geographical region or area.

108. The dissolution of synaptonemal complex occurs during

- (1) Diakinesis
- (2) Leptotene
- (3) Pachytene
- (4) Diplotene

Answer (4)

Sol. The dissolution of synaptonemal complex occurs during diplotene stage.

109. Match **List-I** with **List-II**.

	List-I		List-II
(A)	Hydrarch succession	(I)	Gradual change in the species composition
(B)	Xerarch succession	(II)	Faster and climax reached quickly
(C)	Ecological succession	(III)	Lichens to mesic conditions
(D)	Secondary succession	(IV)	Phytoplankton to mesic conditions

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

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

Answer (2)

- Sol.** (i) In hydrarch succession pioneer species phytoplanktons, with series of seral community leads to mesic condition.
- (ii) In xerarch succession pioneer species lichens, with series of seral community leads to mesic condition.
- (iii) Ecological succession leads to gradual change in the species composition.
- (iv) Secondary succession is faster and reach to the climax quickly.

Therefore, option (2) is correct.

110. In 'rivet popper hypothesis', Paul Ehrlich compared the rivets in an airplane to

- (1) Ecosystem
- (2) Genera within a family
- (3) Species within a genus
- (4) Genetic diversity

Answer (3)

Sol. A proper perspective through an analogy, the 'rivet popper hypothesis' is used by Paul Ehrlich considered Airplane as an ecosystem and rivets used to join all parts together is considered as species. Therefore, he compared rivets in an airplane to species within a genus.

111. Match List-I with List-II.

	List-I (Type of cross)		List-II (Phenotypic ratio)
(A)	Monohybrid Cross	(I)	1 : 1
(B)	Dihybrid Cross	(II)	1 : 2 : 1
(C)	Incomplete dominance	(III)	3 : 1
(D)	Test Cross	(IV)	9 : 3 : 3 : 1

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

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

Answer (3)**Sol.** The phenotypic ratio of monohybrid cross is 3 : 1.

The phenotypic ratio of dihybrid cross is 9 : 3 : 3 : 1.

The phenotypic ratio of incomplete dominance is 1 : 2 : 1.

The phenotypic ratio of test cross is 1 : 1.

Thus, the option depicting the correct matches is option (3).

112. Match List-I with List-II.

	List-I		List-II
(A)	Protein	(I)	C = C double bonds
(B)	Unsaturated fatty acid	(II)	Phosphodiester bond
(C)	Nucleic acid	(III)	Glycosidic bonds
(D)	Polysaccharide	(IV)	Peptide bonds

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

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

Answer (1)**Sol.** Option (1) is correct answer because

- A. Proteins have Peptide bonds
 B. Unsaturated fatty acid contains C = C double bonds
 C. Phosphodiester bonds present in nucleic acid
 D. Glycosidic bonds present in polysaccharide

113. The phenomenon which is influenced by auxin and also played a major role in its discovery :

- (1) Gravitropism
- (2) Apical Dominance
- (3) Phototropism
- (4) Root initiation

Answer (3)

Sol. Auxin influences phototropism, i.e., the growth of the plant in response to light stimulus and this phenomenon played a major role in its discovery. Charles Darwin and his son Francis Darwin observed that the coleoptile of canary grass responded to the unilateral illumination by growing towards the light source (phototropism). They concluded that the tip of coleoptile was the source of auxin and was the site of transmittable influence that caused the bending of the entire coleoptile.

114. In *Calotropis*, aestivation is :

- (1) Imbricate
- (2) Twisted
- (3) Valvate
- (4) Vexillary

Answer (3)

Sol. When sepals or petals in a whorl just touch one another at margin, without overlapping, as in *Calotropis*, it is said to be valvate.

Imbricate aestivation is exhibited by *Cassia*,

Twisted aestivation is exhibited by China rose,

Vexillary aestivation is exhibited by Pea.

115. Given below are two statements :

Statement I :

RuBisCO is the most abundant enzyme in the world.

Statement II :

Photorespiration does not occur in C_4 plants.

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

Answer (1)

Sol. Statement-I: RuBisCO is the most abundant enzyme in the world as it is responsible for the first step of C_3 cycle and found in all photosynthetic organisms.

Statement-II: RuBisCO is encaged in bundle sheath cells in C_4 plants which inhibits its oxygenase activity and thus, inhibits the process of photorespiration.

Hence both the statements are correct.

116. Consider the following tissues in the stelar region of a stem showing secondary growth.

- (A) Primary xylem
- (B) Secondary xylem
- (C) Primary phloem
- (D) Secondary phloem

Arrange these in the **correct** sequence of their position from pith towards cortex.

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

Answer (3)

Sol. The correct sequence of tissues in the stelar region of the stem showing secondary growth from pith towards cortex is

(A) (B) (D) (C)
Primary xylem → Secondary xylem → Secondary phloem → Primary phloem

117. Identify the **correct** statements regarding Mass flow hypothesis.

- (A) Mass flow is faster than diffusion.
- (B) Mass flow is the result of pressure difference between the end points.
- (C) Different substances involved in mass flow move at different paces.
- (D) Mass flow can result through either a positive or a negative hydrostatic pressure gradient.

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

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

Answer (2)

Sol. Long distance transport of substances within a plant cannot be by diffusion alone as it is a slow process. Thus, special long distance transport system (mass flow system) become necessary so as to move substances across long distance and at a much faster rate. Thus statement (A) is correct.

Mass flow is the movement of substances in bulk from one point to another as a result of pressure differences between the two points. Thus, statement (B) is correct.

It is a characteristic of mass flow that substances, whether in solution or in suspension, are swept along at the same pace. Thus, statement (C) is incorrect.

Bulk flow can be achieved either through a positive hydrostatic pressure gradient or a negative hydrostatic pressure gradient. Thus, statement (D) is correct.

Thus, option (2) is correct as it is mentioning all the correct statements.

118. Fatty acids are connected with the respiratory pathway through:

- (1) Dihydroxy acetone phosphate
- (2) Pyruvic acid
- (3) Acetyl CoA
- (4) α -Ketoglutaric acid

Answer (3)

Sol. If fatty acids were to be respired it would first be degraded to acetyl CoA and then enter into respiratory pathway.

119. Inulin is a polymer of:

- | | |
|-----------------|---------------|
| (1) Amino acids | (2) Glucose |
| (3) Fructose | (4) Galactose |

Answer (3)

Sol. Option (3) is the answer because, inulin is a polymer of fructose.

Option (1) is not the answer because, amino acids are building blocks of proteins.

Option (2) is not the answer because, polymers of glucose are cellulose, starch and glycogen.

Option (4) is not the answer because, glucose and galactose are monosaccharides.

120. A heterozygous pea plant with violet flowers was crossed with a homozygous pea plant with white flowers. Violet is dominant over white. Which one of the following represents the expected combinations among 40 progenies formed?

- (1) All 40 produced violet flowers
- (2) All 40 produced white flowers
- (3) 30 produced violet and 10 produced white flowers
- (4) 20 produced violet and 20 produced white flowers

Answer (4)

Sol. Genotype of heterozygous violet flower is Vv

Genotype of homozygous white flower is vv

	Vv	x	vv
	↓		
	V		v
v	Vv		vv
v	Vv		vv

Both white and violet flowers will be produced in equal proportion (20 : 20)

Out of 40 progenies

The expected ratio of violet and white flower plant is 1 : 1.

121. The amount of nutrients such as carbon, nitrogen, potassium and calcium present in the soil at any given time is referred to as :
- (1) Humus (2) Detritus
(3) Standing state (4) Standing crop

Answer (3)

Sol. The amount of nutrients such as carbon, nitrogen, phosphorus, calcium, etc., present in the soil at any given time is referred to as the standing state. Standing crop is the amount of living material present in different trophic levels at a given time.

122. Thermostable DNA polymerase used in PCR was isolated from :

- (1) *Agrobacterium tumifaciens*
(2) *Bacillus thuringiensis*
(3) *Thermus aquaticus*
(4) *Escherichia coli*

Answer (3)

Sol. Option (3) is the answer, because Thermostable DNA polymerase (*Taq* polymerase) used in PCR was isolated from a bacterium *Thermus aquaticus*.

Option (1) is not the answer as *Agrobacterium tumifaciens* is a pathogen of several dicot plants.

Option (2) is not the answer as, specific Bt toxin genes were isolated from *Bacillus thuringiensis* and incorporated into the several crop plants for the development of pest resistant crops.

E. Coli was used as a host by *Eli lily* to produce human insulin.

123. Match List-I with List-II.

	List-I		List-II
(A)	Pteropsida	(I)	<i>Psilotum</i>
(B)	Lycopsida	(II)	<i>Equisetum</i>
(C)	Psilopsida	(III)	<i>Adiantum</i>
(D)	Sphenopsida	(IV)	<i>Selaginella</i>

Choose the correct answer from the options given below :

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

Answer (2)

Sol. Pteropsida — *Adiantum*
Lycopsida — *Selaginella*
Psilopsida — *Psilotum*
Sphenopsida — *Equisetum*

124. What will happen if fresh water lake gets contaminated by addition of polluted water with high BOD?

- (1) Number of submerged aquatic plants in the lake will increase
- (2) Number of aquatic animals in the lake will increase
- (3) Amount of dissolved oxygen in the lake will decrease
- (4) The lake will remain unaffected

Answer (3)

Sol. Higher BOD of water indicates higher amount of biodegradable organic materials present in it. Since BOD is inversely proportional to the dissolved oxygen (DO), therefore, the dissolved oxygen in the lake will decrease.

125. Nitrates and phosphates flowing from agricultural farms into water bodies are a significant cause of :

- (1) Mineralisation
- (2) Stratification
- (3) Eutrophication
- (4) Humification

Answer (3)

Sol. Flowing of nitrates and phosphates from agricultural farms into water bodies cause eutrophication.

Humification is the process of decomposition of detritus to form humus.

Mineralisation is the release of inorganic substances from detritus during decomposition.

Stratification is vertical distribution of different species occupying different levels in an ecosystem .

126. Transfer of pollen grains from anther to stigma of another flower of same plant is known as:

- (1) Autogamy
- (2) Cleistogamy
- (3) Geitonogamy
- (4) Xenogamy

Answer (3)

Sol. Geitonogamy is the transfer of pollen grains from anther to the stigma of another flower of the same plant.

Cleistogamy is a condition in which flower does not open.

Xenogamy is the transfer of pollen grains from anther to the stigma of another flower of different plant of the same species.

127. Match **List-I** with **List-II**

	List-I		List-II
(A)	Auxin	(I)	Promotes female flower formation in cucumber
(B)	Gibberellin	(II)	Overcoming apical dominance
(C)	Cytokinin	(III)	Increase in the length of grape stalks
(D)	Ethylene	(IV)	Promotes flowering in pineapple

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

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

Answer (4)

Sol. Auxin promotes flowering in pineapple. Gibberellin increases the length of grape stalks.

Cytokinin overcome apical dominance. Ethylene promotes female flower formation in cucumber.

128. How many times decarboxylation occurs during each TCA cycle?

- (1) Once
- (2) Twice
- (3) Thrice
- (4) Many

Answer (2)

Sol. During TCA cycle, first decarboxylation occurs when Oxalosuccinic acid is converted into α -ketoglutaric acid and second decarboxylation occurs when α -ketoglutaric acid is converted into succinyl CoA.

129. For chemical defence against herbivores, *Calotropis* has

- (1) toxic ricin
- (2) distasteful quinine
- (3) cardiac glycosides
- (4) strychnine

Answer (3)

Sol. For chemical defence against herbivores, *Calotropis* has highly poisonous cardiac glycosides.

130. Name the component that binds to the operator region of an operon and prevents RNA polymerase from transcribing the operon.

- (1) Repressor protein
- (2) Inducer
- (3) Promotor
- (4) Regulator protein

Answer (1)

Sol. Repressor protein synthesized by regulator gene binds to the operator region of an operon and prevents RNA polymerase from transcribing the structural genes.

131. The last chromosome sequenced in Human Genome Project was :

- (1) Chromosome 22
- (2) Chromosome 14
- (3) Chromosome 6
- (4) Chromosome 1

Answer (4)

Sol. The last chromosome sequenced in Human Genome Project was Chromosome-1. It was completed in May 2006.

132. In which disorder change of single base pair in the gene for beta globin chain results in change of glutamic acid to valine?

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

Answer (4)

Sol. Sickle-cell anaemia is caused by mutation of the gene controlling β -chain of haemoglobin. Due to this mutation, glutamic acid present at 6th position of the β -chain is replaced by amino acid valine.

133. The transverse section of a plant part showed polyarch, radial and exarch xylem, with endodermis and pericycle. The plant part is identified as :

- (1) Dicot stem
- (2) Monocot stem
- (3) Monocot root
- (4) Dicot root

Answer (3)

Sol. Radial vascular bundles are present in roots. Monocot roots have polyarch and exarch condition of xylem.

134. In a pea flower, five petals are arranged in a specialized manner with one posterior, two lateral and two anterior. These are named as _____, _____ and _____ respectively.

- (1) Keel, Standard and Carina
- (2) Standard, Wings and Keel
- (3) Keel, Wings and Standard
- (4) Vexillum, Keel and Standard

Answer (2)

Sol. In pea flowers, vexillary aestivation is found. In this aestivation, the largest petal, *i.e.*, standard overlaps the two smaller lateral petals that are wings which in turn overlap. The two smallest anterior petals are keel.

135. During symport two different molecules move across the membrane

- (1) in same direction with the help of same carrier
- (2) in opposite direction with the help of same carrier
- (3) in same direction with the help of different carriers located at a common site
- (4) in same direction with the help of different carriers located at different sites in the same cell

Answer (1)

Sol. During symport, two different molecules move across the membrane in same direction with the help of same carrier.

SECTION-B

136. Which of the following mineral ion is not remobilized in plants?

- (1) Nitrogen
- (2) Phosphorus
- (3) Potassium
- (4) Calcium

Answer (4)

Sol. Nitrogen, phosphorus and potassium are mobile elements. Calcium is not remobilized in plants.

137. Match **Column-I** with **Column-II**.

	Column-I		Column-II
(A)	<i>Nitrococcus</i>	(I)	Denitrification
(B)	<i>Rhizobium</i>	(II)	Conversion of ammonia to nitrite
(C)	<i>Thiobacillus</i>	(III)	Conversion of nitrite to nitrate
(D)	<i>Nitrobacter</i>	(IV)	Conversion of atmospheric nitrogen to ammonia

Choose the **correct** option.

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

Answer (1)

Sol.

(A)	<i>Nitrococcus</i>	–	Conversion of ammonia to nitrite
(B)	<i>Rhizobium</i>	–	Conversion of atmospheric nitrogen to ammonia
(C)	<i>Thiobacillus</i>	–	Denitrification
(D)	<i>Nitrobacter</i>	–	Conversion of nitrite to nitrate

138. In angiosperms the correct sequence of events in formation of female gametophyte in the ovule is

- (A) 3 successive free nuclear divisions in functional megaspores.
 (B) Degeneration of 3 megaspores.
 (C) Meiotic division in megaspore mother cell.
 (D) Migration of 3 nuclei towards each pole.
 (E) Formation of wall resulting in seven celled embryo sac.

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

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

Answer (2)

Sol. In angiosperms the correct sequence of events in formation of female gametophyte in the ovule is

- The megaspore mother cell undergoes meiosis and forms four haploid megaspores.(C)
- One remains functional and three degenerate.(B)
- 3 successive free nuclear divisions in functional megaspore take place.(A)
- Migration of 3 nuclei towards each pole.(D)
- Formation of wall resulting in seven celled embryo sac.(E)

The correct sequence is (C), (B), (A), (D), (E)

139. Match **List-I** with **List-II**.

	List-I		List-II
(A)	Kanamycin	(I)	Delivers genes into animal cells
(B)	<i>Cla</i> I	(II)	Selectable marker
(C)	Disarmed retroviruses	(III)	Restriction site
(D)	Kanamycin ^R gene	(IV)	Antibiotic resistance

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

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

Answer (3)

Sol. Option (3) is the answer because, Kanamycin is an antibiotic which can be used as selectable marker for *E. coli*.

*Cla*I is a restriction site on plasmid pBR322.

Disarmed retroviruses are used to deliver genes into animal cells, which is an indirect method of gene transfer.

Kanamycin ^Rgene exhibits resistance against kanamycin which is an antibiotic.

140. Which of the following statements is **true**?

- (1) Most algal genera are diplontic
 (2) Most bryophytes do not have haplo-diplontic life cycle
 (3) All pteridophytes exhibit haplo-diplontic pattern
 (4) Seed bearing plants follow haplontic pattern

Answer (3)

Sol. (1) Most algal genera are haplontic.

(2) Most bryophytes have haplo-diplontic life cycle pattern.

(3) Statement is absolutely correct that "all pteridophytes exhibit haplo-diplontic pattern".

(4) Seed-bearing plants are gymnosperms and angiosperms and both of them follow diplontic life cycle pattern.

141. Consider the following plant tissues:

- (A) Axillary buds
 (B) Fascicular vascular cambium
 (C) Interfascicular cambium
 (D) Cork cambium
 (E) Intercalary meristem

Identify the lateral meristems among the above.

- (1) (A), (B), (C) and (E) only (2) (A), (B), (D) and (E) only
 (3) (A), (C) and (D) only (4) (B), (C) and (D) only

Answer (4)

Sol. Fascicular vascular cambium, interfascicular cambium and cork cambium are examples of lateral meristems.

The meristem which occurs between mature tissues is known as intercalary meristem.

Cells of shoot apical meristem form the axillary buds.

Both intercalary meristem and axillary buds are primary meristems

142. A certain plant homozygous for yellow seeds and red flowers was crossed with a plant homozygous for green seeds and white flowers. The F_1 plants had yellow seeds and pink flowers. The F_1 plants were selfed to get F_2 progeny. Assuming independent assortment of the two characters, how many phenotypic categories are expected for these characters in the F_2 generation?

- (1) 4 (2) 6
(3) 9 (4) 16

Answer (2)

Sol. Parents : YYRR × yyrr
Yellow seed and red flowers green seeds and white flowers

Gametes: (YR) (yr)

F_1 gen :

YyRr × YyRr
Yellow seed and pink flowers Yellow seed and pink flowers

F_2 gen :

3 yellow seed	1 Red flower	$\xrightarrow{3 \times 1}$	3 Yellow seed and red flower
	2 Pink flower	$\xrightarrow{3 \times 2}$	6 Yellow seed and pink flower
	1 White flower	$\xrightarrow{3 \times 1}$	3 Yellow seed and white flower
1 green seed	1 Red flower	$\xrightarrow{1 \times 1}$	1 Green seed and red flower
	2 Pink flower	$\xrightarrow{1 \times 2}$	2 Green seed and pink flower
	1 White flower	$\xrightarrow{1 \times 1}$	1 Green seed and white flower

As six different, phenotypic categories are visible, thus option (2) is correct.

143. Given below are two statements :

Statement I: The process of translocation through phloem is unidirectional but through xylem, it is bidirectional.

Statement II: The most readily mobilized elements are phosphorus, sulphur, nitrogen and potassium.

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

Answer (4)

Sol. Statement I is incorrect as the process of translocation through phloem is bidirectional but through xylem it is unidirectional.

Statement II is correct

144. Which of the following statements is **not** correct?
- (1) Plant growth is generally determinate.
 - (2) Plant growth is measurable.
 - (3) Phase of cell elongation of plant cells is characterized by increased vacuolation.
 - (4) Cells in the meristematic phase of growth exhibit abundant plasmodesmatal connections.

Answer (1)

Sol. Plant growth is generally indeterminate. Rest statements are correct.

145. Which of the following statement is **incorrect** about *Agrobacterium tumefaciens*?
- (1) It transforms normal plant cells into tumorous cells.
 - (2) It delivers 'T-DNA' into plant cell.
 - (3) It is used to deliver gene of interest in both prokaryotic as well as eukaryotic host cells.
 - (4) 'Ti' plasmid from *Agrobacterium tumefaciens* used for gene transfer is not pathogenic to plant cells.

Answer (3)

Sol. Option (3) is the correct answer because *Agrobacterium tumefaciens* is used to deliver gene of interest into a variety of plant i.e., in eukaryotic host cells.

Options (1), (2) and (4) are not the correct answer because all these statements are correct w.r.t. *Agrobacterium tumefaciens*.

146. Given below are two statements :

Statement I : The process of copying genetic information from one strand of the DNA into RNA is termed as transcription.

Statement II : A transcription unit in DNA is defined primarily by the three regions in the DNA, i.e., a promoter, the structural gene and a terminator.

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

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

Answer (1)

Sol. Both statements are correct.

The process of copying genetic information from one strand of the DNA into RNA is termed as transcription.

A transcription unit in DNA is defined primarily by the three regions in the DNA i.e. a promoter, the structural gene and a terminator.

147. Which scientist conducted an experiment with ^{32}P and ^{35}S labelled phages for demonstrating that DNA is the genetic material?
- (1) F. Griffith
 - (2) O.T. Avery, C.M. MacLeod and M. McCarty
 - (3) James D. Watson and F.H.C. Crick
 - (4) A.D. Hershey and M.J. Chase

Answer (4)

Sol. DNA is the genetic material was unequivocally proved from Hershey-Chase experiment.

They conducted an experiment with ^{32}P and ^{35}S labelled phages for demonstrating that DNA is genetic material.

148. Which out of the following statements is **incorrect**?

- (1) Both ATP and NADPH + H^+ are synthesised during non-cyclic photophosphorylation.
- (2) Stroma lamellae lack PS II and NADP reductase
- (3) Grana lamellae have both PS I and PS II
- (4) Cyclic photophosphorylation involves both PS I and PS II

Answer (4)

Sol. Cyclic photophosphorylation involves only PS I.

Non cyclic photophosphorylation involves both PS I and PS II.

149. During which stages of mitosis and meiosis, respectively does the centromere of each chromosome split?

- (1) Telophase, Anaphase I
- (2) Anaphase, Anaphase II
- (3) Metaphase, Metaphase II
- (4) Prophase, Telophase I

Answer (2)

Sol. During anaphase of mitosis and anaphase II of meiosis centromere split and chromatids move towards opposite poles.

150. Match the following :

	Type of flower		Example
(A)	Zygomorphic	(I)	Mustard
(B)	Hypogynous	(II)	Plum
(C)	Perigynous	(III)	<i>Cassia</i>
(D)	Epigynous	(IV)	Cucumber

Select the **correct** option :

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

Answer (2)

Sol. Perigynous flowers are found in Plum.

Zygomorphic flowers are found in *Cassia*.

Hypogynous flowers are found in Mustard.

Epigynous flowers are found in Cucumber.

Option (2) is correct.

ZOOLOGY

SECTION-A

151. Which of the following statements are **correct** with respect to the hormone and its function?

- (A) Thyrocalcitonin (TCT) regulates the blood calcium level.
- (B) In males, FSH and androgens regulate spermatogenesis.
- (C) Hyperthyroidism can lead to goitre.
- (D) Glucocorticoids are secreted in Adrenal Medulla.
- (E) Parathyroid hormone is regulated by circulating levels of sodium ions.

Choose the most **appropriate** answer from the options given below :

- (1) (B) and (C) only
- (2) (A) and (D) only
- (3) (C) and (E) only
- (4) (A) and (B) only

Answer (4)

Sol. Option (4) is the correct answer because thyrocalcitonin regulates the blood calcium level. Spermatogenesis in human males is regulated by FSH and androgen.

Option (1), (2) and (3) are not the correct answer because exophthalmic goitre is a form of hyperthyroidism. Glucocorticoids are secreted by the adrenal cortex. Parathyroid hormone along with TCT, play a significant role in calcium balance in the body.

152. 'X' and 'Y' are the components of Binomial nomenclature. This naming system was proposed by 'Z' :

- (1) X – Specific epithet, Y – Generic name, Z – Carolus Linnaeus
- (2) X – Generic name, Y – Specific epithet, Z – R.H. Whittaker
- (3) X – Generic name, Y – Specific epithet, Z – Carolus Linnaeus
- (4) X – Specific epithet, Y – Generic name, Z – R.H. Whittaker

Answer (3)

Sol. In Binomial nomenclature, every organism is given a scientific name that consists of two components

X – Generic name

Y – Specific epithet

Z – Carolus Linnaeus

This system was proposed by Carolus Linnaeus.

153. Select the sequence of steps in Respiration.

- (A) Diffusion of gases (O_2 and CO_2) across alveolar membrane.
- (B) Diffusion of O_2 and CO_2 between blood and tissues.
- (C) Transport of gases by the blood.
- (D) Pulmonary ventilation by which atmospheric air is drawn in and CO_2 rich alveolar air is released out.
- (E) Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2 .

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

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

Answer (3)

Sol. Option (3) is the answer, because the respiration involves the following stages:

1. Breathing or pulmonary ventilation by which atmospheric air is drawn in and CO₂ rich alveolar air is released out.
2. Diffusion of gases (O₂ and CO₂) across alveolar membrane.
3. Transport of gases by the blood.
4. Diffusion of O₂ and CO₂ between blood and tissue.
5. Utilisation of O₂ by the cells for catabolic reactions and resultant release of CO₂

Rest of options (1), (2) and (4) are not the answers because these steps are not arranged in the correct sequence.

154. Which of the following is/are cause(s) of biodiversity losses?

- (1) Over-exploitation only
- (2) Habitat loss and fragmentation only
- (3) Over-exploitation, habitat loss and fragmentation
- (4) Climate change only

Answer (3)

Sol. There are four major causes of biodiversity loss

1. Habitat loss and fragmentation
2. Over-exploitation
3. Co-extinction
4. Alien species invasions

155. Match List-I with List-II.

List-I	List-II
(A) Terpenoides	(I) Codeine
(B) Lectins	(II) Diterpenes
(C) Alkaloids	(III) Ricin
(D) Toxins	(IV) Concanavalin A

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

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

Answer (2)

Sol. Option (2) is the answer because diterpenes belong to the category of terpenoides. Concanavalin A is a lectin.

- Codeine is an alkaloid
- Ricin is a toxin

156. Match **List-I** with **List-II**.

List-I	List-II
(A) Palm bones	(I) Phalanges
(B) Wrist bones	(II) Metacarpals
(C) Ankle bones	(III) Carpals
(D) Digit bones	(IV) Tarsals

Choose the correct answer from the options given below:

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

Answer (2)

Sol. Option (2) is the answer because, metacarpals (palm bones) are 5 in number in each fore limb. Carpals are also known as wrist bones and they are 8 in numbers in each fore limb. In each limb, 14 phalanges (digits) are present. In each hind limb, tarsals (ankle bones) are 7 in number and metatarsals 5 in number.

157. Which of the following sexually transmitted infections are completely curable?

- (1) Hepatitis-B and Genital herpes
- (2) Genital herpes and Genital warts
- (3) HIV infection and Trichomoniasis
- (4) Syphilis and Trichomoniasis

Answer (4)

Sol. Option(4) is the answer because, genital warts, trichomoniasis and syphilis are completely curable if detected early and treated properly. Hepatitis-B, genital herpes and HIV infections are not completely curable.

158. Which of the following can act as molecular scissors?

- (1) RNA polymerase
- (2) DNA polymerase
- (3) Restriction enzymes
- (4) DNA ligase

Answer (3)

Sol. Option(3) is the **correct** answer because the cutting of DNA at specific location became possible with the use of restriction enzymes. So, they are also called molecular scissors.

The DNA fragments can be joined together by using DNA ligase. They are called molecular glue.

DNA polymerase helps in the extension step of PCR.

159. Select **correct** sequence of substages of Prophase-I of meiotic division:

- (A) Zygotene
- (B) Pachytene
- (C) Diakinesis
- (D) Leptotene
- (E) Diplotene

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

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

Answer (1)

Sol. The correct sequence of substages of Prophase-I are

- Leptotene
- Zygotene
- Pachytene
- Diplotene
- Diakinesis

So the **correct** sequence is D, A, B, E, C

160. Given below are two statements:

Statement I: RNA being unstable, mutate at a faster rate.

Statement II: RNA can directly code for synthesis of proteins, hence can easily express the characters.

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

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

Answer (1)

Sol. RNA being unstable mutates of faster rate RNA can directly code for protein synthesis, hence can easily express the character. Both Statements are correct.

161. Given below are two statements:

Statement I : Goblet cells are unicellular glands.

Statement II : Earwax is the secretion of exocrine gland.

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

- (1) Both Statement I and Statement II are true
- (2) Both Statement I and Statement II are false
- (3) Statement I is true but Statement II is false
- (4) Statement I is false but Statement II is true

Answer (1)

Sol. Option (1) is the answer because some of the columnar or cuboidal cells get specialised for secretion and are called glandular epithelium. Goblet cells of alimentary canal are examples of unicellular glands. Exocrine glands secrete mucus, saliva, earwax, oil, milk, digestive enzymes and other cell products. So, both the statements I and II are correct.

162. If there are 250 snails in a pond, and within a year their number increases to 2500 by reproduction. What should be their birth rate per snail per year?

- (1) 25
- (2) 15
- (3) 10
- (4) 9

Answer (4)

Sol. Birth rate = $\frac{\Delta N}{N \Delta t}$

Here, $N = 250$

$$\Delta t = 1 \text{ year}$$

$$\begin{aligned} \Delta N &= 2500 - 250 \\ &= 2250 \end{aligned}$$

$$\begin{aligned} \text{Birth rate} &= \frac{2250}{250 \times 1} \\ &= 9 \end{aligned}$$

163. Given below are two statements regarding oogenesis.

Statement I : The primary follicles get surrounded by more layers of granulosa cells, a theca and shows fluid filled cavity antrum. Now it is called secondary follicle.

Statement II : Graafian follicle ruptures to release the secondary oocyte from the ovary by the process called ovulation.

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

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

Answer (4)

Sol. Option (4) is the answer because, each primary follicle gets surrounded by more layers of granulosa cells and a new theca and are called secondary follicles. The secondary follicles soon transforms into a tertiary follicle which is characterised by a fluid filled cavity called antrum. The Graafian follicle now ruptures to release the secondary oocyte (ovum) from the ovary by the process called ovulation.

So, the statement I is incorrect but statement II is correct.

164. House fly belongs to _____ family.

- (1) Calliphoridae
- (2) Muscidae
- (3) Cyprinidae
- (4) Hominidae

Answer (2)

Sol. Option (2) is the answer because, housefly belongs to the family **Muscidae**.

Option (1) is not the answer because Calliphoridae is the family of blow flies.

Option (3) is not the answer because, Cyprinidae is the family of freshwater fishes.

Option (4) is not the answer because, Hominidae is the family of apes.

165. Diacetyl morphine is also called as:

- (1) Crack
- (2) Smack
- (3) Amphetamine
- (4) Barbiturate

Answer (2)

Sol. Option (2) is the answer because heroin, commonly called smack is chemically diacetyl morphine. Morphine is used as sedatives.

Option (1) is not the answer because cocaine is obtained from coca plant and commonly called coke or crack.

Option (3) is not the answer because amphetamine is a stimulant.

Option (4) is not the answer because, barbiturates belong to the categories of sedatives.

166. Which of the following statements are **correct**?

- (A) Reproductive health refers to total well-being in all aspects of reproduction
- (B) Amniocentesis is legally banned for sex determination in India.
- (C) "Saheli" -a new oral contraceptive for females was developed in collaboration with ICMR (New Delhi)
- (D) Amniocentesis is used to determine genetic disorders and survivability of foetus.

Choose the **most appropriate** answer from the options given below:

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

Answer (1)

Sol. Option (1) is the answer because, according to the world health organisation, reproductive health means a total well-being in all aspects of reproduction. Statutory ban on amniocentesis (A foetal sex determination test based on the chromosomal pattern in the amniotic fluid surrounding the developing embryo) for sex-determination to legally check the increasing menace of female foeticides. Saheli is a new oral contraceptive for females, developed by the scientists at Central Drug Research Institute (CDRI) Lucknow, India.

167. Which one of the following is the quiescent stage of cell cycle ?

- (1) G_1
- (2) G_0
- (3) M
- (4) G_2

Answer (2)

Sol. G_0 is called the quiescent stage of cell cycle. Cells in G_0 phase are metabolically active but do not proliferate.

168. Match **List-I** with **List-II**

	List-I (ECG)		List-II (Electrical activity of heart)
(A)	P-wave	(I)	Depolarisation of ventricles
(B)	QRS complex	(II)	End of systole
(C)	T wave	(III)	Depolarisation of atria
(D)	End of T wave	(IV)	Repolarisation of ventricles

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

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

Answer (2)

Sol. Option (2) is the answer because, the P-wave represents the electrical excitation (depolarisation) of the atria which leads to the contraction of both the atria. The QRS complex represents the depolarisation of the ventricles. The T-wave represents the return of the ventricles from excited to normal state (Repolarisation). The end of the T-wave marks the end of systole.

169. Which of the following is **not** a secondary metabolite?

- (1) Anthocyanin
- (2) Lecithin
- (3) Curcumin
- (4) Morphine

Answer (2)

Sol. Option (2) is the answer because, lecithin is a phospholipid. They are found in cell membrane. Option (1), (3) and (4) are not the answers because anthocyanins, morphine and curcumin are the secondary metabolites.

170. Given below are two statements :

Statement I :

Intra Cytoplasmic Sperm Injection (ICSI) is another specialised procedure of *in-vivo* fertilisation.

Statement II :

Infertility cases due to inability of the male partner to inseminate female can be corrected by artificial insemination (AI).

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

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

Answer (4)

Sol. Option (4) is the answer because, Intra Cytoplasmic Sperm Injection (ICSI) is the another specialised procedure of *in-vitro* fertilization to correct infertility cases either due to inability of the male partner to inseminate the female or due to very low sperm counts in the ejaculates, could be corrected by artificial insemination.

171. Match **List - I** with **List - II**.

List - I	List - II
(A) Eosinophils	(I) 6 - 8%
(B) Lymphocytes	(II) 2 - 3%
(C) Neutrophils	(III) 20 - 25%
(D) Monocytes	(IV) 60 - 65%

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

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

Answer (1)

Sol. Option (1) is the answer, because percentage of eosinophils, lymphocytes, neutrophils and monocytes in total WBCs is 2-3%, 20-25%, 60-65% and 6-8% respectively.

Other options (2), (3) and (4) do not represent correct percent of these cells.

172. Select **incorrect** statement, regarding chemical structure of insulin.

- (1) C-peptide is not present in mature insulin molecule.
- (2) Polypeptide chains A and B are linked by disulphide bridges.
- (3) Mature insulin molecule consists of three polypeptide chains - A, B and C.
- (4) Insulin is synthesized as prohormone which contains extra stretch of C-peptide.

Answer (3)

Sol. Option (3) is the answer because mature insulin does not contain C-peptide chain which is removed during maturation of pro-insulin into insulin. So, it contains only two polypeptide chains A and B.

Option (1) is not the answer because C-peptide is absent in mature insulin molecule.

Option (2) is not the answer because polypeptide chains A and B are linked disulphide bridges.

Option (4) is not the answer because an extra stretch C-peptide is not present in mature insulin but present in pro-insulin.

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

Assertion (A) : Ascending limb of loop of Henle is impermeable to water and allows transport of electrolytes actively or passively.

Reason (R) : Dilution of filtrate takes place due to efflux of electrolytes in the medullary fluid.

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

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

Answer (2)

Sol. Option (2) is the answer because both (A) and (R) are true but (R) is not the correct explanation of (R).

Dilution of filtrate takes place as a result of passage of electrolytes actively or passively to the medullary interstitium when the concentrated filtrate passes through ascending limb of loop of Henle. This is due to the fact that ascending limb of loop of Henle is impermeable to water and allows transport of electrolytes.

174. Match **List - I** with **List - II**.

List - I	List - II
(A) Typhoid	(I) Protozoan
(B) Elephantiasis	(II) <i>Salmonella</i>
(C) Ringworm	(III) Aschelminthes
(D) Malaria	(IV) <i>Microsporum</i>

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

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

Answer (1)

Sol. Option (1) is the answer as it represents the correct match of list-I with list-II because: -

Typhoid is caused by a pathogenic bacteria, *Salmonella typhi*.

Elephantiasis or filariasis is caused by an Aschelminth, named as *Wuchereria bancrofti*.

Many fungi belonging to the genera *Microsporum*, *Trichophyton* and *Epidermophyton* are responsible for ringworm.

Plasmodium a tiny protozoan is responsible for malaria.

175. The Cockroach is :

- (1) Ureotelic only
- (2) Ureotelic and Uricotelic
- (3) Ammonotelic only
- (4) Uricotelic only

Answer (4)

Sol. Option (4) is the correct answer because in cockroach excretion is performed by Malpighian tubules. Each tubule is lined by glandular and ciliated cells. They absorb nitrogenous waste products and convert them into uric acid which is excreted out through the hindgut. Therefore, they are called uricotelic.

- Many bony fishes, aquatic amphibians and aquatic insects are ammonotelic in nature.
- Mammals, many terrestrial amphibians and marine fishes are ureotelic in nature.

176. Brainstem of human brain consists of:

- (1) Thalamus, Hypothalamus and Corpora quadrigemina
- (2) Amygdala, Hippocampus and Corpus Callosum
- (3) Mid-brain, Pons and Medulla Oblongata
- (4) Forebrain, Cerebellum and Pons

Answer (3)

Sol. Option (3) is the answer because mid brain, pons and medulla oblongata are the three major regions to make up the brain stem of human brain. Amygdala and hippocampus form a complex structure called the limbic system. Hindbrain comprises pons, cerebellum and medulla.

177. Match **List-I** with **List-II**

- | List-I | List-II |
|----------------------------|---------------------|
| (A) Non-medicated IUDs | (i) Multiload 375 |
| (B) Copper releasing IUDs | (ii) Rubber barrier |
| (C) Hormone releasing IUDs | (iii) Lippes loop |
| (D) Vaults | (iv) LNG- 20 |

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

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

Answer (1)

Sol. Option (1) is the answer because,

The IUDs are presently available as

The non-medicated IUDs e.g Lippes loop

Copper releasing IUDs e.g CuT, Cu7, Multiload 375

Hormone releasing IUDs e.g LNG- 20, Progestasert.

Vaults are barrier made of rubbers.

178. Which one of the following acts as an inducer for lac operon?

- (1) Glucose
- (2) Galactose
- (3) Sucrose
- (4) Lactose

Answer (4)

Sol. Lactose acts as inducer of *lac* operon. Lactose binds with repressor protein and inactivates it allowing the expression of structural genes.

179. Identify the fossil of man who showed the following characteristics.

- (A) Brain capacity of 1400 cc
- (B) Used hides to protect their body
- (C) Buried their dead bodies

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

- (1) *Homo habilis*
- (2) *Australopithecus*
- (3) *Homo erectus*
- (4) Neanderthal man

Answer (4)

Sol. Option(4) is the correct answer because the Neanderthal man had brain capacity of 1400 cc. They used hides to protect their body and buried their dead bodies.

The brain capacity of *Homo habilis* were between 650 – 800 cc and that of *Homo erectus* was around 900 cc.

180. Arrange the sequence of different hormones for their role during gametogenesis.

- (A) Gonadotropin LH stimulates synthesis and secretion of Androgen
- (B) Gonadotropin releasing hormone from hypothalamus
- (C) Androgen stimulates spermatogenesis
- (D) Gonadotropin FSH helps in the process of spermiogenesis
- (E) Gonadotropins from anterior pituitary gland

Choose the correct answer from the options given below:

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

Answer (1)

Sol. Option(1) is the answer because the correct sequence of different hormones for their role during gametogenesis is:

- B. Gonadotropin releasing hormone from hypothalamus
- E. Gonadotrophin from anterior pituitary gland
- A. Gonadotropin LH stimulates synthesis and secretion of Androgen
- C. Androgen stimulates spermatogenesis
- D. Gonadotropin FSH helps in the process of spermiogenesis

181. Given below are two statements:

Statement I : In bacteria, the mesosomes are formed by the extensions of plasma membrane.

Statement II: The mesosomes, in bacteria, help in DNA replication and cell wall formation.

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

Answer (1)

Sol. Statement I is correct as mesosomes in bacteria, represents a special membranous structure, which is formed by the extensions of plasma membrane into the cells.

Statement II is correct as mesosomes help in cell wall formation, DNA replication and distribution to daughter cells in bacteria.

Thus, option (1) is correct

182. Match **List-I** with **List-II**.

	List-I		List-II
(A)	Deforestation	(I)	Responsible for heating of Earth's surface and atmosphere
(B)	Reforestation	(II)	Conversion of forested areas to non-forested areas
(C)	Green-house effect	(III)	Natural ageing of lake by nutrient enrichment of its water
(D)	Eutrophication	(IV)	Process of restoring a forest that once existed but was removed

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

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

Answer (2)

Sol. Deforestation is the conversion of forested areas to non-forested ones.

Reforestation is the process of restoring a forest that once existed but was removed at some point of time in the past.

The greenhouse effect is a naturally occurring phenomenon that is responsible for heating of Earth's surface and atmosphere

Eutrophication is the natural aging of a lake by nutrient enrichment of its water.

Thus, option (2) is correct as it is mentioning all the correct matches.

183. Select the **correct** statements about sickle cell anaemia.

- (A) There is a change in gene for beta globin.
- (B) In the beta globin, there is valine in the place of Lysine.
- (C) It is an example of point mutation.
- (D) In the normal gene U is replaced by A.

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

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

Answer (2)

Sol. Sickle cell anaemia is caused by the substitution of Glutamic acid by valine at the sixth position of the beta globin chain of the haemoglobin molecule. It is an example of point mutation. The substitution of amino acid in the globin protein results due to the single base substitution at the sixth codon of the beta globin gene from GAG to GUG.

Thus, option (2) is correct

184. Given below are two statements:

Statement I : The nose contains mucus-coated receptors which are specialised for receiving the sense of smell and are called olfactory receptors.

Statement II : Wall of the eye ball has three layers. The external layer is called choroid (dense connective tissue), middle layer is sclera (thin pigmented layer) and internal layer is retina (ganglion cells, bipolar cells and photoreceptor cells).

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

- (1) Both Statement I and Statement II are true
- (2) Both Statement I and Statement II are false
- (3) Statement I is true but Statement II is false
- (4) Statement I is false but Statement II is true

Answer (3)

Sol. Option (3) is the correct answer as **Statement I** is correct and **Statement II** is incorrect because the wall of the eye ball is composed of three layers. The external layer is composed of a dense connective tissue and is called the sclera. The middle layer, Choroid, contains many blood vessels and looks bluish in colour. The choroid layer is thin over the posterior 2/3 of the eye ball and becomes thick in the anterior part to form the ciliary body. The innermost layer is the retina and it contains 3 layers of neural cells- from inside to outside-ganglion cells, bipolar cells and photoreceptor cells.

185. Match **List-I** with **List-II**.

	List-I		List-II
(A)	Contractile vacuole	(I)	<i>Asterias</i>
(B)	Water vascular system	(II)	<i>Amoeba</i>
(C)	Canal system	(III)	<i>Spongilla</i>
(D)	Flame cells	(IV)	<i>Taenia</i>

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

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

Answer (2)

Sol. Option (2) is the answer as it represents the correct match.

- Contractile vacuole is present in *Amoeba* and helps in osmoregulation.
- Water vascular system is the most distinctive feature of echinoderms such as *Asterias*, *Echinus* etc.
- Sponges have water transport or canal system in *Spongilla*.

Platyhelminthes like *Taenia* have specialised cells called flame cells that helps in osmoregulation and excretion.

SECTION-B

186. Arrange the events of Renin – Angiotensin mechanism in **correct** sequence.

- (A) Activation of JG cells and release of renin.
- (B) Angiotensin II activates release of aldosterone.
- (C) Fall in glomerular blood pressure.
- (D) Reabsorption of Na^+ and water from distal convoluted tubule.
- (E) Angiotensinogen is converted to Angiotensin I and then to Angiotensin II.

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

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

Answer (3)

Sol. Option (3) is the answer as events associated with renin-Angiotensin mechanism are arranged in a correct sequence i.e.,

- (C) Fall in glomerular blood pressure
- (A) Activation of J.G cells and release of renin
- (E) Angiotensinogen is converted to Angiotensin I and then to Angiotensin II
- (B) Angiotensin II activates release of aldosterone
- (D) Reabsorption of Na^+ and water from distal convoluted tubule

Option (1), (2) and (4) are incorrect as they do not represent the correct sequence of the respective event.

187. Select the **correct** statements :

- (A) Platyhelminthes are triploblastic pseudocoelomate and bilaterally symmetrical organisms.
- (B) Ctenophores reproduce only sexually and fertilization is external.
- (C) In tapeworm, fertilization is internal but sexes are not separate.
- (D) Ctenophores are exclusively marine, diploblastic and bioluminescent organisms.
- (E) In sponges, fertilization is external and development is direct.

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

- (1) (A) and (E) only
- (2) (B) and (D) only
- (3) (A), (C) and (D) only
- (4) (B), (C) and (D) only

Answer (4)

Sol. Option (4) is answer as it includes the correct statement *i.e.* (B), (C) and (D) options.

Option (1) is incorrect as platyhelminths are coelomate invertebrates and sponges show internal fertilization, thus statements (A) and (E) are incorrect.

Option (3) is incorrect as it includes statements (A).

Option (2) is incorrect as it includes only (B) and (D) statements whereas statements (C) is also correct *i.e.* tapeworm is a flatworm and is hermaphrodite.

188. Select the **correct** sequential steps regarding absorption of fatty acids and glycerol, in intestine.

- (A) Micelles are reformed into small protein coated fat globules called chylomicrons.
- (B) Micelles move into intestinal mucosa.
- (C) Fatty acids and glycerol are incorporated into small droplets called micelles.
- (D) Lacteals release the absorbed substances into blood stream.
- (E) Chylomicrons are transported into lacteals.

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

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

Answer (1)

Sol. Option (1) is the answer as it represents the correct sequential steps regarding absorption of fatty acid and glycerol, in intestine *i.e.*;

(C) Fatty acid and glycerol are incorporated into small droplets called micelles

(B) Micelles move into intestinal mucosa

(A) Micelles are reformed into small protein coated fat globules called chylomicrons

(E) Chylomicrons are transported into lacteals

(D) Lacteals release the absorbed substances into blood stream. Other option (2), (3) are (4) are not representing a correct sequence for absorption of fatty acids and glycerol.

189. Given below are two statements :

Statement I : In cockroach, the forewings are transparent and prothoracic in origin.

Statement II : In cockroach, the hind wings are opaque, leathery and mesothoracic in origin.

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

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

Answer (2)

Sol. Option (2) is the answer as both Statement I and Statement II are false because in cockroach the first pair of wings arises from mesothorax and not from prothorax. Moreover they are opaque, dark and leathery and not transparent as mentioned in Statement I

Statement II is incorrect as the hind wings in cockroach are transparent, membranous and are metathoracic in origin.

190. Match **List-I** with **List-II**.

	List-I		List-II
(A)	Cytokine barriers	(I)	Mucus coating of respiratory tract
(B)	Cellular barriers	(II)	Interferons
(C)	Physiological barriers	(III)	Neutrophils and Macrophages
(D)	Physical barriers	(IV)	Tears and Saliva

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

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

Answer (3)

Sol. Option (3) is the answer as it represents the correct match of list I and list II because,

- Cytokine barriers includes interferons which are proteins secreted by virus infected cells to protect non-infected cells from further viral infection.
- Cellular barriers include certain types of W.B.Cs of our body like neutrophils and monocytes and natural killer cells in the blood as well as macrophages in tissues.
- Physiological barriers includes acid in the stomach, tears from eyes and saliva in mouth-all prevent microbial growth.

Physical barriers include skin and mucus coating of respiratory tract, GIT etc.

191. With reference to Hershey and Chase experiments. Select the **correct** statements.

- (A) Viruses grown in the presence of radioactive phosphorus contained radioactive DNA.
- (B) Viruses grown on radioactive sulphur contained radioactive proteins.
- (C) Viruses grown on radioactive phosphorus contained radioactive protein.
- (D) Viruses grown on radioactive sulphur contained radioactive DNA.
- (E) Viruses grown on radioactive protein contained radioactive DNA.

Choose the **most appropriate** answer from the options given below :

- (1) (A) and (C) only
- (2) (B) and (D) only
- (3) (D) and (E) only
- (4) (A) and (B) only

Answer (4)

Sol. In Hershey and Chase experiment, after centrifugation the bacterial cells showed the presence of a radioactive DNA labelled with P^{32} while radioactive protein labelled with S^{35} appeared outside the bacterial cell i.e. in the medium.

Labelled DNA was also found in the next generation of phage. Bacteria that were infected with viruses that had radioactive protein were not radioactive.

Statement A and B are correct.

Hence option (4) is correct.

192. The salient features of genetic code are :

- (A) The code is palindromic
- (B) UGA act as initiator codon
- (C) The code is unambiguous and specific
- (D) The code is nearly universal

Choose the **most appropriate** answer from the options given below :

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

Answer (2)

Sol. The genetic code are unambiguous and specific

The genetic code is universal.

Genetic codon are non-palindromic

UGA is terminator codon.

Therefore option (2) is correct.

193. Select the **correct** statements regarding dissolved Oxygen and Biochemical oxygen demand.

- (A) BOD is inversely related to dissolved oxygen.
- (B) Low dissolved oxygen and high BOD lead to loss of aquatic life.
- (C) High BOD leads to high dissolved oxygen.
- (D) Both BOD and dissolved oxygen are indicator of health of a water body.
- (E) Both BOD and dissolved oxygen are affected by amount of organic matter in the water body.

Choose the **most appropriate** answer from the options given below :

- (1) (A), (B), (C), (D) only
- (2) (B), (C), (D), (E) only
- (3) (A), (B), (C), (E) only
- (4) (A), (B), (D), (E) only

Answer (4)

Sol. BOD is inversely related to dissolved oxygen.

Higher the BOD lower the dissolved oxygen of water body.

BOD and dissolved oxygen is affected by amount of organic matter in water body.

Therefore, statement A, B, D and E are correct.

194. Select the **incorrect** statement with respect to Multiple Ovulation Embryo Transfer (MOET) Technology.

- (1) Cow is administered with hormones to induce super-ovulation.
- (2) Super-ovulating cow is either mated with elite bull or is artificially inseminated.
- (3) Fertilised eggs at 4 to 6 cells – stages are recovered non-surgically from super-ovulating cow and transferred to surrogate mother.
- (4) It is used to increase herd size in a short time.

Answer (3)

Sol. Option (3) is answer because, in MOET, the fertilized eggs at 8–32 cells stages recovered non-surgically from super-ovulating cow and transferred to surrogate mothers. Hence, the statement given in option (3) is an incorrect statement.

Statements given in options. (1), (2) and (4) are correct statements w.r.t. MOET.

195. Match **List - I** with **List - II**.

	List - I		List - II
(A)	Gene therapy	(I)	Separation of DNA fragments
(B)	RNA interference	(II)	Diagnostic test for AIDS
(C)	ELISA	(III)	Cellular defence
(D)	Gel electrophoresis	(IV)	Allows correction of a gene defect

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

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

Answer (1)

Sol. Option (1) is the answer because

- A. Gene therapy allows correction of a gene defect
- B. RNA interference takes place in all eukaryotes as a method of cellular defence
- C. ELISA is used as a diagnostic test for AIDS
- D. Gel Electrophoresis is used in separation of DNA fragments

196. Given below are two statements:

Statement I :

Parathyroid hormone acts on bones and stimulates the process of bone resorption.

Statements II :

Parathyroid hormone along with Thyrocalcitonin plays a significant role in carbohydrate metabolism.

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

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

Answer (3)

Sol. Option (3) is the answer because parathyroid hormone is a hypercalcemic hormone, which acts on bone and stimulates the process of bone resorption.

PTH along with TCT plays a significant role in the calcium balance in the body.

Hence, Statement I is correct but Statement II is false

197. Select the **correct** statement/s with respect to mechanism of sex determination in Grasshopper.

- (A) It is an example of female heterogamety.
- (B) Male produces two different types of gametes either with or without X chromosome.
- (C) Total number of chromosomes (autosomes and sex chromosomes) is same in both males and females.
- (D) All eggs bear an additional X chromosome besides the autosomes.

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

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

Answer (3)

Sol. Grasshopper shows male heterogamety and chromosomal constituent of male is AA + XO and female is AA + XX

Males have lesser number of sex chromosomes as compared to females.

Male produce two types of gametes (A + X) and (A + O)

198. Match **List-I** with **List-II**.

List-I	List-II
(A) Columnar epithelium	(I) Ducts of glands
(B) Ciliated epithelium	(II) Inner lining of stomach and intestine
(C) Squamous epithelium	(III) Inner lining of bronchioles
(D) Cuboidal epithelium	(IV) Endothelium

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

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

Answer (2)

Sol. Option (2) is correct answer because

- (A) Columnar epithelium is present in inner lining of stomach and intestine
- (B) Ciliated epithelium is present in inner lining of bronchioles
- (C) Squamous epithelium present in inner lining of blood vessels and is called endothelium
- (D) Cuboidal epithelium is present in the lining of renal tubules and ducts of glands

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

Assertion (A) :

A person goes to high altitude and experiences "Altitude Sickness" with symptoms like breathing difficulty and heart palpitations.

Reason (R) :

Due to low atmospheric pressure at high altitude, the body does not get sufficient oxygen.

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

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

Answer (1)

Sol. Altitude sickness is experienced at high altitude where body does not get enough oxygen due to low atmospheric pressure and cause nausea, fatigue and heart palpitations.

200. Which of the following statements are **correct** with respect to Golgi apparatus?

- (A) It is the important site of formation of glycoprotein and glycolipids.
- (B) It produces cellular energy in the form of ATP.
- (C) It modifies the protein synthesized by ribosomes on ER.
- (D) It facilitates the transport of ions.
- (E) It provides mechanical support.

Choose the **most appropriate** answer from the options given below :

- | | |
|----------------------|----------------------|
| (1) (A) and (D) only | (2) (D) and (E) only |
| (3) (B) and (C) only | (4) (A) and (C) only |

Answer (4)

Sol. Golgi apparatus is the important site of formation of glycoprotein and glycolipids. It modifies the protein synthesized by ribosomes present on endoplasmic reticulum.

Mitochondria produce ATP and cell membranes facilitate the transport of ions.

Cytoskeleton provides the mechanical support to the cell.

