BOOKLET CODE

T3

NEET 2024
Question Paper, Answer Key and Soultions

Infinity Learn by **Sri Chaitanya** Educational Institutions

INSTRUCTIONS

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on ORIGINAL Copy care fully with blue/black ball point pen only.

2. The test is of 3 hours 20 minutes duration and the Test Booklet contains 200 multiple-choice questions (four options with a single correct answer) from Physics, Chemistry and Biology (Botany and Zoology). 50 questions in each subject are divided into two Sections (A and B) as per details given below:

    (a) Section A shall consist of 35 (Thirty-five) Questions in each subject (Question Nos - 1 to 35, 5 I to 85, 101 to 135 and 151 to 185).All questions are compulsory.

    (b) Section B shall consist of 15 (Fifteen) questions in each subject (Question Nos - 36 to 50, 86 to 100, 136 to 150 and 186 to 200). In Section B, a candidate needs to attempt any 10 (Ten) questions out of 15 (Fifteen) in each subject.

    Candidates are advised to read all 15 questions in each subject of Section B before they start attempting the question paper. In the event of a candidate attempting more than ten questions, the first ten questions answered by the candidate shall be evaluated.

3. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 720.

4. Use Blue/Black Ball Point Pen only for writing particulars on this page/marking responses on Answer Sheet.

5. Rough work is to be done in the space provided for this purpose in the Test Booklet only.

6. On completion of the test, the candidate must hand over the Answer Sheet (ORIGINAL and OFFICE Copy) to the Invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.

7. The CODE for this Booklet is **T3**. Make sure that the CODE printed on the Original Copy of the Answer Sheet is the same as that on this Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.

8. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/ Answer Sheet.

9. Use of white fluid for correction is NOT permissible on the Answer Sheet.

10. Each candidate must show on-demand his/her Admit Card to the Invigilator.

11. No candidate, without special permission of the centre Superintendent or Invigilator, would leave his/her seat.

12. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign (with time) the Attendance Sheet twice. Cases, where a candidate has not signed the Attendance Sheet second time, will be deemed not to have handed over the Answer Sheet and dealt with as an Unfair Means case.

13. Use of Electronic/Manual Calculator is prohibited.

14. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Room/Hall. All cases of unfair means will be dealt with as per the Rules and Regulations of this examination.

15. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

16. The candidates will write the Correct Test Booklet Code as given in the Test Booklet/Answer Sheet in the Attendance Sheet.

17. Compensatory time of one hour five minutes will be provided for the examination of three hours and 20 minutes duration, whether such candidate (having a physical limitation to write) uses the facility of Scribe or not.

PHYSICS

Section-A

1. A tightly wound 100 turns coil of radius 10 cm carries a current of $7A$. The magnitude of the magnetic field at the centre of the coil is (Take permeability of free space as $4\pi \times 10^{-7}$ SI units)

   (1) 4.4 mT
   (2) 44 T
   (3) 44 mT
   (4) 4.4 T

Ans: (1)

Sol: For a circular coil magnetic field at the centre

$$B = \frac{\mu_0 n_i}{2r} = \frac{4\pi \times 10^{-7} \times 100 \times 7}{2 \times 0.1}$$

$$= \frac{2 \times 22}{7} \times 10^{-7} \times 7 = 44 \times 10^{-4}$$

$$= 4.4 \, mT$$

2. Match **List–I** with **List–II** following

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

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

Ans: (3)

Sol:

A.	Diamagnetic	→	small negative-II
B.	Ferromagnetic	→	large negative-III
C.	Parmagnetic	→	greater than zero but small-IV
D.	Non-magnetic	→	zero-I

3. A thermodynamics system is taken through the cycle *abcda*. The work done by the gas along the path bc is
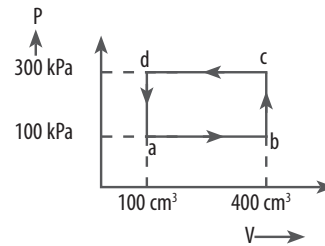
   (1) $-90 \, J$ (2) $-60 \, J$
   (3) zero (4) $30 \, J$

Ans: (3)

Sol: BC is isochoric W = 0

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

   (1) both the reflected and refracted light will be completely polarised.
   (2) the reflected light will be completely polarised but the refracted light will be partially polarised.
   (3) the reflected light will be partially polarised
   (4) the refracted light will be completely polarised

Ans: (2)

Sol: At Brewster angle reflected light is completely polarised but refracted light is partially polarised

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

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

Ans: (4)

Sol: In ideal transformer

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

6. A logic circuit provides the output Y as per the following truth table

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

The expression for the output Y is

(1) $\overline{B}$

(2) B

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

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

Ans: (1)

Sol:

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

$Y = \overline{B}$

7. In a Vernier calipers, $(N+1)$ divisions of vernier scales coincide with N divisions of main scale. If 1 MSD represents 0.1 mm, the vernier constant (in cm) is

(1) 100 N

(2) 10(N + 1)

(3) $\dfrac{1}{10N}$

(4) $\dfrac{1}{100(N+1)}$

Ans: (4)

Sol: $(N+1)VSD = N \times MSD$

$1 \quad VSD = \dfrac{N}{N+1}MSD$

$VC = 1MSD - 1VSD$

$= \left(1 - \dfrac{N}{N+1}\right)MSD$

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

8. The maximum elongation of a steel wire 1 m length if the elastic limit of steel and its Young's modulus, respectively, are $8 \times 10^8 \ N \ m^{-2}$ and $2 \times 10^{11} \ N \ m^{-2}$ is

(1) 40 mm

(2) 8 mm

(3) 4 mm
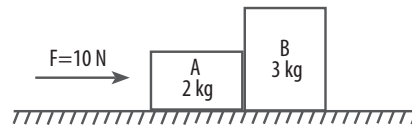
(4) 0.4 mm

Ans: (3)

Sol: elongation in a wire

$e = \dfrac{F}{A}\dfrac{l}{Y}$

$= \dfrac{8 \times 10^8 \times 1}{2 \times 10^{11}} = 4 \times 10^{-3} m$

$= 4 \ mn$

9. A horizontal force 10 N is applied to a block A as shown in figure. The mass of blocks A and B

are 2 kg and 3 kg, respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is

(1) 6 N

(2) 10 N

(3) zero

(4) 4 N

Ans: (1)

Sol: Force on B by A is

$m_B A = m_B \dfrac{F}{m_A + m_B}$

$= \dfrac{3 \times 10}{5} = 6N$

10. If the monochromatic source in Young's double slit experiment is replaced by white light, then

(1) there will be a central bright white fringe surrounded by a few coloured fringes.

(2) all bright fringes will be of equal width.

(3) interference pattern Will disappear.

(4) there will be a central dark fringe surrounded by a few coloured fringes.

Ans: (1)

Sol: If white light is placed instead of monochromatic light, central fringe will be white surrounded by colour fringe

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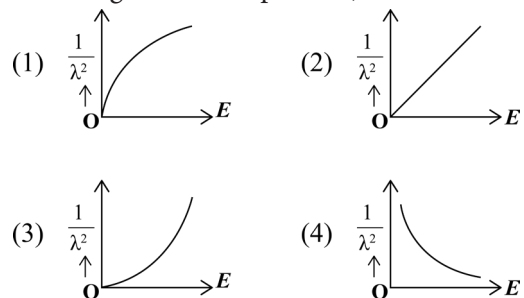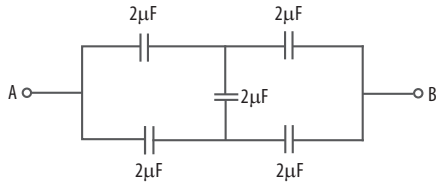

Ans: (2)

Sol: $\lambda = \dfrac{h}{p} \qquad \dfrac{1}{\lambda} \propto p \qquad \dfrac{1}{\lambda^2} \propto p^2$

$E = \dfrac{p^2}{2m} \propto \dfrac{1}{\lambda^2}\dfrac{1}{2m}$

so $\dfrac{1}{\lambda^2} \propto E$
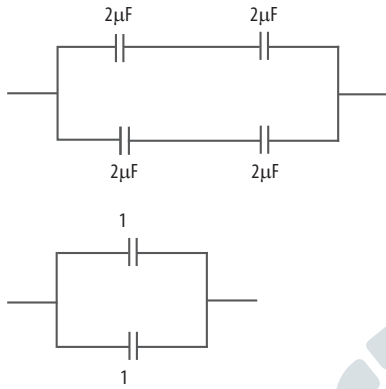
Straigth line passing through origin

12. In the following circuit, the equivalent capacitance between terminal A and terminal B is

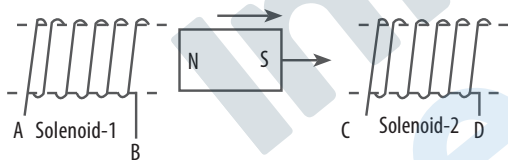(1) 0.5 μF

(2) 4 μF

(3) 2 μF

(4) 1 μF

Ans: (3)

Sol: Balanced Wheatstone Bridge


1 + 1 = 2 μF

13.

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

(1) *AB* and *CD*

(2) *BA* and *DC*

(3) *AB* and *DC*

(4) *BA* and *CD*

Ans: (3)

Sol. In Ab it will be clock-wise A to B.
In CD it will be clock-wise D to C.

14. Consider the following statements A and B and identify the correct answer:
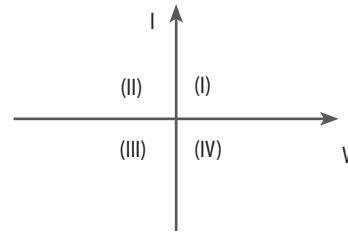
A. For a solar-cell, the I-V characteristics lies in the IV quadrant of the given graph.

B. In a reverse biased *pn* junction diode, the current measured (μA), is due to majority charge carriers.

(1) Both A and B are incorrect.

(2) Both A and B are incorrect.

(3) A is correct but B is incorrect.

(4) A is incorrect but B is correct.

Ans: (3)

Sol: For a solar cell
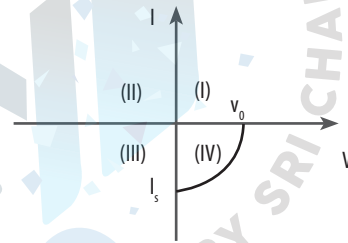
(A) V_0 is the open circuit voltage and its I_s the short circuit current

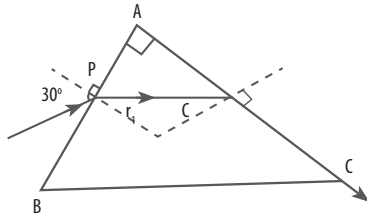(B) Reverse bias current is due to minority change carriers.

15. A light ray enters through a right angled prism at point *P* with the angle of incidence $30°$ as shown in figure. It travels through the prism parallel to its base *BC* and emerges along the face *AC*. The refractive index of the prism is:
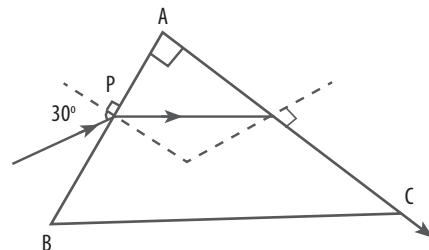
(1) $\dfrac{\sqrt{3}}{4}$

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

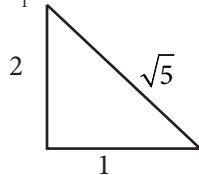(3) $\dfrac{\sqrt{5}}{4}$

(4) $\dfrac{\sqrt{5}}{2}$

Ans: (4)

Sol:

$r_1 + C = A = 90°$

$r_1 = 90 - C$

$\dfrac{\sin i}{\sin r} = \mu$

$\dfrac{\sin 30}{\sin(90 - C)} = \dfrac{1}{\sin c}$

$\dfrac{1}{2} = \cot C$

$\tan C = 2$

$\sin C = \dfrac{2}{\sqrt{5}}$

$\mu = \dfrac{1}{\sin C} = \dfrac{\sqrt{5}}{2}$

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

    Assertion (A) : The potential (V) at any axial point, at 2m distance (r) from the centre of the dipole of dipole moment vector $\overline{P}$ of magnitude, 4×10^{-6} C m, is 9 $\times 10^3$ V. (Take $\dfrac{1}{4\pi\epsilon_0} = 9 \times 10^9$)

    Reason (R)   : $V = \pm \dfrac{2P}{4\pi\epsilon_0 r^2}$, where r is the distance of any axial point, situated at 2m from the centre of the dipole

    (1)   A is true but R is false.

    (2)   A is false but R is true.

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

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

Ans: (1)

Sol: Potential due to dipole

$\dfrac{kp\cos\theta}{r^2}$ for axial line $\theta = 0°$

$\dfrac{9 \times 10^9 \times 4 \times 10^{-6}}{4} = 9 \times 10^3 v$

A true, R false

17. The moment of inertia of a thin rod about an axis passing through its mid point and perpendicular to the rod, is 2400 g cm². The length of the 400 g rod is nearly

    (1)   20.7 cm   (2)   72 .0 cm

    (3)   8.5 cm   (4)   17.5 cm

Ans: (3)

Sol: Momentum of Inertia of a rod about centre perpendicular to length,
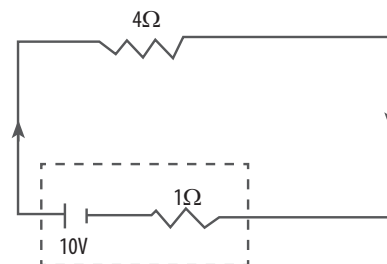
$\dfrac{Ml^2}{12} = I$

M = 400 gm cm²

I = 2400 gm

$l^2 = \dfrac{12\,I}{M}$

$= \dfrac{12 \times 2400}{400} = \sqrt{72} = 8.5\ cm$

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

    (1)   8 V   (2)   10 V

    (3)   4 V   (4)   6 V

Ans: (1)

Sol: Terminal Potential Difference

$V = iR = \dfrac{E}{R+r}R$

$= \dfrac{10}{4+1} \times 4 = 8V$

19. Match List–I with List–II

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

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

Ans: (4)

Sol: Energy of hydrogen spectra

$$E = 13.6\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)eV$$

and wavelength $= \dfrac{1240}{E} nm$

$$13.6\left(\frac{1}{4} - \frac{1}{9}\right) = \frac{5 \times 13.6}{36} \approx 1.89$$

$$\lambda = \frac{1240}{1.89} = 656$$

$$13.6\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = 13.6\left(\frac{4-1}{16}\right)$$

$$= \frac{13.6 \times 3}{16} = \frac{1240 \times 16}{13.6 \times 3} = 486.1 \text{ and so on.}$$

A–III, B–IV, C–II, D–I

20. If c is the velocity of light in free space, the correct statements about photon among the following are:

A. The energy of a photon is E=hv.

B. The velocity of a photon is c.

C. The momentum of a photon, $P = \dfrac{hv}{c}$.

D. In a photon-electron collision, both total energy and total momentum are conserved.

E. Photon possesses positive charge.

Choose the correct answer from the options given below:

(1) A, C and D only

(2) A, B, D and E only
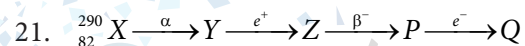
(3) A and B only

(4) A, B, C and D only

Ans: (4)

Sol. Energy photon → E = hv

velocity → C

$$p = \frac{hv}{C}$$

in collision both P and E are conserved. Photon is charrge less.

So, A, B, C and D are correct.
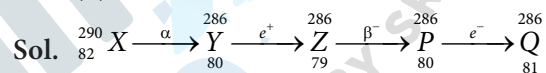
21. $_{82}^{290}X \xrightarrow{\alpha} Y \xrightarrow{e^+} Z \xrightarrow{\beta^-} P \xrightarrow{e^-} Q$

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

(1) 288, 82

(2) 286, 81

(3) 280, 80

(4) 286, 80

Ans: (2)

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

So Q mass number is 286

Atomic ni is 81.

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

(1) 7

(2) 6

(3) 10

(4) 5

Ans: (3)

Sol. Displacement S = 2t – 1

velocity $\dfrac{ds}{dt} = 2 \, m/s$
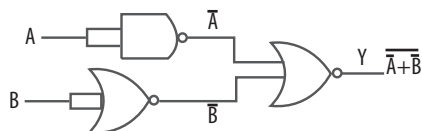
Force = 5 N

Power = Fv= 5×2=10 W

23. The output (Y) of the given logic gate is similar to the output of an/a
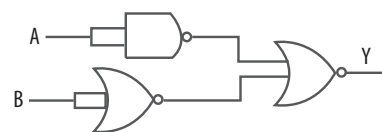
(1) OR gate

(2) AND gate

(3) NAND gate

(4) NOR gate

Ans: (2)

Sol.

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

So, it is AND gate.

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

    (1) 4.9 ms^{-2}
    (2) 3.92 ms^{-2}
    (3) 19.6 ms^{-2}
    (4) 9.8 ms^{-2}

Ans: (2)

Sol. $g = \dfrac{GME}{R^2}$

$$g^1 = \dfrac{GME}{10\left(\dfrac{R}{2}\right)^2} = \dfrac{GME}{R^2}\dfrac{4}{10}$$

$$= \dfrac{4 \times 9.8}{10} = 3.92 \text{ m/s}^2$$

25. Given below are two statements:

    Statement I : Atoms are electrically neutral as they contain equal number of positive and negative charges.

    Statement II : Atoms of each element are stable and emit their characteristic spectrum.

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

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

Ans: (3)

Sol. Statement-I atoms are electrically neutral.
Atoms of each element are stable and they emit characteristic spectrum.

26. A wheel of bullock cart is rolling on a level road as shown in the figure below. If its linear speed is v in the direction shown. Which one of the following options is correct (P and Q are any highest and lowest points on the wheel respectively?
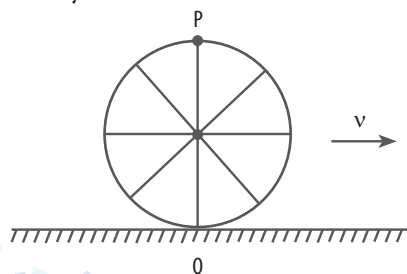
    (1) Both the points P and Q move with equal speed.
    (2) Point P has zero speed.
    (3) Point P moves slower than point Q.
    (4) Point P moves faster than point Q.

Ans: (4)

sol.
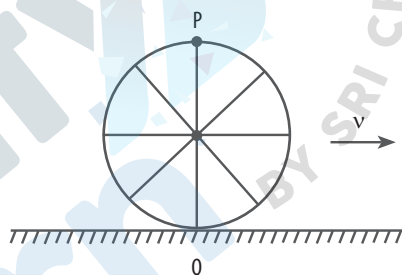
Point P has a velocity 2 V but point Q has a velocity zero.

27. A particle moving with uniform speed in a circular path maintains:

    (1) constant velocity but varying acceleration.
    (2) varying velocity and varying acceleration.
    (3) constant velocity.
    (4) constant acceleration.

Ans: (2)

Sol. In uniform circular motion magnitude of velocity remains constant but direction changes even direction of acceleration also changes.

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

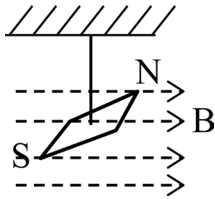   (1) 1.98 mN   (2) 99 N
    (3) 19.8 mN   (4) 198 N

Ans: (3)

Sol. Extra force required.

$$2\pi RT = 2 \times \frac{22}{7} \times 4.5 \times 10^{-2} \times 7 \times 10^{-2}$$

$$= 198 \times 10^{-4} \text{ N} = 19.8 \text{ mN}.$$

29. In a uniform magnetic field of 0.049 T, a magnetic needle performs 20 complete oscillations in 5 seconds as shown. The moment of inertia of the needle is 9.8×10^{-6} kg m². If the magnitude of magnetic moment of the needle is $x \times 10^{-5}$ Am²; then the value of 'x' is

    (1) $50 \pi^2$ (2) $1280 \pi^2$

    (3) $5 \pi^2$ (4) $128 \pi^2$

Ans: (2)

Sol. $T = 1\pi \sqrt{\dfrac{I}{MB}}$

$$\frac{5}{20} = 2\pi \sqrt{\frac{9.8 \times 10^{-6}}{M \times 49 \times 10^{-3}}}$$

$$\frac{1}{8\pi} = \sqrt{\frac{2 \times 10^{-4}}{M}}$$

$$\frac{1}{64\pi^2} = \frac{2 \times 10^{-4}}{M}$$

$$M = 128\pi^2 \times 10^{-4} = 1280\pi^2 \times 10^{-5}$$

30. Two bodies A and B of same mass undergo completely inelastic one dimensional collision. The body A moves with velocity v_1 while body B is at rest before collision. The velocity of the system after collision is v_2. The ration $v_1 : v_2$ is:

    (1) 4 : 1   (2) 1 : 4

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

Ans: (4)

Sol. Here $m_1 = m_2$; $u_1 = v_1$. $u_2 = 0$

Perfectly inelastic collision →

$$m_1 u_1 = (m_1 + m_2) v$$

$$m v_1 = 2m v_2$$

$$\frac{v_1}{v_2} = \frac{2}{1}$$

31. If $x = 5\sin\left(\pi t + \dfrac{\pi}{3}\right) m$ represents the motion of a particle executing simple harmonic motion,

the amplitude and time period of motion, respectively, are:

    (1) 5 cm, 1 s

    (2) 5 m, 1s

    (3) 5 cm, 2 s

    (4) 5 m, 2 s

Ans: (4)

Sol. $x = 5\sin(\pi t + \pi/3)m$

amplitude $\rightarrow$ 5 m

$\omega = \pi$

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

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

    (1) strain and arc

    (2) angular speed and stress

    (3) strain and angle

    (4) stress and angle

Ans: (3)

Sol. Strain has no dimension, angle and solid angle also has no dimension.

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

(Take $\dfrac{1}{4\pi \in_0} = 9 \times 10^9$ SI units)
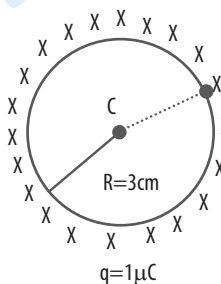
    (1) 0.5×10^5

    (2) zero

    (3) 3×10^5

    (4) 1×10^5

Ans: (2)

Sol. For a shell potential at surface and any point inside is same. So, potential difference between C and P is zero.

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

(1) $\dfrac{T}{4}$ (2) $\sqrt{2}T$

(3) T (4) $4T$

Ans: (4)

Sol. In a horizontal circle when a bob is whirled tension in the string $T = m\omega^2 \ell$. If ω is doubled T increases to 4T.

35. A wire of length 'l' and resistance 100Ω is divided into 10 equal parts. The first 5 parts are connected in series while the next 5 parts are connected in parallel. The two combinations are again connected in series. The resistance of this final combination is:

(1) $55\ \Omega$

(2) $60\ \Omega$

(3) $26\ \Omega$

(4) $52\ \Omega$

Ans: (4)

**Sol.** Resistance of each part $\dfrac{100}{10} = 10\ \Omega$

If 5 such connected i series equivalent is = $50\ \Omega$

If 5 such connected in parallel equivalent is $\dfrac{10}{5} = 2\ \Omega$

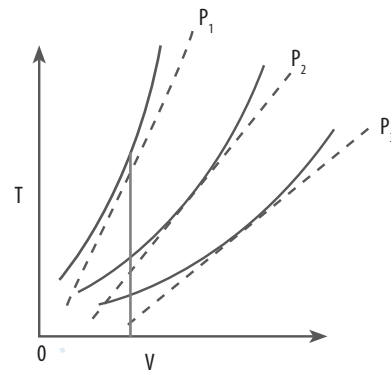Combination of series of these two 50 + 2 = $52\ \Omega$

Section-B

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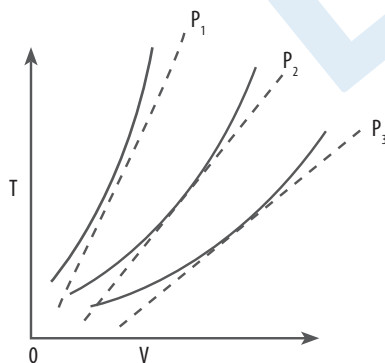
(1) $P_2 > P_1 > P_3$

(2) $P_1 > P_2 > P_3$

(3) $P_3 > P_2 > P_1$

(4) $P_1 > P_3 > P_2$

Ans: (2)

Sol.

If we draw lines parallel to T axis, i.e., at constant volume.

$T_1 > T_2 > T_3$.

So, $P_1 > P_2 > P_3$

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

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

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

(3) there is no current.

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

Ans: (4)

Sol. Inside the capacitor current is displacement current which is equal to conduction current.

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

(1) they travel with a speed equal to $\dfrac{1}{\sqrt{\mu_0\ \epsilon_0}}$.

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

(3) they are transverse in nature.

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

Ans: (2)

Sol. Electromagnetic wave is produced by oscillating charge but not with charge moving with constant velocity.

39. Choose the correct circuit which can achieve the bridge balance.

(1)

(2)

(3)

(4)
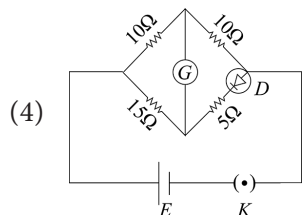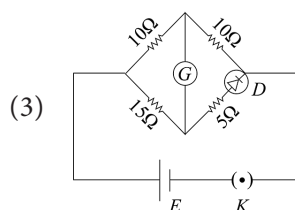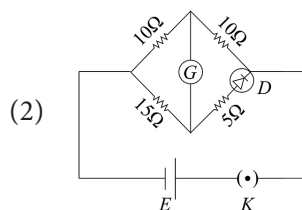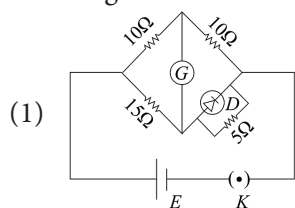
Ans: (3)

Sol. Among all circuits in (2) and (4) diodes are reversed bias. So, no current will flow . In (1) resistance is short circuited so the path will be a zero resistance. In (3) diode is in forward biased so it could balance.

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

(A) the charge stored in it, increases.

(B) the energy stored in it, decreases.

(C) its capacitance increases.

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

(E) the product of charge and voltage increases.

Choose the most appropriate answer from the options given below:

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

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

Ans: (4)

Sol. Plate connected to battery means voltage drop is constant.

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

If d decreases, C increases

Q = CV

If C increases, Q increases

$$U = \frac{1}{2}CV^2$$

If C increases, energy stored increases ratio of $\frac{Q}{V} = C$, which increases.

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

(1) $\alpha\beta t$ (2) $\alpha\beta / t$

(3) $\beta t / \alpha$ (4) $\alpha t / \beta$

Ans: (4)

Sol. Units of $\alpha = \dfrac{N}{S^2}$

Units of $\beta = \dfrac{N}{S}$

Units of $\dfrac{\alpha t}{\beta} = \dfrac{N}{S^2} \times S \times \dfrac{S}{N} = 1(\text{Dimensionless})$

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

(1) 100×10^3 N   (2) 2×10^3 N

(3) 5×10^3 N   (4) 50×10^3 N

Ans: (4)

Sol. $F = AY\alpha\Delta\theta$

$=(10^{-3})(0.5\times10^{11})(10^{-5})(100)$

$=50\times10^3$ N

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

(1) 17   (2) 32

(3) 34   (4) 28
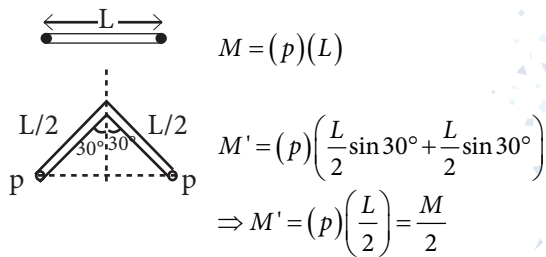
Ans: (4)

Sol. $M = \dfrac{f_0}{f_e} = \dfrac{140}{5} = 28$

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

(1) 2 M

(2) $\dfrac{M}{\sqrt{3}}$

(3) M

(4) $\dfrac{M}{2}$

Ans: (4)

Sol.

$M = (p)(L)$

$M' = (p)\left(\dfrac{L}{2}\sin 30° + \dfrac{L}{2}\sin 30°\right)$

$\Rightarrow M' = (p)\left(\dfrac{L}{2}\right) = \dfrac{M}{2}$

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

$C = 10\ \mu F$

210 V, 50 Hz
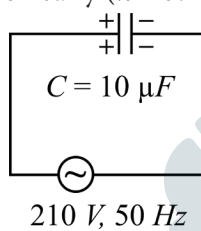
(1) 1.20 A   (2) 0.35 A

(3) 0.58 A   (4) 0.93 A

Ans: (4)

Sol. $X_C = \dfrac{1}{\omega C}$; $i_{rms} = \dfrac{V_{rms}}{X_C}$

$i_0 = \sqrt{2}\ i_{rms} = \sqrt{2}\ \dfrac{V_{rms}}{1}(\omega C)$

$= \sqrt{2} \times 210 \times 2\pi \times 50 \times 10 \times 10^{-6}$

$= 0.93\ \text{A}$

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

(1) 1 : 2

(2) 2 : 3

(3) 1 : 1

(4) 2 : 9

Ans: (4)

Sol. Series, $P_s = \dfrac{P_1 P_2}{P_1 + P_2} = \dfrac{2}{3}\ kW$

Parallel, $P_P = P_1 + P_2 = 3\ \text{kW}$

Ratio = $\dfrac{P_s}{P_P} = \dfrac{2}{9}$

47. The velocity (v)–time (t) plot of the motion of a body is shown below:
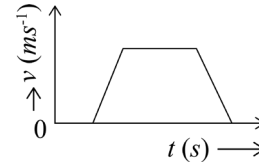
The acceleration (a) – time (t) graph that best suits this motion is:
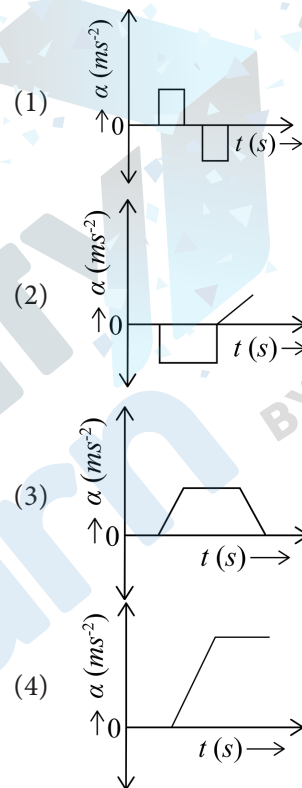
Ans: (1)

Sol. Slope in velocity – time graph gives acceleration.
In 1st part, slope = Positive and constant
In 2nd part, slope = zero
In 3rd part, slope = Negative and constant.

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

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

Ans: (4)

Sol: Time period of simple pendulum is

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

$$\Rightarrow T \propto \sqrt{l}$$

(Independent of mass bob)
Length becomes half

$$\therefore T' = \frac{T}{\sqrt{2}} = \frac{x}{2}T$$

$$\Rightarrow x = \sqrt{2}$$

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

(1) $\dfrac{GmM}{2R}$ (2) $\dfrac{GmM}{3R}$

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

Ans: (3)

Sol: Using energy conservation,

$$V_i + K_i + E = U_f + K_f$$

$$\frac{-GMm}{R} + 0 + E = \frac{-GMm}{3R} + \frac{GMm}{2(3R)}$$

$$\Rightarrow E = \frac{5}{6}\frac{GMm}{R}$$

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

(A) hold the sheet there if it is magnetic.

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

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

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

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

(1) A, C and D only

(2) C only

(3) B and D only

(4) A and C only

Ans: (4)

Sol: Statement A is correct

A magnetic sheet will be attracted towards the magnetic pole. To hold it, we require a force ib opposite direction.

Statement A is incorrect

Non-magnetic sheet will neither attract nor repel.

Statement C is correct.

Motion of the sheet results in change in magnetic flux, thus inducing eddy current, which will slow the sheet. in order to maintain uniform velocity, external force in the initial direction of motion is required.

Statement D is wrong.

Due to non-conducting and non-polar nature of sheet, eddy currents will not be generated. Hence, without the need of external force, sheet will be moving with uniform velocity.

CHEMISTRY

Section-A

51. Match List I with List II.

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

Choose the correct answer from the options given below.

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

Ans: (3)

Sol. $2H_2O \rightarrow O_2$ (4F)

$$H_2O \rightarrow \frac{1}{2}O_2 \text{ (2F)}$$

$$MnO_4^- \rightarrow Mn^{+2} \text{ (5F)}$$

$$\underset{1 \text{ mole}}{Ca} \rightarrow Ca^{+2} \text{ (2F)}$$

1.5 mole ——— (3F)

$$2FeO \Rightarrow Fe_2O_3 \text{ (2F)}$$
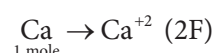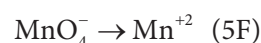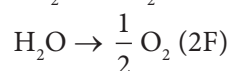
52. Which reaction is **not** a redox reaction?

(1) $H_2 + Cl_2 \rightarrow 2\,HCl$

(2) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2\,NaCl$

(3) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

(4) $2\,KClO_3 + I_2 \rightarrow 2\,KIO_3 + Cl_2$

Ans: (2)

Sol. $\overset{0}{H_2} + \overset{0}{Cl_2} \rightarrow 2\,\overset{+1\ -1}{HCl}$

$\overset{+1\ -1}{BaCl_2} + \overset{+1\ +6}{H_2SO_4^{-2}} \rightarrow \overset{+2\ +6}{BaSO_4^{-2}} + 2\,\overset{+1\ -1}{HCl}$

$\overset{0}{Zn} + \overset{+2}{CuSO_4^{-2}} \rightarrow \overset{+2}{ZnSO_4^{-2}} + \overset{0}{Cu}$

53. Intramolecular hydrogen bonding is present in

(1)

(2) HF

(3)

(4)

Ans: (3)

Sol.
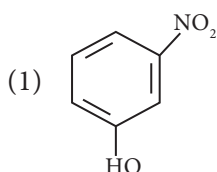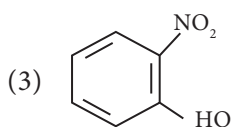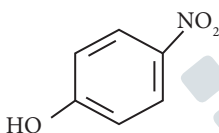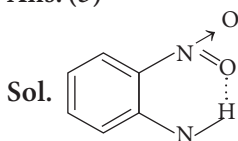
54. Fehling's solution 'A' is

(1) alkaline solution of sodium potassium tartrate (Rochelle's salt)

(2) aqueous sodium citrate

(3) aqueous copper sulphate

(4) alkaline copper sulphate

Ans: (3)

Sol. $CuSO_4$ + (aqueous)

55. 1 gram of sodium hydroxide was treated with 25 mL of 0.75 M HCl solution, the mass of sodium hydroxide left unreacted is equal to

(1) Zero mg   (2) 200 mg

(3) 750 mg   (4) 250 mg

Ans: (4)

Sol. NaOH + HCl

40g — 1 mole

$\boxed{0.75\ g}$ —— $\dfrac{0.75}{40}$ mole

= 750 mg $1000 - 750 = 250$ mg

56. Match List I with List II.

List I (Compound)	List II (Shape/geometry)
(A) NH_3	(I) Trigonal Pyramidal
(B) BrF_5	(II) Square Planar
(C) XeF_4	(III) Octahedral
(D) SF_6	(IV) Square Pyramidal

Choose the correct answer from the options given below.

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

Ans: (3)

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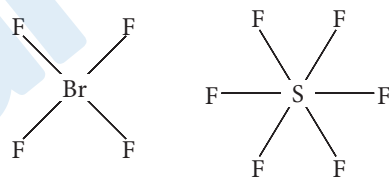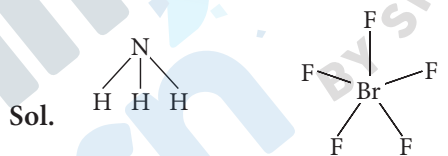
57. The E° value for the Mn^{3+}/Mn^{2+} couple is more positive than that of Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+} due to change of

(1) d^4 to d^5 configuration

(2) d^3 to d^5 configuration

(3) d^5 to d^4 configuration

(4) d^5 to d^2 configuration

Ans: (1)

Sol. Mn — $4s^2 3d^5$

Mn^{+3} — $4s^0 2d^4$

Mn^{+2} — $4s^0 3d^5$

∴ $3d^4 \rightarrow 3d^5$

58. Match List I with List II.

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

Choose the correct answer from the options given below.

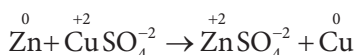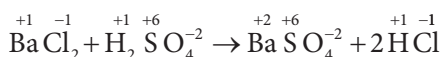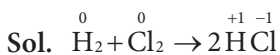|	(A)	(B)	(C)	(D)
(1)	I	II	III	IV
(2)	II	III	IV	I
(3)	IV	III	II	I
(4)	IV	II	III	I

Ans: (2)

Sol. Isothermal $\Delta T = 0$,
Isochoric $\Delta V = 0$,
Isobaric $\Delta P = 0$,
Adiabatic $\Delta Q = 0$.

59. Activation energy of any chemical reaction can be calculated if one knows the value of

   (1) orientation of reactant molecules during collision.

   (2) rate constant at two different temperatures.

   (3) rate constant at standard temperature.

   (4) probability of collision.

Ans: (2)

Sol. $\log \dfrac{K_2}{K_1} = \dfrac{E_a}{2.303R}\left(\dfrac{1}{T_1} - \dfrac{1}{T_2}\right)$

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

   (1) 2,3-dimethylbutane

   (2) 2,2-dimethylbutane

   (3) n-hexane

   (4) 2-methylpentane

Ans: (1)

Sol.
$$H_3C - \overset{\overset{\displaystyle CH_3}{|}}{CH} - \overset{\overset{\displaystyle CH_3}{|}}{CH} - CH_3 \quad \text{2,3 dimethyl butane}$$
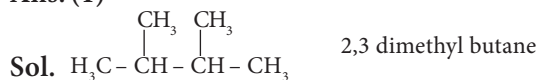
61. 'Spin only' magnetic moment is same for which of the following ions?

   A. Ti^{3+}

   B. Cr^{2+}

   C. Mn^{2+}

   D. Fe^{2+}

   E. Sc^{3+}

   Choose the most appropriate answer from the options given below:

   (1) B and C only

   (2) A and D only

   (3) B and D only

   (4) A and E only

Ans: (3)

Sol.
		unpaired e⁻
Ti^{+3} — $4s^0 3d^1$		(1)
Cr^{+2} — $4s^0 3d^4$		(4)
Mn^{+2} — $4s^0 3d^5$		(5)
Fe^{+2} — $4s^0 3d^6$		(4)
Sc^{+3} — $4s^0 3d^0$		(0)

62. Arrange the following elements in increasing order of electronegativity:

   N, O, F, C, Si

   Choose the correct answer from the options given below.

   (1) $O < F < N < C < Si$

   (2) $F < O < N < C < Si$

   (3) $Si < C < N < O < F$

   (4) $Si < C < O < N < F$

Ans: (3)

Sol. $Si < C < N < O < F$
1.8   2.5   3.0   3.5   4.0 (E.N)

63. Which one of the following alcohols reacts instantaneously with Lucas reagent?

   (1) $CH_3 - \overset{\overset{\displaystyle CH_3}{|}}{CH} - CH_2OH$

   (2) $CH_3 - \overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}} - OH$

   (3) $CH_3 - CH_2 - CH_2 - CH_2OH$

   (4) $CH_3 - CH_2 - \overset{}{\underset{\underset{\displaystyle CH_3}{|}}{CH}} - OH$
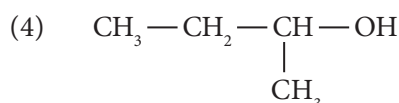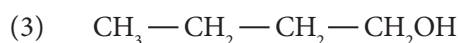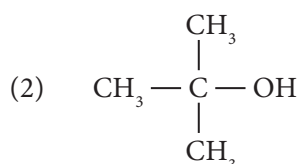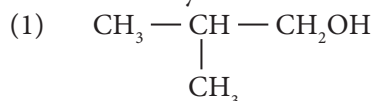
Ans: (2)

Sol. Order of reactivity
3^0 OH $> 2^0$ OH $> i$OH alcohols

64. Given below are two statements:

Statement I : Both $\left[Co(NH_3)_6\right]^{3+}$ and $\left[CoF_6\right]^{3-}$ complexes are octahedral but differ in their magnetic behaviour.

Statement II : $\left[Co(NH_3)_6\right]^{3+}$ is diamagnetic whereas $\left[CoF_6\right]^{3-}$ is paramagnetic.

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

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

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

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

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

Ans: (3)

$Co - 4s^2\ 3d^7$

$Co^{+3} - 4s^0\ 3d^6$

Sol.

dia
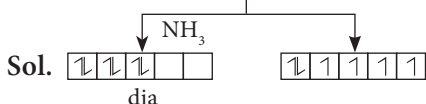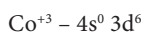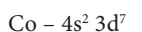
65. Given below are two statements:

Statement I : The boiling point of hydrides of Group 16 elements follow the order

$H_2O > H_2Te > H_2Se > H_2S$
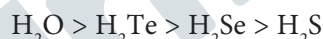
Statement II : On the basis of molecular mass, H_2O is expected to have lower boiling point than the other members of the group but due to the presence of extensive H-bonding in H_2O, it has higher boiling point.

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

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

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

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

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

Ans: (3)

Sol. $H_2O > H_2Te > H_2Se > H_2S$

       H.Bonding   mol.wt
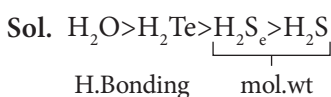
66. Match List I with List II.

List I (Quantum Number)		List II (Information provided)
(A) m_l	(I)	shape of orbital
(B) m_s	(II)	size of orbital
(C) l	(III)	orientation of orbital
(D) n	(IV)	orientation of spin of electron

Choose the correct answer from the options given below.

	(A)	(B)	(C)	(D)
(1)	III	IV	II	I
(2)	III	I	IV	III
(3)	I	III	II	IV
(4)	III	IV	I	II
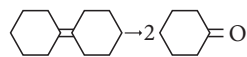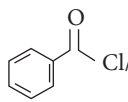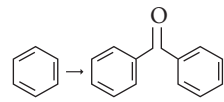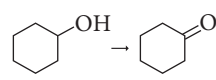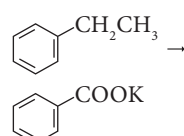
Ans: (4)

Sol. Principle quantum number (n) – size of orbital

Azimuthal quantum number (l) – shape of orbital

Magnetic quantum number (m_l) – orientation of orbital

Spin quantum number (m_s) – spin of the electron

67. Match List I with List II.

List I (Reaction)	List II (Reagents/Condition)
A.	I. Anhyd. $AlCl_3$
B.	II. CrO_3
C.	III. $KMnO_4/$ KOH, Δ
D.	IV. (i) O_3 (ii) Zn-H_2O

Choose the correct answer from the options given below.

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

Ans: (1)

Sol. A – Ozonolysis
B – Benzoylation
C –Oxidation
D –Oxidation of side chain alkyl

68. Identify the correct reagents that would bring about the following transformation.

$$\text{C}_6\text{H}_{11}-\text{CH}_2-\text{CH}=\text{CH}_2 \rightarrow \text{C}_6\text{H}_{11}-\text{CH}_2-\text{CH}_2-\text{CHO}$$
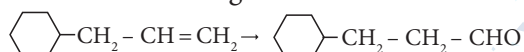
(1) (i) BH_3
   (ii) $H_2O_2/\overset{\ominus}{O}H$
   (iii) alk. $KMnO_4$
   (iv) $H_3\overset{\oplus}{O}$

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

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

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

Ans: (4)

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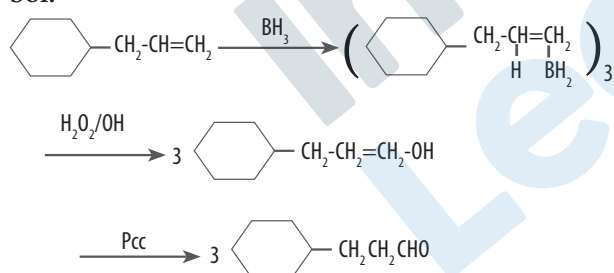
69. The reagents with which glucose does **not** react to give the corresponding tests/products are

   A. Tollen's reagent
   B. Schiff's reagent
   C. HCN
   D. NH_2OH
   E. $NaHSO_3$

   Choose the correct answer from the options given below.

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

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

Ans: (1)

Sol. Glucose does not reacts with Schiff's reagent and $NaHSO_3$

70. Match List I with List II.

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

Choose the correct answer from the options given below.

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

Ans: (1)

Sol. Conceptual

71. Among Group 16 elements, which one does **not** show –2 oxidation state?

   (1) Te   (2) Po
   (3) O   (4) Se

Ans: (2)

Sol. Po does not form –2 oxidation state.

72. For the reaction $2A \rightleftharpoons B + C$, $K_c = 4 \times 10^{-3}$. At a given time, the composition of reaction mixture is: $[A] = [B] = [C] = 2 \times 10^{-3}$ M.

   Then, which of the following is correct?

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

Ans: (1)

Sol. $Q = \dfrac{2\times10^{-3} \times 2\times10^{-3}}{\left(2\times10^{-3}\right)^2} = 1$

$Q > K_C$

Equilibrium move in backward reaction.

73. Which plot of ln k vs $\dfrac{1}{T}$ is consistent with Arrhenius equation?

(1)   (2)

(3)   (4)
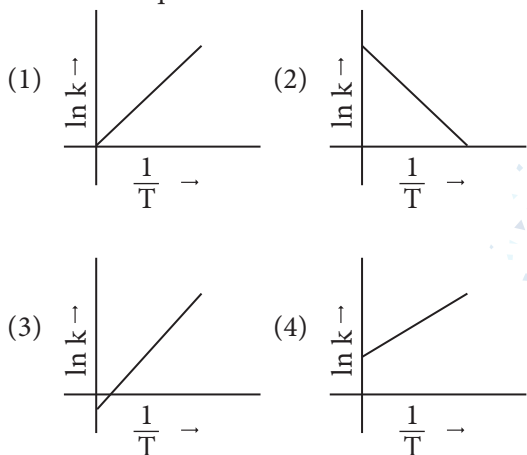
Ans: (2)

Sol. $K = A.e^{\frac{-E_a}{RT}}$

$\ln K = \ln A + \left(\dfrac{-E_a}{R}\right)\dfrac{1}{T}$

$y = C + (-m)x$

straight line with negative slope

$\text{Slope} = \dfrac{-E_a}{R}$

74. In which of the following equilibria, K_p and K_c are **not** equal?

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

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

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

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

Ans: (3)

Sol. $\Delta_{ng} \neq 0 : K_p \neq K_C$

75. Given below are two statements:

Statement I : The boiling point of three isomeric pentanes follows the order.

n-pentane > isopentane > neopentane
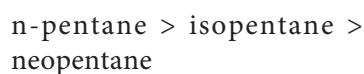
Statement II : When branching increases, the molecule attains a shape of sphere. This results in smaller surface area for contact, due to which the intermolecular forces between the spherical molecules are weak, thereby lowering the boiling point.

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

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

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

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

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

Ans: (3)

Sol. As branching increases, van der Waal forces decreases, attraction decreases.

76. The compound that will undergo S_N^1 reaction with the fastest rate is

(1)   (2)

(3)   (4)
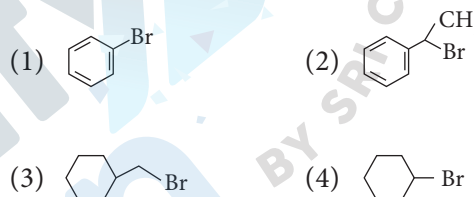
Ans: (2)

Sol. rate of $SN^1 \propto$ stability of carbocation

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

(1) $-4x$

(2) $-\dfrac{4}{9}x$

(3) $-x$

(4) $-\dfrac{x}{9}$

Ans: (3)

Sol. $E_{(n,Z)} = E_{1(H)} \times \dfrac{Z^2}{n^2}$

$E_{(n,Z)} \propto \dfrac{Z^2}{n^2}$

$\dfrac{-X}{E_{(2,4)}} = \dfrac{2^2}{1^2} \times \dfrac{2^2}{4^2} = 1$

$E_{(Be^{+3},2)} = -X\,J$

78. In which of the following processes entropy increases?

    A. A liquid evaporates to vapour.

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

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

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

    Choose the correct answer from the options given below.

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

Ans: (1)

Sol. Entropy order : S < l < g

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

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

Ans: (4)

Sol. Sublimation

80. Match List I with List II.

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

    Choose the correct answer from the options given below.

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

Ans: (3)

Sol.

(A) $\left[Co(NH_3)_5(NO_2)\right]Cl_2$ and $\left[Co(NH_3)_5(ONO)\right]Cl_2$ are shown linkage isomerism.

(B) $\left[Co(NH_3)_5(SO_4)\right]Br$ and $\left[Co(NH_3)_5\,Br\right]SO_4$ are shown ionisation isomerism.

(C) $\left[Co(NH_3)_6\right]^{+3}\left[Cr(CN)_6\right]^{-3}$ and $\left[Cr(NH_3)_6\right]^{+3}\left[Co(CN)_6\right]^{-3}$ are shown coordination isomerism.

(D) $\left[Co(H_2O)_6\right]Cl_3$ and $\left[Co(H_2O)_5\,Cl\right]Cl_2.H_2O$ are shown solvate isomerism.

81. Given below are two statements:

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

    Statement II : Aniline cannot be prepared through Gabriel synthesis.

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

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

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

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

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

Ans: (3)

Sol. Aniline does not undergo Friedal Crafts alkylation reaction, because Aniline directly react with lewis acids to form adduct (additional product).

Aniline cannot be prepared through Gabrial synthesis due to for the synthesis of Aniline precursors are aryl halide, these aryl halides not undergo SN reactions.

82. Arrange the following elements in increasing order of first ionization enthalpy:

    Li, Be, B, C, N

    Choose the correct answer from the options given below:

    (1) Li < Be < C < B < N
    (2) Li < Be < N < B < C
    (3) Li < Be < B < C < N
    (4) Li < B < Be < C < N

Ans: (4)

Sol. Ionisation Enthalpy Li < B < Be < C < N

83. The highest number of helium atoms is in
   (1) 4 g of helium
   (2) 2.271098 L of helium at STP
   (3) 4 mol of helium
   (4) 4 u of helium

Ans: (3)

Sol.

(1) Number of atoms = $\frac{4}{4} \times N_A = N_A = 6.023 \times 10^{23}$ He atoms

(2) Number of atoms = $\frac{2.271098\,L}{22.4\,lit} \times N_A = 0.1\,N_A = 6.023 \times 10^{23}$ He atoms

(3) Number of atoms = 4 moles = $4 \times N_A = 4 \times 6.023 \times 10^{23}$ He atoms

(4) Number of atoms = 4 atoms

84. The most stable carbocation among the following is:

(1)

(2)

(3)

(4)

Ans: (2)

Sol. According to hyper conjugation

(1) $\rightarrow$ 1 α H $\rightarrow$ 1 H.C

(2) $\rightarrow$ 7 α H $\rightarrow$ 7 H.C

(3) $\rightarrow$ 4 α H $\rightarrow$ 4 H.C

(4) $\rightarrow$ 5 α H $\rightarrow$ 5 H.C

85. The Henry's law constant (K_H) values of three gases (A, B, C) in water are 145, 2×10^{-5} and 35 k bar, respectively. The solubility of these gases in water follow the order:
   (1) A > C > B   (2) A > B > C
   (3) B > A > C   (4) B > C > A

Ans: (4)

Sol. K_H (Henry constant) $\propto \dfrac{1}{\text{solubility of gas}}$

So, correct solubility order is B > C > A

Section-B

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

Ans: (4)

Sol.

A. 32% $\dfrac{32}{64} = \dfrac{1}{2}$ $\dfrac{\frac{1}{2}}{\frac{1}{2}} = 1$

B. 20% $\dfrac{20}{40} = \dfrac{1}{2}$ $\dfrac{\frac{1}{2}}{\frac{1}{2}} = 1$

C. 48% $\dfrac{48}{32} = \dfrac{3}{2}$ $\dfrac{\frac{3}{2}}{\frac{1}{2}} = 3$

Molecule formula = ABC_3

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

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

$ROH + PCl_5 \rightarrow RCl + HCl + B$
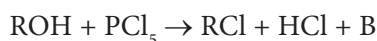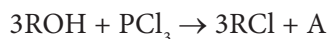
   (1) H_3PO_4 and $POCl_3$
   (2) H_3PO_3 and $POCl_3$
   (3) $POCl_3$ and H_3PO_3
   (4) $POCl_3$ and H_3PO_4

Ans: (2)

Sol. $3R–OH + PCl_3 \rightarrow 3R–Cl + H_3PO_3$ (A)

$R–OH + PCl_5 \rightarrow RCl + HCl + POCl_3$ (B)

88. The plot of osmotic pressure (π) vs concentration (mol L^{-1}) for a solution gives a straight line with slope 25.73 L bar mol^{-1}. The temperature at which the osmotic pressure measurement is done is:

(Use R = 0.083 L bar mol^{-1} K^{-1})

(1) 25.73° C   (2) 12.05° C

(3) 37° C   (4) 310° C

Ans: (3)

Sol. $\pi = CRT + 0$

$y = mx + C$

Slope (m) = RT = 25.73 L bar mol^{-1}

$T = \dfrac{25.73 \text{ L bar mole}^{-1}}{R}$

$T = \dfrac{25.73 \text{ L bar mole}^{-1}}{0.083 \text{ L bar mole}^{-1} \text{ K}^{-1}}$

$T = 37°C$

89. For the given reaction:

'P' is

(1)

(2)

(3)

(4)

Ans: (4)

Sol.
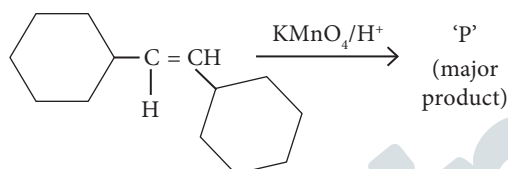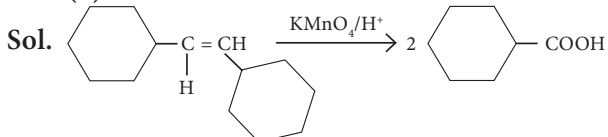
90. Given below are two statements:

Statement I : $\left[Co(NH_3)_6\right]^{3+}$ is a homoleptic complex whereas $\left[Co(NH_3)_4Cl_2\right]^+$ is a heteroleptic complex.

Statement II : Complex $\left[Co(NH_3)_6\right]^{3+}$ has only one kind of ligands but $\left[Co(NH_3)_4Cl_2\right]^+$ has more than one kind of ligands.

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

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

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

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

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

Ans: (3)

Sol. Homoleptic complexes having same ligands Heteroleptic complexes having different ligands

$\left[Co(NH_3)_6\right]^{3+}$ is a homoleptic complex whereas $\left[Co(NH_3)_4Cl_2\right]^+$ is a heteroleptic complex.

Complex $\left[Co(NH_3)_6\right]^{3+}$ has only one kind of ligands but $\left[Co(NH_3)_4Cl_2\right]^+$ has more than one kind of ligands.

91. During the preparation of Mohr's salt solution (Ferrous ammonium sulphate), which of the following acid is added to prevent hydrolysis of Fe^{2+} ion?

(1) dilute nitric acid

(2) dilute sulphuric acid

(3) dilute hydrochloric acid

(4) concentrated sulphuric acid

Ans: (2)

Sol. During the preparation of Mohr's salt solution (Ferrous ammonium sulphate), Dilute H_2SO_4 acid is added to prevent hydrolysis of Fe^{2+} ion.

92. Identify the correct answer.

(1) Dipole moment of NF_3 is greater than that of NH_3

(2) Three canonical forms can be drawn for CO_3^{2-} ion.

(3) Three resonance structures can be drawn for ozone.

(4) BF_3 ha non-zero dipole moment.

Ans: (2)

Sol.
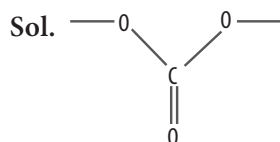
93. Given below are certain cations. Using inorganic qualitative analysis, arrange them in increasing group number from 0 to VI.

    A. Al^{3+} B. Cu^{2+}
    C. Ba^{2+} D. Co^{2+}
    E. Mg^{2+}

    Choose the correct answer from the options given below:

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

Ans: (3)

Sol. Cu^{2+} (2), Al^{3+}(3), Co^{2+}(4), Ba^{2+}(5), Mg^{2+}(6)

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

    $$CH_3-CH_2-CH_2-I \xrightarrow{NaCN} A$$
    $$\xrightarrow[\text{Partial hydrilysis}]{OH^-} B \xrightarrow[Br_2]{NaOH} \underset{(major)}{C}$$
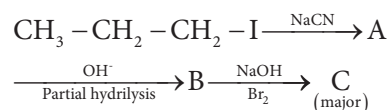
    (1) butanamide
    (2) α– bromobutanoic acid
    (3) propylamine
    (4) butylamine

Ans: (3)

Sol.
$$CH_3-CH_2-CH_2-I \xrightarrow{NaCN}$$
$$CH_3-CH_2-CH_2-C \equiv N \xrightarrow[\text{Partial hydrilysis}]{OH^-}$$
$$CH_3-CH_2-CH_2-CONH_2 \xrightarrow[Br_2]{NaOH}$$
$$\underset{\text{propylamine}}{CH_3-CH_2-CH_2-NH_2}$$
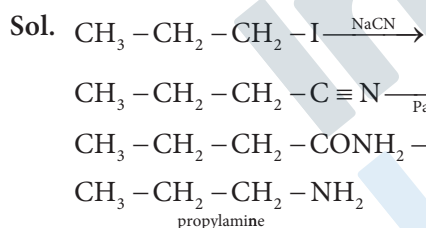
95. The rate of a reaction quadruples when temperature changes from 27°C to 57°C. Calculate the energy of activation.

    Given R = 8.314 J K^{-1} mol^{-1}, log 4 = 0.6021

    (1) 3.80 kJ/mol   (2) 3804 kJ/mol
    (3) 38.04 kJ/mol   (4) 380.4 kJ/mol

Ans: (3)

Sol. $\log \dfrac{K_2}{K_1} = \dfrac{E_a}{2.303R}\left(\dfrac{1}{T_1}-\dfrac{1}{T_2}\right)$

$E_a = 38.04$ kJ/mole
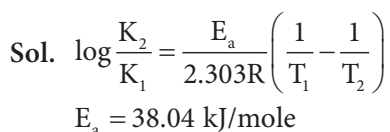
96. Consider the following reaction in a sealed vessel at equilibrium with concentrations of $N_2 = 3.0 \times 10^{-3}$ M, $O_2 = 4.2 \times 10^{-3}$ M and NO $= 2.8 \times 10^{-3}$ M.

    $$2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$$
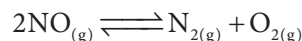
    If 0.1 mol L^{-1} of $NO_{(g)}$ is taken in a closed vessel, what will be degree of dissociation (α) of $NO_{(g)}$ at equilibrium

    (1) 0.8889   (2) 0.717
    (3) 0.00889   (4) 0.0889

Ans: (2)
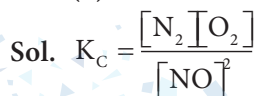
Sol. $K_C = \dfrac{[N_2][O_2]}{[NO]^2}$

$K_C = \dfrac{3.0\times10^{-3}\times4.2\times10^{-3}}{2.8\times10^{-3}\times2.8\times10^{-3}}$

$K_C = 1.607$

$$2NO \rightleftharpoons N_2 + O_2$$
$$\quad 1 \qquad 0 \quad\; 0$$
$$1-x \quad x/2 \quad x/2$$

$K_C = \dfrac{[N_2][O_2]}{(NO)^2}$

$K_C = \dfrac{\dfrac{x}{2}\cdot\dfrac{x}{2}}{(1-x)^2}$

$1.607 = \left(\dfrac{\dfrac{x}{2}}{1-x}\right)^2$

$\dfrac{x}{2-2x} = \sqrt{1.607}$

$\dfrac{x}{2-2x} = 1.265$

$x = 0.717$

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

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

    (1) 413.14 calories   (2) 100 calories
    (3) 0 calorie   (4) –413.14 calories

Ans: (4)

Sol. $W = -2.303nRT\log_{10}\dfrac{P_1}{P_2}$
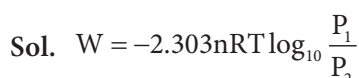
$W = -2.303\times1\times2\times298\ \log_{10}\dfrac{40}{20}$

$W = -413.14$ calories

98. Mass in grams of copper deposited by passing 9.6487 A current through a voltmeter containing copper sulphate solution for 100 seconds is:

(Given : Molar mass of Cu : 63 g mol^{-1}, 1F = 96487 C)

(1) 31.5 g   (2) 0.0315 g

(3) 3.15 g   (4) 0.315 g

Ans: (4)

Sol. $W = ZQ$

$$W = \frac{Gmw}{valency} \times \frac{i \cdot t}{F}$$

$$W = \frac{63}{2} \times \frac{9.6487 \times 100}{96487}$$

$$W = 0.315 \text{ g}$$

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

(1)

(2)

(3)

(4)
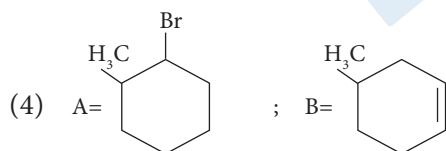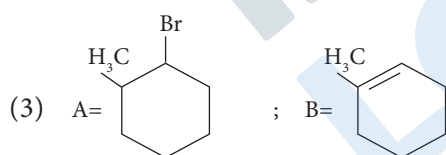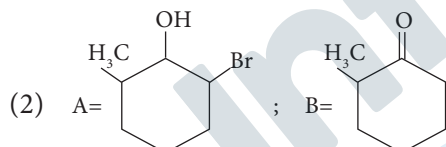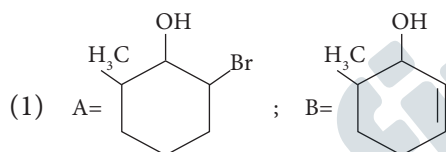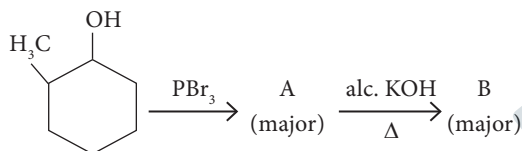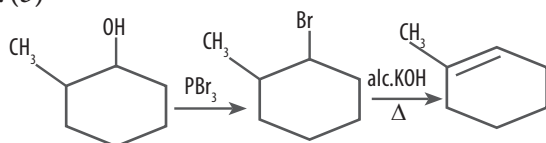
Ans: (3)

Sol.

100. The pair of lanthanoid ions which are diamagnetic is

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

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

Ans: (3)

Sol.

(1) Gd^{3+} → 4f^7 5d^0 6s^0

  Eu^{3+} → 4f^6 5d^0 6s^0

(2) Pm^{3+} → 4f^4 5d^0 6s^0

  Sm^{3+} → 4f^5 5d^0 6s^0

(3) Ce^{4+} → 4f^0 5d^0 6s^0

  Yb^{2+} → 4f^{14} 5d^0 6s^0

(4) Ce^{3+} → 4f^0 5d^0 6s^0

  Eu^{2+} → 4f^7 5d^0 6s^0

BOTANY

Section-A

101. Identify the set of correct statements:

A. The flowers of Vallisneria are colourful and produce nectar.

B. The flowers of waterlily are not pollinated by water.

C. In most of water-pollinated species, the pollen grains are protected from wetting.

D. Pollen grains of some hydrophytes are long and ribbon like.

E. In some hydrophytes, the pollen gains are carried passively inside water.

Choose the correct answer from the options given below:

(1) A, C, D and E only

(2) B, C, D and E only

(3) C, D and E only

(4) A, B, C and D only

Ans: (2)

Sol. Vallisneria is a hydrophyte. Vallisneria exhibits hydrophilly so does not produce color and nectar.

102. The type of conservation in which the threatened species are taken out from their natural habitat and placed in special setting where they can be protected and given special care is called;

(1) Semi-conservative method

(2) Sustainable development

(3) in-situ conservation

(4) Biodiversity conservation

Ans: (4)

Sol. The type of conservation in which the threatened species are taken out from their natural habitat and placed in special setting where they can be protected and given special care is called biodiversity conservation, specifically *ex situ* conservation

103. Inhibition of Succinic dehydrogenase enzyme by malonate is a classical example of:

    (1) Competitive inhibition
    (2) Enzyme activation
    (3) Cofactor inhibition
    (4) Feedback inhibition

Ans: (1)

Sol. Inhibition of Succinic dehydrogenase enzyme by malonate is a classical example of competitive inhibition.

Natural substarte is succinate and malonate is competitive inhibitor of this enzyme.

104. Identify the part of the seed from the given figure which is destined to form root when the seed germinates.
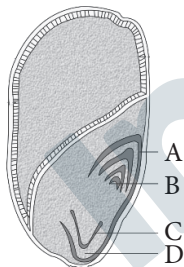
    (1) C   (2) D
    (3) A   (4) B

Ans: (1)

Sol. In the given diagram,C is radicle that develops into root system.

105. Bulliform cells are responsible for

    (1) Increased photosynthesis in monocots.
    (2) Providing large spaces for storage of sugars.
    (3) Inward curling of leaves in monocots.
    (4) Protecting the plant from salt stress

Ans: (3)

Sol. Bulliform cells are responsible for inward curling of leaves in monocots.(grasses)

106. Which of the following are required for the dark reaction of photosynthesis?

    A. Light   B. Chlorophyll
    C. CO_2 D. ATP
    E. NADPH

Choose the correct answer from the options given below:

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

Ans: (1)

Sol. The following are required for the dark reaction of photosynthesis

    C. CO_2
    D. ATP
    E. NADPH

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

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

Ans: (1)

Sol. Formation of interfascicular cambium from fully developed parenchyma cells is an example for Dedifferentiation.

108. Hind II always cuts DNA molecules at a particular point called recognition sequence and it consists of:

    (1) 4 bp   (2) 10
    (3) 8 bp   (4) 6 bp

Ans: (4)

Sol. The first restriction endonuclease–Hind II, always cut DNA molecules at a particular point by recognising a specific sequence of six base pairs. This specific base sequence is known as the recognition sequence for Hind II

109. Tropical regions show greatest level of species richness because

    A. Tropical latitudes have remained relatively undisturbed for millions of years, hence more time was available for species diversification.
    B. Tropical environments are more seasonal.
    C. More solar energy is available in tropics.

D. Constant environments promote niche specialization.

E. Tropical environments are constant and predictable.

Choose the correct answer from the options given below:

(1) A, B and E only

(2) A, B and D only

(3) A, C, D and E only

(4) A and B only

Ans: (3)

Sol. Tropical regions show greatest level of species richness because

A. tropical latitudes have remained relatively undisturbed for millions of years, hence more time was available for species diversification.

C. more solar energy is available in tropics.

D. constant environments promote niche specialisation.

E. tropical environments are constant and predictable.

B. Temperate environments are more seasonal.

110. Which one of the following is not a criterion for classification of fungi?

(1) Mode of spore formation

(2) Fruiting body

(3) Morphology of mycelium

(4) Mode of nutrition

Ans: (4)

Sol. Mode of nutrition is not a criterion for classification of fungi.

111. How many molecules of ATP and NADPH are required for every molecule of CO_2 fixed in the Calvin cycle?

(1) 3 molecules of ATP and 3 molecules of NADPH

(2) 3 molecules of ATP and 2 molecules of NADPH

(3) 2 molecules of ATP and 3 molecules of NADPH

(4) 2 molecules of ATP and 2 molecules of NADPH

Ans: (2)

Sol. Three molecules of ATP and two molecules of NADPH are required for every molecule of CO_2 fixed in the Calvin cycle.

112. These are regarded as major causes of biodiversity loss:

A. Over exploitation

B. Co-extinction

C. Mutation

D. Habitat loss and fragmentation

E. Migration

Choose the correct option

(1) A, B, and E only

(2) A, B and D only

(3) A, C and D only

(4) A, B, C and D only

Ans: (2)

Sol. Major causes of biodiversity loss include:

Habitat loss and fragmentation

Over exploitation

Alien species invasion

Coextinction

Migration and mutation are not included in the 'Evil Quartet'.

113. The capacity to generate a whole plant from any cell of the plant is called:

(1) Differentiation

(2) Somatic hybridization

(3) Totipotency

(4) Micropropagation

Ans: (3)

Sol. The capacity to generate a whole plant from any cell of the plant is called Totipotency.

114. The equation of Verhulst-Pearl logistic growth is $\dfrac{dN}{dt} = rN\left[\dfrac{K-N}{K}\right]$ from this equation K indicates

(1) Carrying capacity

(2) Population of density

(3) Intrinsic rate of natural increase

(4) Biotic potential

Ans: (1)

Sol. The equation of Verhulst-Pearl logistic growth

is $\dfrac{dN}{dt} = rN\left(\dfrac{K-N}{K}\right)$.

K = Carrying capacity

N = Population density

r = Intrinsic rate of natural increase
t = Time

115. Spindle fibers attach to kinetochores of chromosomes during

    (1)   Anaphase

    (2)   Telophase

    (3)   Prophase

    (4)   Metaphase

Ans: (4)

Sol. Spindle fibers attach to kinetochores of chromosomes during metaphase.

116. Identify the type of flowers based on the position of calyx, corolla androeium with respect to the ovary from the given figures (a) and (b)
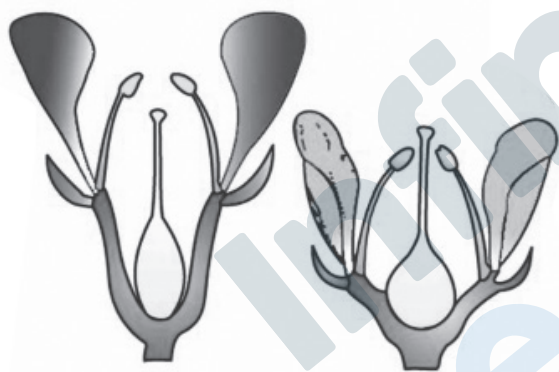
    (1)   (a) Perigynous; (b) Epigynous

    (2)   (a) Perigynous; (b) Perigynous

    (3)   (a) Epigynous; (b) Hypogynous

    (4)   (a) Hypogynous; (b) Epigynous

Ans: (2)

Sol. Perigynous flower : Gynoecium is situated in the center and other floral parts are situated around on the rim .Ex: Plum,Rose and peach.

117. Match List I with List II

	List – I		List –II
A)	*Rhizopus*	I)	Mushroom
B)	*Ustilage*	II)	Smut fungus
C)	*Puccinia*	III)	Bread mould
D)	*Agarius*	IV)	Rust fungus

Choose the correct answer from the options given below:

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

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

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

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

Ans: (3)

Sol.

	List I		List II
(A)	Rhizopus	(III)	Bread mould
(B)	Ustilago	(II)	Smut fungus
(C)	Puccinia	(IV)	Rust fungus
(D)	Agaricus	(I)	Mushroom

118. In a plant, black seed colour (BB/Bb) is dominant over white seed color (bb). In order to find out the genotype of the black seed plant, with which of the following genotype will you cross it?

    (1)   Bb

    (2)   BB/Bb

    (3)   BB

    (4)   bb

Ans: (4)

Sol. In order to find out the genotype of the dominant trait like black seed(BB) in a plant, it is crossed with recessive plant with white seed (bb) .Such cross is known as test cross.

119. A pink flowered Snapdragon plant was crossed with a red flowered Snapdragon plant. What type of phenotype/s is/are expected in the progeny?

    (1)   Only pink flowered plant

    (2)   Red, Pink as well as white flowered plants

    (3)   Only red flowered plants

    (4)   Red flowered as well as pink flowered plants

Ans: (4)

Sol. When a pink flowered Snapdragon plant (Rr) was crossed with a red flowered Snapdragon(RR) plant. The type of phenotype/s expected in the progeny is 50% red colored and 50% pink colored flowers are obtained.

120. Match List I with List II

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

Choose the correct answer from the options given below:

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

Ans: (1)

Sol.

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

121. Lecithin, a small molecular weight organic compound found in living tissues, is an example of:

(1) Glycerides
(2) Carbohydrates
(3) Amino acids
(4) Phospholipids

Ans: (4)

Sol. Lecithin, a small molecular weight organic compound found in living tissues, is an example of phospholipid.

122. Match List I with List II

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

Choose the correct answer from the options given below:

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

Ans: (1)

Sol.

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

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

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

Ans: (3)

Sol.

Epidermal cell
Subsidiary cell
Chloroplast
Guard cells
Stomatal pore
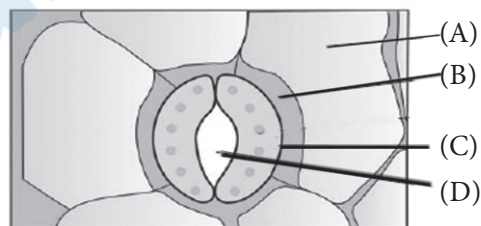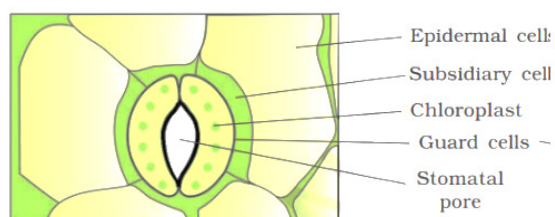
124. Which of the following is an example of actinomorphic flower?
    (1) *Pisum*   (2) *Sesbania*
    (3) *Datura*   (4) *Cassia*

Ans: (3)

Sol. A flowe r is said to be actinomorphic if it can be cut into two equal halves in any plane. Example: Datura.

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

Ans: (2)

Sol. A transcription unit in DNA is defined primarily by the three regions in the DNA: (i) A Promoter (ii) The Structural gene (iii) A Terminator

The promoter and terminator flank the structural gene in a transcription unit. The promoter is said to be located towards 5' -end (upstream) of the structural gene (the reference is made with respect to the polarity of coding strand).

126. What is the fate of a piece of DNA carrying out gene of interest which is transferred into an alien organism?
    A. The piece of DNA would be able to multiply itself independently in the progeny cells of the organism.
    B. It may get integrated into the genome of the recipient.
    C. It may multiply and be inherited along with the host DNA.
    D. The alien piece of DNA is not an integral part of chromosome.
    E. It shows ability to replicate.

    Choose the correct answer from the options give below:
    (1) B and C only   (2) and E only x
    (3) and B only   (4) D and E only

Ans: (1)

Sol. The fate of a piece of DNA, which is transferred into an alien organism:

Most likely, this piece of DNA would not be able to multiply itself in the progeny cells of the organism. But, when it gets integrated into the genome of the recipient, it may multiply and be inherited along with the host DNA.

This is because the alien piece of DNA has become part of a chromosome, which has the ability to replicate. In a chromosome there is a specific DNA sequence called the origin of replication, which is responsible for initiating replication.

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

Ans: (1)

Sol. 2,4- D is a type of auxin used by gardeners to prepare weed-free lawns. But no damage is caused to grass as auxins do not affect mature monocots.

128. The cofactor of the enzyme carboxypeptidase is
    (1) Flavin   (2) Haem
    (4) Zinc   (4) Niacin

Ans: (3)

Sol. The cofactor of the enzyme carboxypeptidase is zinc (Zn^{2+}).

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

Ans: (1)

Sol. The lac operon consists of one regulatory gene (the i gene – here the term i does not refer to inducer, rather it is derived from the word inhibitor) and three structural genes (z, y, and a).

The i gene codes for the repressor of the lac operon.

The z gene codes for beta-galactosidase (β-gal), which is primarily responsible for the hydrolysis of the disaccharide, lactose .

The y gene codes for permease, which increases permeability of the cell to β-galactosides.

The a gene encodes a transacetylase

130. Which one of the following can be explained on the basis of Mendel's Law of Dominance?

　A. Out of one pair of factors, one is dominant and the other is recessive.

　B. Alleles do not show any expression and both the characters appear as such in F_2 generation.

　C. Factors occur in pairs in normal diploid plants.

　D. The discrete unit controlling a particular character is called factor.

　E. The expression of only one of the parental characters is found in a monohybrid cross.

Choose the correct answer from the options given below:

　(1) B, C and D only

　(2) A, B, C and E

　(3) A, B and C only

　(4) A, C, D and E only

Ans: (4)

Sol. Since both the alleles are expressed, both the characters appear in F_2 generation.

131. Given below are two statements:

　Statement I : Bt toxins are insect group specific and coded by a gene *cry* IAc

　Statement II : Bt toxin exists as inactive protoxin in *B. thuringiensis*. However, after ingestion by the insect the inactive protoxin gets converted into active form

due to acidic pH of the insect gut.

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

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

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

　(3) Both Statement I and Statement II are true

　(4) Both Statement I and Statement II are false

Ans: (1)

Sol. Bt toxins are insect group specific and coded by a gene cry IAc,

Bt toxin exists as inactive protoxin in *B. thuringiensis*. However, after ingestion by the insect the inactive protoxin gets converted into active form due to alkaline pH of the insect gut.

132. Given below are two statements:

　Statement I : Parenchyma is living but collenchyma is dead tissue.

　Statement II : Gymnosperms lack xylem vessels but presence of xylem vessels is the characteristic of angiosperms.

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

　(1) Statement I is true put Statement II is false

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

　(3) Both Statement I and Statement II are true

　(4) Both Statement I and Statement II are false

Ans: (2)

Sol. Both Parenchyma and collenchyma are living tissues.

Presence of xylem vessels is the characteristic of angiosperms.

133. Given below are two statements:

　Statement I : Chromosomes become gradually visible under light microscope during leptotene stage.

　Statement II : The beginning of diplomat stage is recognized by dissolution of synaptonemal complex.

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

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

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

(3) Both Statement I and Statement II are true

(4) Both Statement I and Statement II are false

Ans: (3)

Sol. Chromosomes become gradually visible under light microscope during the leptotene stage.

The beginning of the diplotene stage is recognized by dissolution of the synaptonemal complex.

134. Match List I with List II

	List – I		List –II
A)	Nucleolus	I)	Site of formation of glycolipid
B)	Centriole	II)	Organization like the cartwheel
C)	Leucoplasts	III)	Site for active ribosomal RNA synthesis
D)	Golgi	IV)	For strong nutrients

Choose the correct answer from the options given below

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

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

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

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

Ans: (3)

Sol.

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

135. List of endangered species was released by-

(1) FOAM   (2) IUCN

(3) GEAC   (4) WWF

Ans: (2)

Sol. List of endangered species was released by IUCN (International Union for conservation of nature and natural resources).

136. The DNA present in chloroplast is:

(1) Linear, single stranded

(2) Circular, single stranded

(3) Linear, double stranded

(4) Circular, double stranded

Ans: (4)

Sol. The DNA present in chloroplast is circular, double-stranded.

137. Which of the following are fused in somatic hybridization involving two varieties of plants?

(1) Protoplasts   (2) Pollens

(3) Callus   (4) Somatic embryos

Ans: (1)

Sol. Protoplasts of two varieties of plants can be fused in a process called somatic hybridization

138. Identify the correct description about the given figure:

(1) Cleistogamous flowers showing autogamy.

(2) Compact inflorescence showing complete autogamy.

(3) Wind pollinated plant inflorescence showing flowers with well exposed stamens.

(4) Water pollinated flowers showing stamens with mucilaginous covering

Ans: (3)

Sol. Wind pollinated flowers often possess well-exposed stamens (so that the pollens are easily dispersed into wind currents, Figure 1.10) and large often-feathery stigma to easily trap air-borne pollen grains
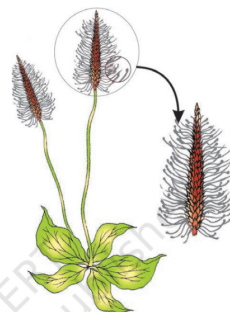
139. Spraying sugarcane crop with which of the following plant growth regulators, increases the length of stem, thus, increasing the yield?

(1) Cytokinin

(2) Abscisic acid

(3) Auxin

(4) Gibberellin

Ans: (4)

Sol. Spraying sugarcane crop with the plant growth regulator, gibberellins increases the length of stem, thus, increasing the yield.

140. Match List-I with List II

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

Choose the correct answer from the options given below:

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

Ans: (4)

Sol.

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

141. Match List-I with List II

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

Choose the correct answer from the options given below:

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

Ans: (3)

Sol.

A-IV	GLUT-4 enables glucose transport into cells.
B-I	Insulin is a peptide hormone.
C-II	Trypsin is an enzyme which helps in the digestion of proteins.
D-III	Collagen is an abundant and unique protein in animals which is found in the intercellular ground substance.

142. Given below are two statements:

Statement I : In C_3 plants, some O_2 binds RuBisCO, hence CO_2 fixation is decreased.

Statement II : In C_4 plants, mesophyll cells show very little photorespiration while bundle sheath cells do not show photorespiration.

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

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

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

(3) Both Statement I and Statement II are true

(4) Both Statement I and Statement II are false

Ans: (1)

Sol. In C_4 plants, mesophyll cells do not have RuBisCO thus there is no photorespiration while bundle sheath cells ar edeep seated

and have thick walls as a result no gases can diffuse into these cells.So, C_4 plants do not show photorespiration.

143. Identify the step in tricarboxylic acid cycle, which does not involve oxidation of substrate.

    (1) Succinyl-CoA → Succinic acid
    (2) Isocitrate → α-ketoglutaric acid
    (3) Malic acid → Oxaloacetic acid
    (4) Succinic acid → Malic acid

Ans: (1)

Sol. In tricarboxylic acid cycle, conversion of Succinyl-CoA → Succinic acid does not involve oxidation of substrate.It involves substrate level phosphorylation where GTP is formed.

144. Match List-I with List II

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

Choose the correct answer from the options given below:

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

Ans: (4)

Sol.

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

145. Which of the following statement is correct regarding the process of replication in E.coli?

    (1) The DNA dependent DNA polymerase catalyses polymerization in 5'→3' as well as 3'→5" direction.
    (2) The DNA dependent DNA polymerase catalyses polymerization in 5'→3' direction.
    (3) The DNA dependent DNA polymerase catalyses polymerization in one direction that is 3'→5'
    (4) The DNA dependent RNA polymerase catalyses polymerization in one direction, that is 5'→3'

Ans: (2)

Sol. The DNA dependent DNA polymerase catalyzes polymerization in $5 \to 3$ direction

146 In an ecosystem if the Net Primary productivity(NPP) of first trophic level is 100_x $(kcal\,m^{-2})^{-1}$ what would be the GPP (Gross primary productivity) of the third trophic level of the same ecosystem?

    (1) $10x (kcal\,m^{-2}) yr^{-1}$
    (2) $\dfrac{100x}{3x} (kcal\,m^{-2}) yr^{-1}$
    (3) $\dfrac{x}{3x} (kcal\,m^{-2}) yr^{-1}$
    (4) $x (kcal\,m^{-2}\,yr^{-1}$

Ans: (4)

Sol. Based on 10 percent rule, if NPP of 1st trophic level is $100\,x\,(kcal\,m^{-2})\,yr^{-1}$

NSP of 2nd trophic level is $10\,x\,(kcal\,m^{-2})\,yr^{-1}$

NSP of 3rd trophic level is $x\,(kcal\,m^{-2})\,yr^{-1}$

147. Match List-I with List II

	List – I		List – II
A)	Rose	I)	Twisted aestivation
B)	Pea	II)	Perigynous flower
C)	Cotton	III)	Drupe
D)	Mango	IV)	Marginal placentation

Choose the correct answer from the options given below:

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

Ans: (3)

Sol.

	List – I		List – II
A	Rose	II	Perigynous flower
B	Pea	IV	Marginal placentation
C	Cotton	I	Twisted aestivation
D	Mango	III	Drupe

148. Match List-I with List II

	List – I		List – II
A)	Robert May	I)	Species-area relation ship
B)	Alexander von Humboldt	II)	Long term ecosystem experiment using out door plots
C)	Paul Ehrlich	III)	Global species diversity at about 7 million
D)	David Tilman	IV)	Rivet popper hypothesis

Choose the correct answer from the options given below:

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

Ans: (4)

Sol.

A-III	Robert May Global stated that species diversity is about 7 million.
B-I	Alexander von Humboldt established species-area relationships.
C-IV	Paul Ehrlich proposed the 'Rivet popper hypothesis'.
D-II	David Tilman conducted long term ecosystem experiment using outdoor plots.

149. Match List I with List II

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

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

Ans: (3)

Sol.

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

150. Read the following statements and choose the set of correct statements

In the members of Phaeophyceae,

A. Asexual reproduction occurs usually by biflagellate zoospores.

B. Sexual reproduction is by oogamous method only.

C. Stored food is in the form of carbohydrates which is either mannitol or laminarin.

D. The major pigments found are chlorophyll a, c and carotenoids and xanthophyll.

E. Vegetative cells have a cellulosic wall, usually covered on the outside by gelatinous coating of algin.

Choose the correct answer from the options given below:
(1) A, C, D and E only
(2) A, B, C and E only
(3) A, B, C and D only
(4) B, C, D and E only

Ans: (1)

Sol. In Phaeophyceae sexual reproduction is by isogamy, anisogamy and oogamy.

ZOOLOGY

Section-A

151. Match List-I with List II:

Column – I		Column – II
A)	Typhoid	I) Fungus
B)	Leishmania-sis	II) Nematode
C)	Ringworm	III) Protozoa
D)	Filariasis	IV) Bacteria

Choose the correct answer from the option given below:

(1) A-III, B-I, CATV, D-II

(2) A-II, B-IV, CIIII, D-I

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

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

Ans: (4)

Sol.

A-IV	Typhoid is a bacterial (Salmonella typhi) disease.
B-III	Leishmaniasis is a protozoan (Leishmania donovani) disease.
C-I	Ringworm is a fungal (Microsporum) disease.
D-II	Filariasis is caused by a nematode (Wuchereria bancrofti).

152. Match List-I with List II:

Column – I		Column – II
A)	Non- medicated IUD	I) Multiload 375
B)	Copper releasing IUD	II) Progestogens
C)	Hormone releasing IUD	III) Lippes loop
D)	Implants	IV) LNG-20

Choose the correct answer from the option given below:

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

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

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

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

Ans: (2)

Sol.

A-III	Lippes loop is a non-medicated IUD.
B-I	Multiload 375 is a copper releasing IUD.
C-IV	LNG-20 is a hormone releasing IUD.
D-II	Progestogens are components of implants.

153. Given below are two statements:

Statement-I : The presence or absence of hymen is not a reliable indicator of virginity

Statement-II : The hymen is torn during the first coitus only

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

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

(2) Statement I is incorrect, II is correct

(3) Both statement I and II are correct.

(4) Both statement I and II are false.

Ans: (1)

Sol. Statement I is true but Statement II is false. The presence or absence of hymen is not a reliable indicator of virginity.

The hymen can be torn during a fall, jolt, horse back ride or coitus.

154. In both sexes of cockroach, a pair of joined filamentous structures called anal cerci are present on:

(1) 8th and 9th segment

(2) 11th segment

(3) 5th segment

(4) 10th segment

Ans: (4)

Sol. In both sexes of cockroach, a pair of jointed filamentous structures called anal cerci are present on 10th segment. They are sensory appendages which detect ground vibrations.

155. Match List-I with List II:

Column – I		Column – II
A)	Pons	I) Provides additional space for neurons, regulates posture and balance
B)	Hypothala-mus	II) Controls respiration and gastric sectretions.

C)   Medulla   III)   Connects different regions of the brain

D)   Cerebellum   IV)   Neuro secretory cells

Choose the correct answer from the option given below:

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

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

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

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

Ans: (4)

Sol.

A-III	Pons connects different regions of the brain.
B-IV	Hypothalamus has neurosecretory cells which secrete hormones.
C-II	Medulla has centers which control respiration and gastric secretions.
D-I	Cerebellum provides additional space for neurons, regulates posture and balance.

156. Which of the following is not a steroid hormone?

(1)   Progesterone   (2)   Glucagon

(3)   Cortisol   (4)   Testosterone

Ans: (2)

Sol. Glucagon is a peptide hormone secreted by the pancreas. Progesterone, cortisol and testosterone are steroid hormones.

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

3'TACTGGCAAATATCCATTCA5'

(1)   5'AUGUACCGUUUAUAGGGAAGU3'

(2)   5'ATGTACCGTTTATAGGTAAGT3'

(3)   5' AUGUACCGUUUAUAGGUAAGU3'

(4)   5'AUGUAAAGUUUAUAGGUAAGU3'

Ans: (3)

Sol. DNA template:
3'TACATGGCAAATATCCATTCA5'
RNA transcript:
5'ATGTACCGTTTATAGGTAAGT3'

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

(a)   (b)   (c)
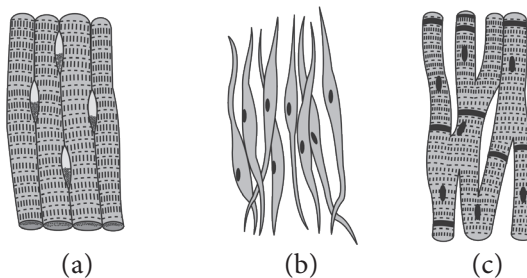
	(a)	(b)	(c)
(1)	Skeletal-Biceps	Involunatary-Intestine	Smooth-Heart
(2)	Involuntary-Nose tip	Skeletal-Bone	Cardiac-Heart
(3)	Smooth-Toes	Skeletal-Legs	Cardiac-heart.
(4)	Skeletal-Triceps	Smooth-Stomach	Cardiac-Heart

Ans: (4)

Sol. (a) Skeletal-Triceps (b) Smooth - Stomach (c)
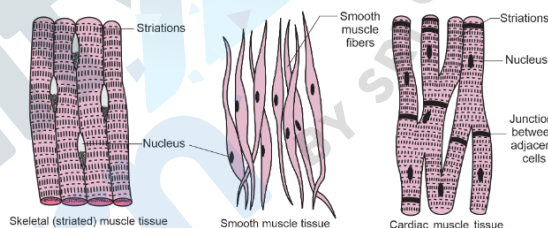
159. Following are the stages of cell division:

A. Gap 2 Phase

B. Cytokinesis

C. Synthesis Phase

D. Karyokinesis

E. Gap 1 phase

Choose the correct sequences of stages from the options given below:

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

(2)   E-C-A-D_B

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

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

Ans: (2)

Sol. E.Gap 1 phase---- C.Synthesis phase----A. Gap 2 phase------D. Karyokinesis------B. Cytokinesis

160. Which of the following are Autoimmune disorders?

A. Myasthenia gravis

B. Rheumatoid arthritis

C. Gout

D. Muscular dystrophy

E. Systemic Lupus Erythematosus(SLE)

Choose the most appropriate answer from the option given below?
(1) B, C and E only
(2) C, D and E only
(3) A, B and D only
(4) A, B and E only

Ans: (4)

Sol. Autoimmune disorders include myasthenia gravis, rheumatoid arthritis, and systemic lupus erythematosus (SLE). These disorders are caused when the immune system attacks the body's own tissues and cells, cause inflammation, damage, and various symptoms.

Gout is caused due to the accumulation of uric acid in the joints.

Muscular dystrophy is a genetic disorder.

161. Match List I with List II

Column – I		Column – II
A)	Lipase	I) Peptide bond
B)	Nuclease	II) Ester bond
C)	Protease	III) Glycosidic bond
D)	Amylase	IV) Phosphodiester bond

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

Ans: (1)

Sol.

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

162. The flippers of the Penguins and Dolphins are the example of the

(1) Convergent evolution
(2) Divergent evolution
(3) Adaptive radiation
(4) Natural selection

Ans: (1)

Sol. The flippers of the penguins and dolphins exemplify the convergent evolution. Penguins are birds and dolphins are mammals. These distantly related animals exhibit similarity in function due to a common aquatic environment.

163. Match List I with List II

Column – I		Column – II
A)	Expiratory capacity	I) Expiratory reserve volume+ Tidal volume+Inspiratory reserve volume
B)	Functional residual capacity	II) Tidal volume+Expiratory reserve volume
C)	Vital capacity	III) Tidal volume+ Inspiratory reservc volume
D)	Inspiratory capacity	IV) Expiratory reserve volume+Residual volume

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

Ans: (3)

Sol.

A-II	Expiratory capacity (EC) = Tidal volume (TV) + Expiratory reserve volume (ERV)
B-IV	Functional residual capacity (FRC) = Expiratory reserve volume (ERV) + Residual volume (RV)
C-I	Vital capacity (VC) = Expiratory reserve volume (ERV) + Tidal volume (TV) + Inspiratory reserve volume (IRV)
D-III	Inspiratory capacity (IC) = Tidal volume (TV) + Inspiratory reserve volume (IRV)

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

Ans: (2)

Sol. Factors affecting Hardy-Weinberg equilibrium include:

Mutation

Gene migration/gene flow

Gene recombination

Genetic drift

Natural selection

The Hardy-Weinberg equilibrium is a principle stating that the genetic variation in a population will remain constant from one generation to the next in the absence of disturbing factors.

165. Given below are some stages of human evolution Arrange them in correct sequence. (past to recent)
   (A) *Homo habilis*
   (B) *Homo sapiens*
   (C) *Homo neanderihalensis*
   (D) *Homo erectus*

   Choose the correct sequence of human evolution from the option given below:
   (1) C-B-D-A
   (2) A-D-C-B
   (3) D-A-C-B
   (4) B-A-D-C

Ans: (2)

Sol. The sequence of human evolution from the past is as follows:Dryopithecus→Ramapithecus→Austalopithecus→Homo habilis→Homo erectus→Homo neanderthalensis→Homo sapiens. So, it is A - D- C- B

166. Following are the stages of pathway for conduction of an action potential through the heart:

A. AV bundle

B. Purkinje fibres

C. AV node

D. Bundle branches

E. SA node

Choose the correct sequence of pathway from the options given belôw :
(1) B-D-E-C-A
(2) E-A-D-B-C
(3) E-C-A-D-B
(4) A-E-C-B-D

Ans:(3)

Sol. The conduction pathway of the heart: SAN (Sinoatrial node)→AVN (Atrio ventricular node)→AV bundles→Bundle branches (interventricular septum)→Purkinje fibers (special fibers in the ventricular walls)So it is, E-C-A-D-B

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

Ans: (4)

Sol. Factors favoring the formation of oxyhaemoglobin in alveoli are
High pO_2
Low pCO_2
Low temperature
Lesser H^+ concentration (high pH)

168. Match List I with Lhst II:

	Column – I		Column – II
A)	α-1 antitrypsin	I)	Cotton bollworm
B)	Cry IAn	II)	ADA deficiency
C)	CRY IAc	III)	Emphysema
D)	Enzyme replacement therapy	IV)	Corn borer

Chosse the correct answer from the option given below

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

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

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

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

Ans: (1)

Sol.

A-III	α -1 ntitrypsin is a biological product obtained from transgenic animals to treat emphysema
B	Cry IAb
C	Cry IAc
D	Enzyme replacement therapy is a treatment method for ADA deficiency

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

   Assertion A :　FSH acts upon ovarian follicles in female and Leydig cells in male.

   Reason R :　Growing ovarian follicles secrete estrogen in female while interstitial cells secrete androgen in male humán being.

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

   (1)　A is true but R is false

   (2)　A is false but R is true

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

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

Ans: (2)

Sol. A is false but is true.

   FSH acts upon ovarian follicles in females and Sertoli cells in males.

   Growing ovarian follicles secrete oestrogen in female while interstitial cells secrete androgen in males.

170. The following diagram showing restriction sites in E. coli cloning vectorpBR322. Find the role of 'X ' and 'Y ' genes :
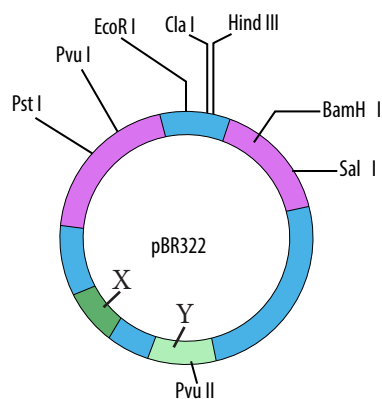
(1)　The gene 'X ' is for protein involved in replication of Plaśmid and 'Y ' for resistance to antibiotics.

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

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

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

Ans: (4)

Sol.　The gene ' X ' is responsible for controlling the copy numberof the linked DNA and ' Y ' for protein involved in the replication of Plasmid.
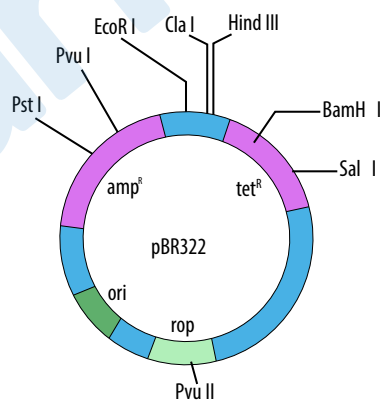
171. Match List I with List II: }

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

Choose the correct answer from the options given below:

Select the correct option.

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

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

(3) A-IV, B-III, C-I, D2-II

(4) A-I, B-III, C-II, DIIV

Ans: (2)

Sol.

A-III	Cocaine is obtained from Erythroxylum coca.
B-IV	Heroin is obtained by diacetylation of morphine. The plant source of morphine is Papaver somniferum
C-I	Morphine is an effective sedative in surgery.
D-II	Marijuana is obtained from Cannabis sativa.

172. Consider the following statements:

A. Annelids are true coelomates

B. Poriferans are pseudocoelomates

C. Aschelminthes are acoelomates

D. Platyhelminthes are pseudocoelomates

Choose the correct answer from the options give below:

(1) C only   (3) B only

(2) D only   (4) A only

Ans: (4)

Sol.

- Annelids are true coelomates.
- Poriferans do not have a body cavity.
- They have a cellular level of organisation.
- Aschelminthes are pseudocoelomates. Platyhelminthes are acoelomates.

173. Given below are two statements :

Statement I: In the nephron, the descending limb of loop of Henle is impermeable to water and permeable to electrolytes.

Statement II : The proximal convoluted tubule is lined by simple columnar brush border epithelium and increases the surface area for reabsorption.

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

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

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

(3) Both Statement I and Statement II are true

(4) Both Statement I and Statement II are false

Ans: (4)

Sol. Both Statement I and Statement II are false.

In the nephron, the descending limb of loop of Henle is permeable to water and impermeable to electrolytes.

The proximal convoluted tubule is lined by simple cuboidal brush border epithelium and increases the surface area for reabsorption.

174. Match List-I with List II

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

Choose the correct answer from the options given below :

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

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

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

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

Ans: (2)

Sol.

A-III	Fibrous joints are found between cranial bones of the skull. They do not allow any movement.
B-I	Cartilaginous joints are present between the adjacent vertebrae. They permit limited movement.
C-IV	Knee joint is a hinge joint which helps in locomotion.
D-II	Ball and socket joint is present between humerus and scapula of the pectoral girdle. It allows rotational movement.

175 Which of the following is not a natural/traditional contraceptive method?

(1) Lactational amenorrhea

(2) Vaults

(3) Coitus interruptus

(4) Periodic abstinence

Ans: (2)

Sol. Vaults, diaphragms and cervical caps are barrier methods of contraception for women. Lactational amenorrhea, coitus interruptus, and periodic abstinence are natural methods of contraception.

Section-B

176. Match List-I with List II

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

Choose the correct answer from the options given below :

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

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

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

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

Ans: (4)

Sol.

A-II	Pleurobrachia belongs to phylum Ctenophora.
B-I	Radula is a rasping organ of molluscs.
C-IV	Stomochord is a buccal diverticulum found in hemichordates.
D-III	Air bladder helps in buoyancy in bony fishes (Osteicthyes).

177. Match List-I with List II

List – I		List – II
A) Axoneme	I)	Centriole
B) Cartwheed pattern	II)	Cilia and flagella
C) Crista	III)	Chromosome
D) Satellite	IV)	Mitochondria

Choose the correct answer from the options given below:

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

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

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

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

Ans: (2)

Sol.

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

178. Which of the following statements is incorrect?

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

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

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

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

Ans: (1)

Sol. Bio-reactors are used to produce large scale bacterial cultures.

179. Match List-I with List II

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

Choose the correct answer from the options given below:

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

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

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

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

Ans: (1)

Sol.

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

180. Match List-I with List II

List – I		List – II	
A)	Common cold	I)	*Plasmodium*
B)	Haemozoin	II)	Typhoid
C)	Widal test	III)	Rhinoviruses
D)	Allergy	IV)	Dust mites

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

Ans: (1)

Sol.

A-III	Common cold is caused by a group of viruses called Rhino viruses.
B-I	Haemozoin is the toxic substance released by human RBCs when infected with Plasmodium.
C-II	Widal test is a diagnostic test for typhoid.
D-IV	Allergy may be caused due to various allergens like dust, mites, animal dander, pollen, various foods, etc.

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

    Assertion (A) : Breast-feeding during initial period of infant growth is recommended by doctors for bringing a healthy baby.

    Reason (R) : Colostrum contains several antibodies absolutely essential to develop resistance for the new born baby.

    In the light of the above statements, choose the most appropriate answer from the options given below :
    (1) A is correct but R s not correct.
    (2) A is not correct but R is correct.
    (3) Both A and R are correct and R is the correct explanation of A.
    (4) Both A and R are correct but R is NOT the correct explanation of A.

Ans: (3)

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

    Assertion (A) : Breast-feeding during the initial period of infant growth is recommended by doctors for bringing a healthy baby.

    Reason (R) : Colostrum contains several antibodies absolutely essential to develop resistance for the new born baby.

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

182. Match List-I with List II.

List – I		List – II	
A)	*Pterophylllum*	I)	Hag fish
B)	*Myxine*	II)	Saw fish
C)	*Pristis*	III)	Angel fish
D)	*Exocoetus*	IV)	Flying fish

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

Ans: (4)

Sol.

A-III	*Pterophyllum* is the scientific name of angelfish.
B-I	*Myxine* is the scientific name of hagfish.
C-II	*Pristis* is the scientific name of sawfish
D-IV	*Exocoetus* is the scientific name of flying fish.

183. The "Ti plasmid" of Agrobacterium tumefaciens stands for

    (1) Tumor inducing plasmid
    (2) Temperature independent plasmid
    (3) Tumour inhibjing plasmid
    (4) Tumor independent plasmid

Ans: (1)

Sol. The "Ti plasmid" of Agrobacterium tumefaciens stands for "Tumor inducing plasmid".

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

    (1) Infundibulum
    (2) Ampulla
    (3) Uterine fundus
    (4) Isthmus

Ans: (3)

Sol. The uterine fundus is the dome-shaped structure of the uterus/womb/hystera/metra. The infundibum is the funnel-shaped structure of the fallopian tube with finger-like structures called fimbriae. Ampulla is the wider, middle part of the oviduct. The Isthmus is the narrow region of the oviduct.

185. Match List-I with List II.

	List – I		List – II
A)	Down's syndrome	I)	11th chromosome
B)	α -Thalassemia	II)	'*X*' chromosome
C)	β-Thalassemia	III)	21st chromosome
D)	Klinefelter's syndrome	IV)	16th chromosome

Choose the correct answer from the options given below :

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

Ans: (1)

Sol.

A-III	Down's syndrome is caused due to an extra copy of the 21st chromosome.
B-IV	α - thalassemia is caused due to mutations in HBA1 and the HBA2 genes of the 16th chromosome.
C-I	β- thalassemia is caused due to a mutation in the beta globin gene on the 11th chromosome.
D-II	Klinefelter's syndrome is caused due to an extra copy of the X chromosome.

186. The following are the statements about nonchordates :

    A. Pharynx is perforated by gill slits.
    B. Notochord is absent.
    C. Central nervous system is dorsal.
    D. Heart is dorsal if present.
    E. Post anal tail is absent.

Choose the most appropriate answer from the options given below :

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

Ans: (1)

Sol. The characteristics of nonchordates include: Absence of perforated gill slits

Absence of notochord

Absence of dorsal nerve cord

Dorsal heart, if present

Absence of post-anal tail

Notochord, dorsal nerve cord, pharyngeal gill slits, post-anal tail, and ventral heart are the characteristics of chordates.

187. Match List-I with List II.

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

Choose the correct answer from the options given below :

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

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

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

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

Ans: (2)

Sol.

A-III	Birds & Reptiles prevailed in the Mesozoic Era.
B-I	Lower invertebrates flourished in Proterozoic Era.
C-IV	Cenozoic Era is the age of mammals.
D-II	Fish & Amphibia evolvved in Paleozoic Era.

188. Given below are two statements :

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

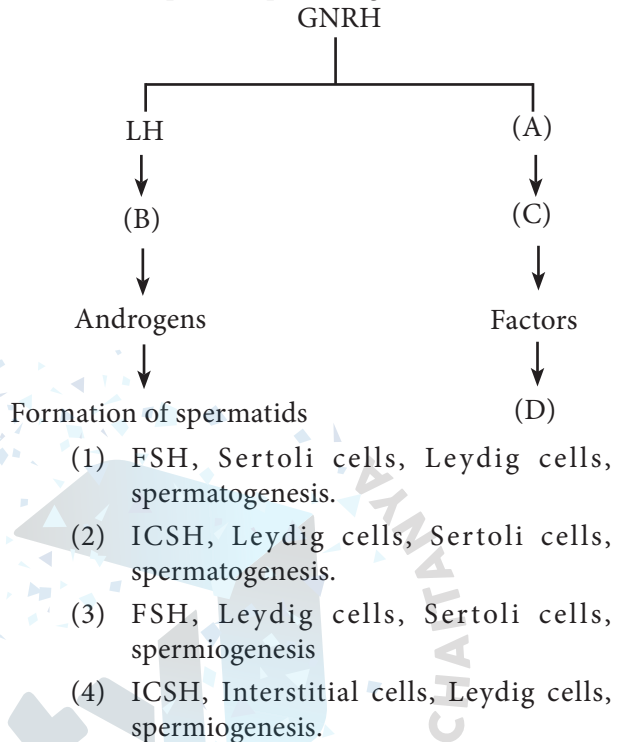**Statement II :** The brain stem consists of the medulla oblongata, pons and cerebrum.

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

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

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

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

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

Ans: (1)

Sol. Statement I is correct but Statement II is incorrect. The cerebral hemispheres are connected by nerve tract known as corpus callosum. The brain stem consists of the medulla oblongata, pons and midbrain.

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

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

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

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

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

Ans: (3)

Sol. GnRH of the hypothalamus stimulates the pituitary to secrete gonadotropins, LH and FSH. LH influences Leydig cells to secrete androgens. FSH influences Sertoli cells to secrete factors required for spermiogenesis.
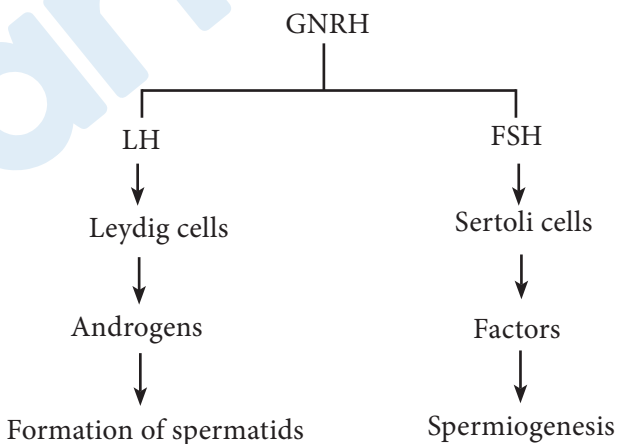
190. Match List-I with List II.

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

Choose the correct answer from the options given below:

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

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

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

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

Ans: (2)

Sol.

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

191. Match List-I with List II.

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

Choose the correct answer from the options given below :

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

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

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

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

Ans: (2)

Sol.

A-III	Exophthalmic goiter is protrusion of eyeballs caused due to hypersecretion of thyroid hormone.
B-IV	Acromegaly is excessive secretion of growth hormone.
C-I	Cushing's syndrome is due to excess secretion of cortisol. Symptoms include moon face and hyperglycemia.
D-II	Cretinism is caused due to hyposecretion of thyroid hormone and is characterised by stunted growth.

192. Match List-I with List II.

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

Choose the correct answer from the options given below :

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

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

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

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

Ans: (1)

Sol.

A-III	Goblet cells of alimentary canal are unicellular glands.
B-IV	Salivary glands possess compound epithelium.
C-I	Moist surface of buccal cavity is lined by multicellular glandular epithelium
D-II	Pancreas is an endocrine gland.

193. Given below are two statements :

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

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

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

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

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

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

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

Ans: (3)

Sol. Both Statement I and Statement II are correct.
Bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced.
Both bone marrow and thymus provide micro environments for the development and maturation of T-lymphocytes.

194. Match List-I with List II.

	List – I		List – II
A)	The structures used for storing of food.	I)	Gizzard
B)	Ring of 6-8 blind tubules at junction fore gut and midgut	II)	Gastric Caeca
C)	Ring of 100-150 yellow coloured thin filaments at junction of mid gut and hind gut.	III)	Malpighian tubules
D)	The structures used for grinding the food.	IV)	Crop

Choose the correct answer from the options given below :

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

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

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

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

Ans: (3)

Sol.

A-IV	The crop is the structure used for storing of food.
B-II	Gastric Caeca are a ring of 6-8 blind tubules at the junction of foregut and midgut.
C-III	Malpighian tubules form a ring of 100-150 yellow coloured thin filaments at the junction of midgut and hind gut.
D-I	A gizard is the structure which helps in grinding food.

195. Choose the correct statement given below regarding juxta medullary nephron.

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

(2) Juxta medutlary nephrons outnumber the cortical nephrons.

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

(4) Renal corpusple of juxta medullary nephron lies in the olfter portion of the renal medulla.

Ans: (1)

Sol. Henle's loop of juxtamedullary nephron runs deep into the medulla.
Cortical nephrons outnumber the juxtamedullary nephrons.
Renal corpuscle of the juxtamedullary nephron lies in the the renal cortex

196. Match List-I with List II.

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

Choose the correct answer from the options given below:

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

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

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

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

Ans: (4)

Sol.

A-III	P wave represents depolarisation of atria.
B-II	QRS complex represents depolarisation of ventricles.
C-IV	T wave represents repolarisation of ventricles.
D-I	Heart muscles are electrically silent in T-P gap.

197. As per ABO bleop grouping system, the blood group of father is B^+, mother is A^+ and child is O^+. Their respedife genotype can be

A. $I^Bi/I^Ai/ii$

B. $I^BI^B/I^AI^A/ii$

C. $I^AI^B/iI^A/I^Bi$

D. $I^Ai/I^Bi/I^Ai$

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

Choose the mostlappropriate answer from the options given beldw :

(1) C & B only

(2) D & B only

(3) A only

(4) B only

Ans: (3)

Sol. When a B blood group father and A blood group mother gives birth to O blood group child, it means the parents are heterozygous for their ABO blood group .Their genotypes will be $i^b i, i^a i$ respectively.

198. Given below are two statements :

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

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

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

(1) Statement I is true but Statement II is fals

(2) Statement I is false but Statement II is thu

(3) Both Statement I and Statement II are trues

(4) Both Statement I and Statement II are false

Ans: (2)

Sol. Statement I is false but statement II is true. Gause's competitive exclusion principle states that two closely related species competing for same resources cannot exist indefinitely. According to Gause's principle, during competition, the inferior will be eliminated. This may be true if resources are limiting.

199. Regarding catalytic cycle of an enzyme action select the correct sequential steps :

A. Substrate enzyme complex formation.

B. Free enzyme ready to bind with another substrate.

C. Release of products.

D. Chemical bonds of the substrate broken.

E. Substrate binding to active site.

Choose the correct answer from the options give below:

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

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

Ans: (3)

Sol. The catalytic cycle of an enzyme action can be described in the following steps:

1. First, the substrate binds to the active site of the enzyme, fitting into the active site.

2. The binding of the substrate induces the enzyme to alter its shape, fitting more tightly around the substrate.

3. The active site of the enzyme, now in close proximity of the substrate breaks the chemical bonds of the substrate and the new enzyme- product complex is formed.

4. The enzyme releases the products of the reaction and the free enzyme is ready to bind to another molecule of the substrate and run through the catalytic cycle once again.

200. Given below are two statements :

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

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

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

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

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

(3) Both Statement I and Statement II are correct

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

Ans: (3)

Sol. Mitochondria and chloroplasts ar both double membrane-bound organelles. The Inner membrane of mitochondria is relatively less permeable, as compared to chloroplast.