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Important Instructions for test:

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 OFFICE Copy carefully with **blue/black** ball point pen only.

2. The test is of 3 hours duration and the Test Booklet contains 200 multiple-choice questions (four options with a single correct answer) from Physics, Chemistry and Biology (Botany and Zoology). 50 questions in each subject are divided into two Sections (A and B) as per details given below : (a) Section A shall consist of 35 (Thirty-five) Questions in each subject (Question Nos – 1 to 35, 51 to 85, 101 to 135 and 151 to 185). All questions are compulsory. (b) Section B shall consist of 15 (Fifteen) questions in each subject (Question Nos – 36 to 50, 86 to 100, 136 to 150 and 186 to 200). In Section B, a candidate needs to attempt any 10 (Ten) questions out of 15 (Fifteen) in each subject. Candidates are advised to read all 15 questions in each subject of Section B before they start attempting the question paper. In the event of a candidate attempting more than ten questions, the first ten questions answered by the candidate shall be evaluated.

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

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

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

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

7.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.

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

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

10. 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

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

Physics

SECTION : A

1. The dimensions of universal gravitational constant are
(1) $M^{-2} L^2 T^{-1}$
(2) $M^{-1} L^3 T^{-2}$
(3) $ML^2 T^{-1}$
(4) $M^{-2} L^3 T^{-2}$

2. The water drops fall at regular intervals from a tap 5 m above the ground. The third drop is leaving the tap at an instant when the first drop touches the
ground. How far above the ground is the second drop at that instant? (Take g = 10 m/s^2)
(1) 1.25 m
(2) 2.50 m
(3) 3.75 m
(4 5.00 m

3. The motion of a particle along a straight line is
described by equation:
$x = 8 + 12t - t^3$
where x is in metre and t in second. The retardation of the particle when its velocity becomes zero, is:
(1) 24 ms^{-2}
(2) zero
(3) 6 ms^{-2}
(4) 12 ms^{-2}

4. A person swims in a river aiming to reach exactly opposite point on the bank of a river. His speed of swimming is 0.5 m/s at an angle 120° with the direction of flow of water. The speed of water in stream is
(1) 1.0 m/s
(2) 0.5 m/s
(3) 0.25 m/s
(4) 0.43 m/s.

5. When light propagates through a material medium of relative permittivity εr and relative permeability µr, the velocity of light, v is given by (c-velocity of light in vacuum)
(1) $v = c$
(2) $v = \sqrt{\dfrac{m_r}{\varepsilon_r}}$
(3) $v = \sqrt{\dfrac{\varepsilon_r}{m_r}}$
(4) $v = \dfrac{c}{\sqrt{\varepsilon_r \mu_r}}$

6. A 5000 kg rocket is set for vertical firing. The exhaust speed is 800 ms^{-1}. To give an initial upward acceleration of 20 ms^{-2}, the amount of gas ejected per second to supply the needed thrust will be (g = 10 ms^{-2})
(1) 127.5 kg s^{-1}
(2) 187.5 kg s^{-1}
(3) 185.5 kg s^{-1}
(4) 137.5 kg s^{-1}

7. A position dependent force, F= (7 – 2x + 3x^2) N acts on a small body of mass 2 kg and displaces it from x = 0 to x = 5 m. Work done in joule is
(1) 35
(2) 70
(3) 135
(4) 270

8. Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional force are 10% of energy. How much power is generated by the turbine?(g = 10 m/s$_2$)
(1) 8.1 kW
(2) 10.2 kW
(3) 12.3 kW
(4) 7.0 kW

9. A particle of mass m=5 units is moving with uniform speed V=3√2 units in the XY plane along the line Y=X+4. The magnitude of the angular momentum about origin is:
(1) 60 units
(2) 40√2 units
(3) zero
(4) 7.5 units

10. A solid sphere of radius R is placed on a smooth horizontal surface. A horizontal force F is applied at height h from the lowest point. For the maximum acceleration of the centre of mass,

Lowest Point
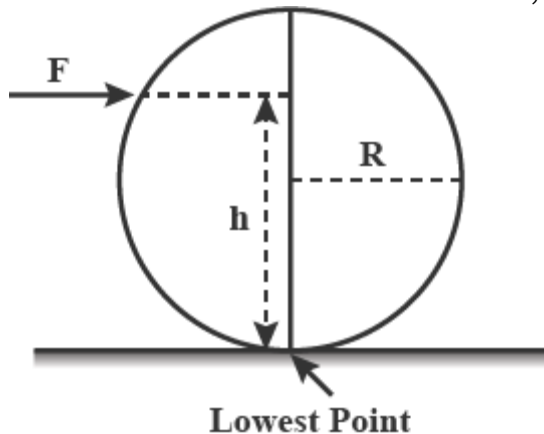
(1) h = R
(2) h = 2R
(3) h = 0
(4) The acceleration will be same whatever h may be

11. The moment of inertia of a thin uniform rod of mass M and length L about an axis passing through its midpoint and perpendicular to its length is I_0. Its moment of inertia about an axis passing through one of its ends and perpendicular to its length is
(1) $I_0 + ML^2 /2$
(2) $I_0 + ML^2 /4$
(3) $I_0 + 2ML^2$
(4) $I_0 + ML^2$

12. The escape velocity of a body on the surface of the earth is 99.0 km/s. If the earth's mass increases to twice its present value and the radius of the earth becomes half, the escape velocity would become
(1) 44.8 km/s
(2) 22.4 km/s
(3) 11.2 km/s (remains unchanged)
(4) 5.6 km/s

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

(1) Uniform and remains constant for both the regions.
(2) A linearly increasing function of distance upto the boundary of the wire and then linearly decreasing for the outside region.
(3) A linearly increasing function of distance r upto the boundary of the wire and then decreasing one with $\frac{1}{r}$ dependence for the outside region.
(4) A linearly decreasing function of distance upto the boundary of the wire and then a linearly increasing one for the outside region.

14. A cylindrical rod having temperature T_1 and T_2 at its end. The rate of flow of heat is Q_1 cal/sec. If all the linear dimensions are doubled keeping temperature constant, then the rate of flow of heat Q_2 will be
(1) $4Q_1$
(2) $2Q_1$
(3) $Q_1 /4$
(4) $Q_1 /2$

15. For hydrogen gas, $C_p - C_v$ = a and for oxygen gas, $C_p - C_v$ = b, so the relation between a and b is given by
(1) a = 16 b
(2) 16 b = a
(3) a = 4 b
(4) a = b

16. The internal energy change in a system that has absorbed 2 kcals of heat and done 500 J of work is:
(1) 6400 J
(2) 5400 J
(3) 7900 J
(4) 8900 J

17. A series LCR circuit with inductance 10 H, capacitance 10 µF , resistance 50 Ω is connected to an ac source of voltage, V = 200sin(100t) volt. If the resonant frequency of the LCR circuit is v_1 and the frequency of the ac source is v, then
(1) v_0 = v = 50 Hz
(2) v_0 = v = $\frac{50}{\pi}$ Hz
(3) v_0 = $\frac{50}{\pi}$ Hz, v = 50 Hz

(4) v = 100 Hz; $\nu_0 = \frac{100}{\pi}$ Hz

18. Two simple harmonic motions given by x = A sin (ωt+δ) and y = A sin(ωt+δ+ $\frac{\pi}{2}$) act on a particle simultaneously. Then the motion of particle will be:
(1) a circle and the actual motion is clockwise
(2) an ellipse and the actual motion is counterclockwise
(3) an elllipse and the actual motion is clockwise
(4) a circle and the actual motion is counter clockwise

19. The damping force on an oscillator is directly
proportional to the velocity. The units of the constant of proportionality are:
(1) kgms^{-1}
(2) kgms^{-2}
(3) kgs^{-1}
(4) kgs

20. The equation of a sound wave is given as: y = 0.0015 sin (62.4 x + 316 t). The wavelength of this wave is
(1) 0.4 unit
(2) 0.3 unit
(3) 0.2 unit
(4) 0.1 unit

21. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 sec and the velocity of the wave is 300 m/sec. What is the phase difference between the oscillations of two points?
(1) π/3
(2) 2π/3
(3) π
(4) π/6

22. A point Q lies on the perpendicular bisector of an electrical dipole of dipole moment p. If the distance of Q from the dipole is r (much larger than the size of the dipole), then the electric field at Q is proportional to
(1) p^{-1} and r^{-2}
(2) p and r^{-2}

(3) p$_2$ and r^{-3}
(4) p and r^{-3}

23. A hollow metal sphere of radius 10 cm is charged such that the potential on its surface is 80 V. The potential at the centre of the sphere is
(1) zero
(2) 80 V
(3) 800 V
(4) 8 V

24. Two parallel metal plates having charges + Q and – Q face each other ata certain distance between them. If the plaves are now dipped in kerosene oil tank, the electric field between the plates will
(1) remain same
(2) become zero
(3) increases
(4) decrease

25. Kirchoff's first law, i.e. Σi =2 at a junction, deals with the conservation of
(1) charge
(2) energy
(3) momentum
(4) angular momentum

26. In India electricity is supplied for domestic use at 220 V. It is supplied at 110 Vin USA. If the resistance of a 60 W bulb for use in India is R, the resistance of a 60 W bulb for use in USA will be
(1) R/2
(2) R
(3) 2R
(4) R/4

27. The thermo e.m.f. E in volts of a certain thermocouple is found to vary with temperature difference θ in ^{0}C between the two junctions according to the relation
E = 30θ - $\frac{\theta^2}{15}$
The neutral temperature for the thermocouple will be
(1) 30° C
(2) 450° C
(3) 400 ° C

(4) 225° C

28. A coil carrying electric current is placed in uniform magnetic field, then
(1) torque is formed
(2) e.m.f is induced
(3) both (1) and (2) are correct
(3) none of the above

29. Electromagnets are made of soft iron because soft iron has
(1) low retentivity and high coercive force
(2) high retentivity and high coercive force
(3) low retentivity and low coercive force
(4) high retentivity and low coercive force

30. A conducting circular loop is placed in a uniform magnetic field, B = 0.025 T with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of 1 mm s^{-1}. The induced e.m.f. when the radius is 2 cm, is
(1) $2\pi\mu V$
(2) $\pi\mu V$
(3) $\frac{\pi}{2}\mu V$
(4) $2\mu V$

31. What is the value of inductance L for which the current is maximum in a series LCR circuit with C= 10 μF and ω = 1000s^{-1} ?
(1) 1 mH
(2) cannot be calculated unless R is known
(3) 10 mH
(4) 100 mH

32. Green-house effect is the heating up of earth's atmosphere due to
(1) green plants
(2) infra-red rays
(3) X-rays
(4) ultraviolet rays

33. Light travels through a glass plate of thickness t and refractive index n. If c is the speed of light in vacuum, the time taken by light to travel this thickness of glass is

(1) ntc
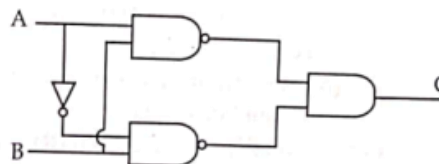(2) $\frac{tc}{n}$
(3) $\frac{t}{nc}$
(4) $\frac{nt}{c}$

34.

The truth table for the given logic circuit is

(1)

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

(2)

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

(3)

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

(4)

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

35. The periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is:
(1) $I_1 + I_2$
(2) $\left(\sqrt{I_1} + \sqrt{I_2}\right)^2$
(3) $\left(\sqrt{I_1} - \sqrt{I_2}\right)$

(4) $2(I_1 + I_2)$

SECTION : B

36. The 21 cm radio wave emitted by hydrogen in interstellar space is due to the interaction called the hyperfine interaction in atomic hydrogen. The energy of the emitted wave is nearly
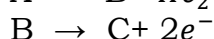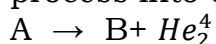(1) 10^{-17} J
(2) 1 J
(3) 7×10^{-8} J
(4) 10^{-24} J

37. In the Davisson and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by
(1) increasing the potential difference between the anode and filament
(2) increasing the filament current
(3) decreasing the filament current
(4) decreasing the potential difference between the anode and filament

38. When an electron jumps from the fourth orbit to the second orbit, one gets the
(1) second line of Lyman series
(2) second line of Paschen series
(3) second line of Balmer series
(4) first line of Pfund series

39. An element A decays by a two-step process into element C.
A $\rightarrow$ B+ He_2^4
B $\rightarrow$ C+ $2e^-$
then
(1) A and C are isotopes
(2) A and C are isobars
(3) A and B are isotopes
(4) A and B are isobars

40. A ball is projected with a velocity, 10 ms−1, at an angle of 60° with the vertical direction. Its speed at the highest point of its trajectory will be
(1) Zero
(2) $5\sqrt{3}$ ms−1
(3) 5 ms−1
(4) 10 ms−1

41. The nuclei of which one of the following pairs of nuclei are isotones?
(1) $_{34}Se^{74}$, $_{31}Ga^{71}$
(2) $_{38}Sr^{84}$, $_{38}Sr^{86}$
(3) $_{42}Mo^{92}$, $_{40}Zr^{92}$
(4) $_{20}Ca^{40}$, $_{16}S^{32}$

42. The half life of a radioactive isotope 'X' is 02 years. It decays to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio of 1: 7 in a sample of a the given rock. The age of the rock is estimated to be
(1) 60 years
(2) 80 years
(3) 100 years
(4) 40 years

43. The following truth-table belongs to which one of the following four gates?

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

(1) NOR
(2) XOR
(3) NAND
(4) OR

44. The output of OR gate is 1
(1) if either input is zero
(2) if both inputs are zero
(3) if either or both inputs are 1
(4) only if both inputs are 1

45. A transistor is operated in common emitter configuration at V_c = 2V such that a change in the base current from $100\mu A$ to $300\,\mu A$ produces a change in the collector current from 10mA to 20mA. The current gain is
(1) 50
(2) 75
(3) 100
(4) 25

46. A wire of length L, area of cross section A is hanging from a fixed support. The length of the wire changes

to L1 when mass M is suspended from its free end. The expression for Young's modulus is :

(1) $\dfrac{MgL}{AL_1}$

(2) $\dfrac{MgL}{A(L_1 - L)}$

(3) $\dfrac{MgL_1}{AL}$

(4) $\dfrac{Mg(L_1 - L)}{AL}$

(1) 4v
(2) v
(3) 2v
(4) 3v

47. The acceleration due to gravity at a height 1 km above the earth is the same as at a depth d below the surface of earth. Then
(1) d = 1 km
(2) d = $\dfrac{3}{2}$ km
(3) d = 2 km
(4) d = $\dfrac{1}{2}$ km

48. In the combination of the following gates the output Y can be written in terms of inputs A and B as
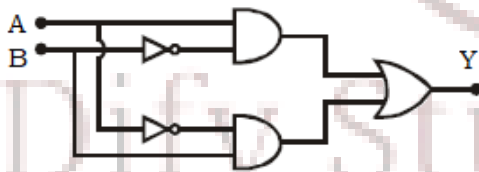
(1) $\overrightarrow{A.B}$
(2) A.$\overline{B}$ + $\overline{A}$ .B
(3) $\overline{A + B}$
(4) $\overline{A.B}$+A.B

49. Which of the following acts as a circuit protects device?
(1) Conductor
(2) Inductor
(3) Switch
(4) Fuse

50. The escape velocity from the Earth's surface is v. The escape velocity from the surface of another planet having a radius, four times that of Earth and same mass density is

Chemistry

SECTION : A

51. The maximum number of molecules is present in
(1) 15 L of H_2 gas at STP
(2) 5 L of N_2 gas at STP
(3) 0.5 g of H_2 gas
(4) 10 g of O_2 gas

52. If ionization potential for hydrogen atom is 93.6 eV, then ionization potential for He_+ will be
(1) 54.4 eV
(2) 6.8 eV
(3) 13.6 eV
(4) 24.5 eV

53. Which of the following is not permissible
arrangement of electrons in an atom?
(1) $n = 5, l = 3, m = 0, s = + 1/2$
(2) $n = 3, l = 2, m = – 3, s = – 1/2$
(3) $n = 3, l = 2, m = – 2, s = – 1/2$
(4) $n = 4, l = 0, m = 0, s = – 1/2$

54. Which one of the following ions will be the smallest in size?
(1) Na^+
(2) Mg^{2+}
(3) F^-
(4) O_2^+

55. Which statement is NOT correct?
(1) A sigma bond is weaker than a S-bond.
(2) Sigma bond is weaker than a π(pi)
(3) A double bond is stronger than a single bond.
(4) A double bond is shorter than a single bond.

56. Compound X on reaction with O_3 followed by Zn/H_2O gives formaldehyde and 2-methyl propanal as products. The compound X is
(1) Pent-2-ene
(2) 3-Methylbut-1-ene
(3) 2-Methylbut-1-ene
(4) 2-Methylbut-2-ene

57. The number of unpaired electrons in a paramagnetic diatomic molecule of an element with atomic number 16 is
(1) 3
(2) 4
(3) 1
(4) 2

58. In which of the following ionisation processes the bond energy increases and the magnetic behaviour changes from paramagnetic to diamagnetic?
(1) $N_2 \rightarrow N_2^+$
(2) $O_2 \rightarrow O_2^+$
(3) $C_2 \rightarrow C_2^+$
(4) $NO \rightarrow NO^+$

59. If 500 ml of gas A at 400 torr and 666.6 ml of B at 600 torr are placed in a 3 litre flask, the pressure of the system will be
(1) 200 torr
(2) 100 torr
(3) 550 torr
(4) 366 torr

60. For a first order reaction A → Products, initial concentration of A is 0.1 M, which becomes 0.001 M after 5 minutes. Rate constant for the reaction in min^{-1} is
(1) 0.2303
(2) 1.3818
(3) 0.9212
(4) 0.4606

61. The enthalpy and entropy change for the reaction: $Br_{2(l)} + Cl_{2(g)} \rightarrow 2BrCl_{(g)}$ are 30 kJ mol^{-1} and 105 J K mol^{-1} respectively. The temperature at which the reaction will be in equilibrium
(1) 273 K
(2) 450 K
(3) 300 K
(4) 285.7 K

62. In the neutral or faintly alkaline medium, $KMnO_4$ oxidises iodide into iodate. The change in oxidation state of manganese in this reaction is from
(1) +6 to +5
(2) +7 to +4

(3) +6 to +4
(4) +7 to +3

63. A 10.0 L flask contains 64 g of oxygen at 27°C. (Assume O_2 gas is behaving ideally). The pressure inside the flask in bar is (Given R = 0.0831 L bar K–1 mol–1)
(1) 4.9
(2) 2.5
(3) 498.6
(4) 49.8

64. Equimolar solutions of the following substances were prepared separately. Which one of these will record the highest pHvalue?
(1) $BaCl_2$
(2) $AlCl_3$
(3) $LiCl$
(4) $BeCl_2$

65. The dielectric constant of H_2O is 80. The electrostatic force of attraction between Na_+ and Cl^- will be
(1) reduced to 1/40 in water than in air
(2) reduced to 1/80 in water than in air
(3) will be increased to 80 in water than in air
(4) will remain unchanged.

66. In which of the following the hydration energy is higher than the lattice energy?
(1) $MgSO_4$
(2) $RaSO_4$
(3) $SrSO_4$
(4) $BaSO_4$

67. Which of the following structure is similar to graphite?
(1) B
(2) B_4C
(3) B_2H_6
(4) BN

68. Given below are two statements:
Statement I: In Lucas test, primary, secondary and tertiary alcohols are distinguished on the basis of their reactivity with conc. HCl + ZnCl2, known as Lucas Reagent.

Statement II: Primary alcohols are most reactive and immediately produce turbidity at room temperature on reaction with Lucas Reagent.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Statement I is incorrect but Statement II is correct
(2) Both Statement I and Statement II are correct
(3) Both Statement I and Statement II are incorrect
(4) Statement I is correct but Statement II is incorrect

69. IUPAC name of the following is $CH_2 = CH- CH_2 - CH_2 - C \equiv CH$
(1) 1, 5-hexenyne
(2) 1-hexene- 5-yne
(3) 1-hexyne- 5-ene
(4) 1, 5-hexynene

70. How many stereoisomers does this molecule have?
$CH_3CH = CHCH_2CHBrCH_3$
(1) 4
(2) 6
(3) 8
(4) 2

71. $3O_2(g) \leftrightharpoons 2O_3(g)$
for the above reaction at 298 K, K_C is found to be 3.0 × 10–59. If the concentration of O_2 at equilibrium is 0.040 M then concentration of O_3 in M is
(1) 1.2 × 10²¹
(2) 4.38 × 10–32
(3) 1.9 × 10–63
(4) 2.4 × 10³¹

72. The radical
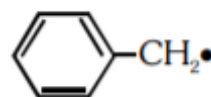
is aromatic because it has:
(1) 7 p-orbitals and 6 unpaired electrons
(2) 7 p-orbitals and 7 unpaired electrons
(3) 6 p-orbitals and 7 unpaired electrons
(4) 6 p-orbitals and 6 unpaired electrons

73. In face-centred cubic lattice, a unit cell is shared equally by how many unit cells?
(1) 2
(2) 4
(3) 6
(4) 8

74. Vapour pressure of benzene at 30°C is 121.8 mm. When 15 g of a non volatile solute is dissolved in 250 g of benzene its vapour pressure decreased to 120.2 mm. The molecular weight of the solute (Mo. wt. of solvent = 78)
(1) 356.7
(2) 456.8
(3) 530.1
(4) 656.7

75. 200 mL of an aqueous solution of a protein contains its 1.26 g. The osmotic pressure of this solution at 300 K is found to be $2.57 \times 10_{-3}$ bar. The molar mass of protein will be (R= 0.083 Lbar $mol_{-1} K^{-1}$)
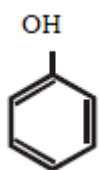(1) 51022 g mol^{-1}
(2) 122044 g mol^{-1}
(3) 31011 g mol^{-1}
(4) 61038 g mol^{-1}

76. Which one is the most acidic compound ?

(1)

OH

(2)

OH
NO$_2$

(3)

OH
O$_2$N   NO$_2$
NO$_2$

(4)

OH
CH$_3$
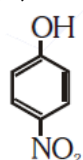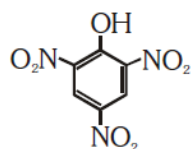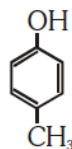
77. A chemical reaction is catalyzed by a catalyst X. Hence X
(1) reduces enthalpy of the reaction
(2) decreases rate constant of the reaction
(3) increases activation energy of the reaction
(4) does not affect equilibrium constant of the reaction

78. For an endothermic reaction, energy of activation is E_a and enthalpy of reaction is ΔH (both of these in kJ/mol). Minimum value of E_a will be:
(1) less than ΔH
(2) equal to ΔH
(3) more than ΔH
(4) equal to zero

79 A particular station of All India Radio, New Delhi broadcasts on a frequency of 1,368 kHz (kilohertz). The wavelength of the electromagnetic radiation emitted by the transmitter is : [speed of light c = 3.0 $\times 10^8$ ms^{-1}]
(1) 21.92 cm
(2) 219.3 m
(3) 219.2 m
(4) 2192 m

80. PH$_4$ I + NaOH forms
(1) PH$_3$
(2) NH$_3$
(3) P$_4$O$_6$
(4) P$_4$O$_{10}$

81. Repeated use of which one of the following fertilizers would increase the acidity of the soil?
(1) Urea
(2) Superphosphate of lime
(3) Ammonium sulphate
(4) Potassium nitrate

82. The oxidation state of Cr in $K_2Cr_2O_7$ is
(1) + 5
(2) + 3
(3) + 6
(4) + 7

83. Which of the following forms colourless compound?
(1) Sc^{3-}
(2) V^{3-}
(3) Ti^{3+}
(4) Cr^{3+}

84. Four successive members of the first series of the transition metals are listed below for which one of them the standard potential ($E_{M^{2+}}+/M$) value has a positive sign?
(1) Co (Z= 27)
(2) Ni (Z= 28)
(3) Cu (Z= 29)
(4) Fe (Z= 26)

85. Atomic number of Cr and Fe are respectively 24 and 26, which of the following is paramagnetic?
(1) $[Cr(CO)_6]$
(2) $[Fe(CO)_5]$
(3) $[Fe(CN)_6]^{-4}$
(4) $[Cr(NH_3)_6]^{+3}$
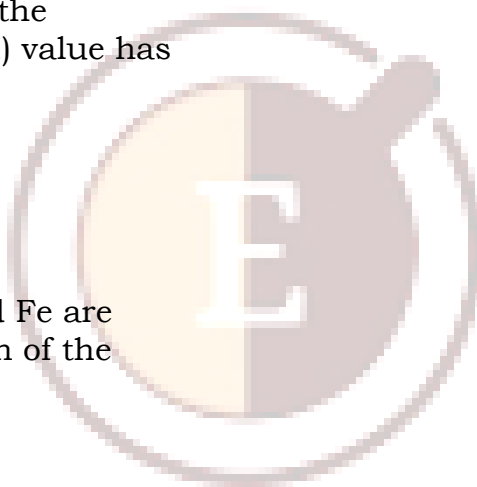
SECTION : B

86. Right option for the number of tetrahedral and octahedral voids in hexagonal primitive unit cell are :
(1) 12, 6
(2) 8, 4
(3) 6, 12
(4) 2, 1

87. The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives 'X' and reaction in presence of light gives 'Y'. Thus, 'X' and 'Y' are:
(1) X= Benzal chloride,
Y= o – Chlorotoluene
(2) X= m – Chlorotoluene,
Y= p – Chlorotoluene
(3) X= o –and p – Chlorotoluene,
Y= Trichloromethyl – benzene
(4) X= Benzyl chloride,
Y= m – Chlorotoluene

88. The pKb of dimethylamine and pKa of acetic acid are 3.27 and 4.77 respectively at T (K). The correct option for the pH of dimethylammonium acetate solution is :
(1) 6.25
(2) 8.50
(3) 5.50
(4) 7.75

89. Schotten-Baumann reaction is a reaction of phenols with
(1) Benzoyl chloride and sodium hydroxide
(2) Acetyl chloride and sodium hydroxide
(3) Salicylic acid and conc. H_2SO_4
(4) Acetyl chloride and conc H_2SO_4

90. A carbonyl compound reacts with hydrogen cyanide to form cyanohydrin which on hydrolysis forms a racemic mixture of α -hydroxy acid. The carbonyl compound is
(1) acetone
(2) diethyl ketone
(3) formaldehyde
(4) acetaldehyde

91. What is the decreasing order of basicity of primary, secondary and tertiary methylamines and NH_3?
(1) $NH_3 > C_2H_5NH_2 > (C_25)_2NH > (C_2H_5)_3N$
(2) $(C_0H_5)_3N > (C_2H_5)_2NH > C_2H_5NH_2 > NH_3$
(3) $(C_2H_5)_2NH > C_2H_5NH_2 > (C_2H_5)_3N > NH_3$
(4) $(C_2H_5)_2NH > (C_2H_5)_3N > C_2H_5NH_2 > NH_3$

92.
An organic compound (C_3H_9N) , when treated with nitrous acid, gave an alcohol and N_2 gas was evolved. on warming with $CHCl_3$ and caustic potash gave which on reduction gave isopropyl methylamine. Predict the structure of (A).
(1)

(2)

$CH_3CH_2 — NH — CH_3$

(3)

(d)

$CH_3CH_2CH_2 — NH_2$
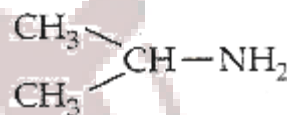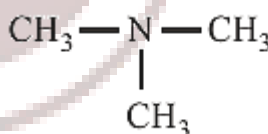
93. Enzymes are made up of
(1) Edible proteins
(2) Proteins with specific structure
(3) Nitrogen containing carbohydrates
(4) Carbohydrates

94. Bakelite is prepared by the reaction between
(1) urea and formaldehyde
(2) ethylene glycol
(3) phenol and formaldehyde
(4) tetramethylene glycol

95. Which one of the following is employed as Antihistamine?
(1) Chloramphenicol
(2) Diphenyl hydramine
(3) Norothindrone
(4) Omeprazole

96. A first order reaction has a specific reaction rate of 10^{-2} sec^{-1}. How much time will it take for 20g of the reactant to reduce to 5 g ?
(1) 138.6 sec
(2) 346.5 sec
(3) 693.0 sec
(4) 238.6 sec

97. Which oxide of nitrogen is not a common pollutant introduced into the atmosphere both due to natural and human activity?
(1) N_2O_5
(2) NO_2
(3) NO
(4) N_2O

98. For the second period elements the correct increasing order of first ionisation enthalpy is:
(1) Li < Be < B < C < N < O < F < Ne
(2) Li < B < Be < C < O < N < F < Ne
(3) Li < B < Be < C < N < O < F < Ne
(4) Li < Be < B < C < O < N < F < Ne

99. Paper chromatography is an example of
(1) Thin layer chromatography
(2) Column chromatography
(3) Adsorption chromatography
(4) Partition chromatography

100. The equilibrium constant of the following are :

$N_2 + 3H_2 \leftrightharpoons 2NH_3$ K_1
$N_2 + O_2 \leftrightharpoons 2NO$ K_2

$H_2 + \frac{1}{2}O_2 \rightarrow H_2O$ K_3
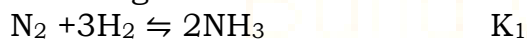
The equilibrium constant (K) of the reaction :
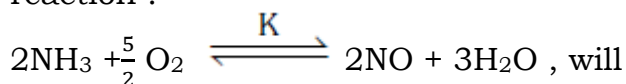
$2NH_3 + \frac{5}{2}O_2 \xrightleftharpoons{\quad K \quad} 2NO + 3H_2O$, will be
(1) $K_2 K_3^3 / K_1$
(2) $K_2 K_3 / K_1$
(3) $K_2^3 K_3 / K_1$
(4) $K_1 K_3^3 / K_2$

BOTANY

SECTION : A

101. A system of classification in which a large number of traits are considered, is
(1) artificial system
(2) synthetic system
(3) natural system
(4) phylogenetic system

102. Trypanosoma belongs to class
(1) Sarcodina
(2) Zooflagellata
(3) Ciliata
(4) Sporozoa

103. Temperature tolerance of thermal blue-green algae is due to
(1) cell wall structure
(2) cell organisation
(3) mitochondrial structure
(4) homopolar bonds in their proteins

104. The plasmids present in the bacterial cells are
(1) circular double helical DNA molecules
(2) circular double helical RNA molecules
(3) linear double helical DNA molecules
(4) linear double helical RNA molecules.

105. In bacteria, plasmid is
(1) extra – chromosomal material
(2) main DNA
(3) non-functional DNA
(4) repetitive gene

106. Bacterial leaf blight of rice is caused by a species of
(1) Xanthomonas
(2) Pseudomonas
(3) Alternaria
(4) Erwinia

107. Which one of the following is true for fungi?
(1) They are phagotrophs
(2) They lack a rigid cell wall
(3) They are heterotrophs
(4) They lack nuclear membrane

108. The 'wing' of Pinus seed is derived from
(1) testa
(2) testa and tegmen
(3) surface of ovuliferous scale
(4) all the above

109. The largest ovules, largest male and female gametes and largest plants are found among
(1) Angiosperms
(2) Tree ferns and some monocots
(3) Gymnosperms
(4) Dicotyledonous plants

110. Algae have cell wall made up of:
(1) cellulose, galactans and mannans
(2) hemicellulose, pectins and proteins
(3) pectins, cellulose and proteins
(4) cellulose, hemicellulose and pectins

111. Epipetalous stamens with free filaments and fused anthers occur in
(1) Asteraceae
(2) Solanaceae
(3) Liliaceae
(4) Poaceae

112. In a cereal grain the single cotyledon of embryo is represented by
(1) scutellum
(2) prophyll
(3) coleoptile
(4) coleorhiza

113. Among flowers of Calotropis, tulip, Sesbania, Asparagus, Colchicine, Sweet pea, Petunia, Indigofera, Mustard, Soyabean, Tobacco and groundnut how many plants have corolla with valvate aestivation?
(1) Five
(2) Six
(3) Seven
(4) Eight

114. Which exposed wood will decay faster
(1) Sapwood
(2) Softwood
(3) Wood with lot of fibres

(4) Heartwood

115. Which one of the following is resistant to enzyme action?
(1) Cork
(2) Wood fibre
(3) Pollen exine
(4) Leaf cuticle

116. Histamine secreting cells are found in
(1) connective tissues
(2) lungs
(3) muscular tissue
(4) nervous tissue

117. In which one of the following preparations are your likely to come across cell junctions most frequently?
(1) Thrombocytes
(2) Tendon
(3) Hyaline cartilage
(4) Ciliated epithelium.

118. Magnification of compound microscope is not connected with
(1) numerical aperture
(2) focal length of objective
(3) focal length of eye piece
(4) tube length

119. Series of reactions which can convert fatty acids to sugars in plants but not in animals is
(1) krebs cycle
(2) glyoxylate cycle
(3) ornithine cycle
(4) glycolysis

120. Which one of the following is not a constituent of cell membrane?
(1) glycolipids
(2) proline
(3) phospholipids
(4) cholesterol.

121. The term 'glycocalyx' is used for
(1) A layer surrounding the cell wall of bacteria
(2) A layer present between cell wall and membrane of bacteria
(3) Cell wall of bacteria

(4) Bacterial cell glyco-engineered to possess Nglycosylated proteins

122. Microtubule is involved in the
(1) cell division
(2) muscle contraction
(3) membrane architecture
(4) dNA recognition

123. Water movement between cells is due to
(1) T.P.
(2) W.P.
(3) D.P.D
(4) Incipient plasmolysis

124. Sulphur is an important nutrient for optimum growth and productivity in
(1) cereals
(2) fibre crops
(3) oilseed crops
(4) pulse crops

125. Boron in green plants assists in
(1) sugar transport
(2) activation of enzymes
(3) acting as enzyme cofactor
(4) photosynthesis

126. The size of chlorophyll molecule is
(1) Head 15 × 15 Å, tail 25 Å
(2) Head 20 × 20 Å, tail 25 Å
(3) Head 15 × 15 Å, tail 20 Å
(4) Head 10 × 12 Å, tail 25 Å

127. Chlorophyll 'a' molecule at its carbon atom 3 of the Pyrrole ring II has one of the following
(1) aldehyde group
(2) methyl group
(3) carboxyl group
(4) magnesium.

128. The first acceptor of electrons from an excited
chlorophyll molecule of photosystem II is
(1) iron-sulphur protein
(2) ferredoxin
(3) quinone
(4) cytochrome

129. When one glucose molecule is completely oxidised, it changes
(1) 36 ADP molecules into 36 ATP molecules
(2) 38 ADP molecules into 38 ATP molecules
(3) 30 ADP molecules into 30 ATP molecules
(4) 32 ADP molecules into 32 ATP molecules

130. How many ATP molecules could maximally be generated from one molecule of glucose, if the complete oxidation of one mole of glucose to CO_2 and H_2O yields 686 kcal and the useful chemical energy available in the high energy phosphate bond of one mole of ATP is 12 kcal?
(1) Thirty
(2) Fifty -seven
(3) One
(4) Two

131. Which is employed for artificial ripening of banana fruits?
(1) Auxin
(2) Coumarin
(3) Ethylene
(4) Cytokinin

132. Proteinaceous pigment which control activities concerned with light
(1) phytochrome
(2) chlorophyll
(3) anthocyanin
(4) carotenoids

133. The device which can remove particulate matter present in the exhaust from a thermal power plant is :
(1) Catalytic Convertor
(2) STP
(3) Incinerator
(4) Electrostatic Precipitator

134. Which one of the following never occurs during mitotic cell division?
(1) Coiling and condensation of the chromatids
(2) Spindle fibres attach to kinetochores of chromosomes
(3) Movement of centrioles towards opposite poles
(4) Pairing of homologous chromosomes

135. Syngamy means
(1) fusion of gametes
(2) fusion of cytoplasms
(3) fusion of two similar spores
(4) fusion of two dissimilar spores

SECTION : B

136. In a flowering plant, archesporium gives rise to
(1) only tapetum and sporogenous cells
(2) only the wall of the sporangium
(3) both wall and the sporogenous cells
(4) wall and the tapetum

137. Megaspores are produced from the megaspore mother cells after
(1) Meiotic division
(2) Mitotic division
(3) Formation of a thick wall
(4) Differentiation

138. Molecular weight of chromosome of yeast cell is
(1) 2.56×10^9
(2) 40×10^9
(3) 0.5×10^9
(4) 1×10^9

139. Which of the following re present maximum number of species among global biodiversity?
(1) Lichens
(2) Fungi
(3) Mosses and Ferns
(4) Algae

140. How does carbon monoxide, a poisonous gas emitted by automobiles, prevent transport of oxygen into the body tissues?
(1) By destroying the haemoglobin
(2) By forming a stable compound with haemoglobin
(3) By obstructing the reaction of oxygen with haemoglobin
(4) By changing oxygen into carbon dioxide.

141. Which one of the following is the correct percentag of the two (out of the total of 4) green house gases that contribute to the total global warming?
(1) CFCs 14%, Methane 20%
(2) CO_2, 40%, CFCs 30%
(3) $N_2 O$ 6%, CO_2 86%
(4) Methane 20%, N_2O 18%

142. In Antirrhinum (Snapdragon), a red flower was crossed with a white flower and in F_1 generation pink flowers were obtained. When pink flowers were selfed, the F_2 generation showed white, red and pink flowers. Choose the incorrect statement from the following :
(1) This experiment does not follow the Principle of Dominance.
(2) Pink colour in F_1 is due to incomplete dominance.
(3) Ratio of F_2 is ¼ (Red) : $\frac{2}{4}$ (Pink) : $\frac{1}{4}$ (white)
(4) Law of Segregation does not apply in this experiment

143. An example of colonial alga is :
(1) Volvox
(2) Ulothrix
(3) Spirogyra
(4) Chlorella

144. Which of the following organisms are known as chief producers in the oceans?
(1) Dinoflagellates
(2) Diatoms
(3) Euglenoids
(4) Cyanobacteria

145. Ciliates differ from all other protozoans in
(1) using flagella for locomotion
(2) having a contractile vacuole for removing excess water
(3) having two types of nuclei
(4) using pseudopodia for capturing prey

46. Which of the following pairs of gases is mainly responsible for green house effect?
(1) Ozone and Ammonia
(2) Oxygen and Nitrogen
(3) Nitrogen and Sulphur dioxide
(4) Carbon dioxide and Methane

147 From evolutionary point of view, retention of the female gametophyte with developing young embryo on the parent

sporophyte for some time, is first observed in :
(1) Liverworts
(2) Mosses
(3) Pteridophytes
(4) Gymnosperms

148. Consider the following four statements whether they are correct or wrong?
(A) The sporophyte in liverworts is more elaborate than that in mosses
(B) Salvinia is heterosporous
(C) The life cycle in all seed-bearing plants is diplontic
(D) In Pinus male and female cones are borne on different trees
(a) Statements (A) and (C)
(b) Statements (A) and (D)
(c) Statements (B) and (C)
(d) Statements (A) and (B)

149. The leaves are modified into tendrils, hooks, pitcher ,and bladder in the following plants respectively:
(a) sweet pea, bignonia, Nepenthes, Utricularia
(b) sweet pea, bignonia, Utricularia, Nepenthes,
(c) Nepenthes , bignonia, sweet pea, Utricularia
(d) Utricularia, Nepenthes, bignonia, sweet pea

150. Select the correct sequence for transport of sperm cells in male reproductive system.
(a) Testis → Epididymis → Vasa efferentia → Rete testis → Inguinal canal → Urethra
(b) Seminiferous tubules → Rete testis →Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra → Urethral meatus
(c) Seminiferous tubules → Vasa efferentia →Epididymis → Inguinal canal → Urethra
(d) Testis → Epididymis → Vasa efferentia →Vas deferens → Ejaculatory duct →
Inguinal canal → Urethra → Urethral meatus

ZOOLOGY

SECTION : A

151. Fish which can be used in biological control of mosquitoes/Larvicidal fish is
(1) Eel
(2) Carp
(3) Cat Fish
(4) Gambusia

152. An egg laying mammal is
(1) Kangaroo
(2) Platypus
(3) Koala
(4) Whale

153. Closed circulatory system occurs in
(1) snail
(2) cockroach
(3) cuttle Fish
(4) all of these

154. One of the following is a very unique feature of the mammalian body:
(1) Homeothermy
(2) Presence of diaphragm
(3) Four chambered heart
(4) Rib cage

155. Which one of the following statements is totally wrong about the occurrence of notochord, while the other three are correct?
(1) It is present only in larval tail in Ascidians
(2) It is replaced by a vertebral column in adult frog
(3) It is absent throughout life in humans from the very beginning
(4) It is present throughout life in Amphioxus

156. DNA synthesis can be specifically measured by estimating the incorporation of radio labelled
(1) uracil
(2) adenine
(3) thymidine
(4) deoxyribose sugar

157. Which one of the following hydrolyses internal phosphodiester bonds in a polynucleotide chain?
(1) Lipase
(2) Protease
(3) Endonuclease
(4) Exonuclease

158. Secretin and cholecystokinin are two hormones involved in digestion. They are secreted by
(1) Duodenum
(2) Ileum
(3) Oesophagus
(4) Stomach

159. Which one of the following statements is true regarding digestion and absorption of food in humans?
(1) Fructose and amino acids are absorbed through intestinal mucosa with the help of carrier ions like Na+.
(2) Chylomicrons are small lipoprotein particles that are transported from intestine into blood capillaries.
(3) About 60% of starch is hydrolysed by salivary amylase in our mouth
(4) Oxyntic cells in our stomach secrete the proenzyme pepsinogen.

160. Listed below are four respiratory capacities (i–iv) and four jumbled respiratory volumes of a normal human adult: Respiratory Respiratory capacities volumes
(i) Residual volume   2500mL
(ii) Vital capacity   3500mL
(iii) Inspiratory reserve   1200mL volume
(iv) Inspiratory capacity 4500mL
Which one of the following is the correct matching of two capacities and volumes?
(1) (ii) 2500mL, (iii) 4500mL
(2) (iii) 1200mL, (iv) 2500mL
(3) (iv) 3500 mL, (i) 1200mL
(4) (i) 4500 mL, (ii) 3500mL

161. The lymph serves to
(1) transport oxygen to the brain
(2) transport carbon dioxide to the lungs
(3) return the interstitial fluid to the blood

(4) return the WBCs and RBCs to the lymph nodes

162. A drop of each of the following, is placed separately on four slides. Which of them will not coagulate?
(1) Blood serum
(2) Sample from the thoracic duct of lymphatic system
(3) Whole blood from pulmonary vein
(4) Blood plasma.

163. Uric acid is nitrogenous waste in
(1) Mammals and molluscs
(2) Birds and lizards
(3) Frog and cartilaginous fishes
(4) Insects and bony fishes

164. Which one of the following statements is correct with respect to kidney function regulation?
(1) When someone drinks lot of water, ADH release is suppressed.
(2) Exposure to cold temperature blood flow stimulates formation of Angiotensin II.
(3) An increase in glomerular blood flow stimulates formation of Angiotensin II.
(4) During summer when body loses lot of water by evaporation, the release of ADH is suppressed.

165. Which one of the following is the correct matching of three items and their grouping category?
         Items   Group
(1) ilium, ischium, pubis - coxal bones of pelvic girdle
(2) actin, myosin, - muscle proteins rhodopsin.
(3) cytosine, uracil, - pyrimidines thiamine
(4) malleus, incus, - ear ossicles cochlea

166. Anaesthetics reduce pain by blocking nerve conduction due to
(1) Blocking neurotransmitter receptor
(2) Blocking Na^+ channel
(3) Blocking K^+ channel
(4) All the above

167. A person entering an empty room suddenly finds a snake right in front on opening the door. Which one of the following is likely to happen in his neurohormonal control system?
(1) Sympathetic nervous system is activated releasing epinephrin and norepinephrin from adrenal medulla.
(2) Neurotransmitters diffuse rapidly across the cleft and transmit a nerve impulse.
(3) Hypothalamus activates the parasympathetic division of brain.
(4) Sympathetic nervous system is activated releasing epinephrin and norepinephrin from adrenal cortex.

168. What is true for cleavage?
(1) Size of embryo increases
(2) Size of cells decrease
(3) Size of cells increase
(4) Size of embryo decreases

169. Seminal plasma in human males is rich in:
(1) fructose and calcium
(2) glucose and calcium
(3) DNA and testosterone
(4) ribose and potassium

170. The test-tube Baby Programme employs which one of the following techniques
(1) Intra cytoplasmic sperm injection (ICSI)
(2) Intra uterine insemination (IUI)
(3) Gamete intra fallopian transfer (GIFT)
(4) Zygote intra fallopian transfer (ZIFT)

171. The process of mating between closely related individuals is
(1) self breeding
(2) inbreeding
(3) hybridisation
(4) heterosis

172. The homologous organs are those that show similarity in
(1) size
(2) origin
(3) function
(4) appearance

173. The process by which organisms with different evolutionary history evolve similar phenotypic adaptations in response to a common environmental challenge, is called:
(1) Convergent evolution
(2) Non-random evolution
(3) Adaptive radiation
(4) Natural selection

174. Human immuno deficiency virus (HIV) has a protein coat and a genetic material which is
(1) single stranded DNA
(2) double stranded DNA
(3) single stranded RNA
(4) double stranded RNA

175. Antibodies in our body are complex
(1) steroids
(2) prostaglandins
(3) glycoproteins
(4) lipoproteins

176. Two microbes found to be very useful in genetic engineering are
(1) Vibrio cholerae and a tailed bacteriophage
(2) Diplococcus sp. and Pseudomonas sp.
(3) Crown gall bacterium and Caenorhabditis elegans
(4) Escherichia coli and Agrobacterium tumefaciens

177. Which one of the following is commonly used in transfer of foreign DNA into crop plants?
(1) Meloidogyne incognita
(2) Agrobacterium tumefaciens
(3) Penicillium expansum
(4) Trichoderma harzianum

178. A temporary endocrine gland in the human body is :
(1) Corpus cardiacum
(2) corpus luteum
(3) Corpus allatum
(4) Pineal gland

179. Which of the following is made up of dead cells?

(1) Collenchyma
(2) Phellem
(3) Phloem
(4) Xylem parenchyma

180. Which of the following features is used to identify a male cockroach from a female cockroach?
(1) Presence of a boat shaped sternum on the 9th abdominal segment
(2) Presence of caudal styles
(3) Presence of anal cerci
(4) Forewings with darker tegmina

181. Select the correct sequence of organs in the alimentary canal of cockroach starting from mouth
(1) Pharynx → Oesophagus →Crop → Gizzard→ Ileum → Colon → Rectum
(2) Pharynx → Oesophagus → Gizzard → Crop → Ileum → Colon→ Rectum
(3) Pharynx → Oesophagus → Gizzard → Ileum → Crop → Colon → Rectum
(4) Pharynx → Oesophagus → Ileum → Crop → Gizzard → Colon → Rectum

182. The genetically modified brinjal in India has been developed for
(1) Drought resistance
(2) Enhancing mineral content
(3) Enhancing shelf life
(4) Insect resistance

183. In the clotting mechanism pathway, thrombin activate factors
(1) VIII, X, V
(2) XI, VIII, X
(3) XI, IX, X
(4) XI, VIII, V

184. A drop of each of the following is placed separately on four slides. Which of them will not coagulate?
(1) Blood serum
(2) Sample from the thoracic duct of lymphatic system
(3) Whole blood from pulmonary vein
(4) Blood plasma

185. The chemical substance released by activated spermatozoa that acts on the

ground substances of the follicle cells is
known as
(1) Progesterone
(2) Hyaluronidase
(3) Gonadotropin
(4) Relaxin

SECTION : B

186. Which of the following is an example of negative feedback loop in humans?
(1) Secretion of tears after falling of sand particles into the eye.
(2) Salivation of mouth at the sight of delicious food
(3) Secretion of sweat glands and constriction of skin blood vessels when it is too hot
(4) Constriction of skin blood vessels and contraction of skeletal muscles when it is too cold

187. During the propagation of a nerve impulse, the action potential results from the movement of:
(1) K_+ ions from extracellular fluid to intracellular fluid
(2) Na_+ ions from intracellular fluid to extracellular fluid
(3) K_+ ions from intracellular fluid to extracellular fluid
(4) Na_+ ions from extracellular fluid to intracellular fluid

188. Which one of the following is the correct description of a certain part of a normal human skeleton?
(1) First vertebra is axis which articulates with the occipital condyles.
(2) The 9 th and 10 th pairs of ribs are called the floating ribs.
(3) Parietal bone and the temporal bone of the skull are joined fibrous joint.
(4) Glenoid cavity is a depression to which the thigh bone articulates

189. Antiparallel strands of a DNA molecule means that
(1) the phosphate groups of two DNA strands, at their ends. share the same position
(2) the phosphate groups at the start of two DNA strands are in opposite position (pole)
(3) one strand turns clockwise

(4) one strand turns anti-clockwise

190. Which one of the following statements is correct with respect to kidney function regulation?
(1) When someone drinks lot of water,ADH release is suppressed.
(2) Exposure to cold temperature blood flow stimulates formation of Angiotensin II.
(3) An increase in glomerular blood flow stimulates formation of Angiotensin II.
(4) During summer when body loses lot of water by evaporation, the release of ADH is suppressed.

191. Match List - I with List – II

List I	List II
(a) Adaptive radiation	(i) Selection of resistant varieties due to excessive use of herbicides and Pesticides
(b) Convergent evolution	(ii) Bones of forelimbs in Man and Whale
(c) Divergent evolution	(iii) Wings of Butterfly and Bird
(d) Evolution by anthropogenic	(iv) Darwin Finches Action

Choose the correct answer from the options given below.

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

192. From his experiments, S.L. Miller produced amino acids by mixing the following in a closed flask
(1) CH_4, H_2 , NH_3 and water vapor at 600°C
(2) CH_3, H_2 , NH_3 and water vapor at 600°C

(3) CH_4, H_2, NH_3 and water vapor at 800°C
(4) CH_3, H_2, NH_4 and water vapor at 800°C

193 Match List-I with List-II

List –I	List –II
(a) Filariasis	(i) Haemophilus influenzae
(b) Amoebiasis	(ii) Trichophyton
(c) Pneumonia	(iii) Wuchereria bancrofti
(d) Ringworm	(iv) Entamoeba histolytica

Choose the correct answer from the options given below

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

194. Match List-I with List-II.

List I	List II
(a) Vaults	(i) Entry of sperm through Cervix is blocked
(b) IUDs	(ii) Removal of Vas deferens
(c) Vasectomy	(iii) Phagocytosis of sperms within the Uterus
(d) Tubectomy	(iv) Removal of fallopian tube

Choose the correct answer from the options given Below

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

195. Match the following columns and select the correct option.

Column-I	Column-II
(a) Placenta	(i) Androgens
(b) Zona pellucida	(ii) Human Chorionic Gonadotropin (hCG)
(c) Bulbo-urethral glands	(iii) Layer of the ovum
(d) Leydig cells	(iv) Lubrication of the Penis

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

196. The partial pressures (in mm Hg) of oxygen (O_2) and carbon dioxide (CO_2) at alveoli (the site of diffusion) are:
(1) pO_2 = 159 and pCO_2 = 0.3
(2) pO_2 = 104 and pCO_2 = 40
(3) pO_2 = 40 and pCO_2 = 45
(4) pO_2 = 95 and pCO_2 = 40

197. Match List-I with List-II.

List-I	List II
(a) Protein	(i) C = C double bonds
(b) Unsaturated fatty acid	(ii) Phosphodiester Bonds
(c) Nucleic acid	(iii) Glycosidic bonds
(d) Polysaccharide	(iv) Peptide bonds

Choose the correct answer from the options given below.

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

198. Identify the correct statement with reference to human digestive system.
(1) IIeum is a highly coiled part
(2) Vermiform appendix arises from duodenum
(3) IIeum opens into small intestine
(4) Serosa is the innermost layer of the alimentary canal

199. Following are the statements about prostomium of earthworm.
(1) It serves as a covering for mouth.
(2) It helps to open cracks in the soil into which it can crawl.
(3) It is one of the sensory structures.
(4) It is the first body segment.

Choose the correct answer from the
options given below.
(1) (b) and (c) are correct
(2) (a), (b) and (c) are correct
(3) (a), (b) and (d) are correct
(4) (a), (b), (c) and (d) are correct

200. Which of the following statements
are true/false?
(i)　　In Torpedo, the electric organs are
capable of generating strong electric
shock to paralyze the prey.
(ii)　　Bony fishes use pectoral, pelvic,
dorsal anal and caudal fins in swimming.
(iii)　　Amphibian skin is moist and has
thick scales.
(iv)　　Birds are poikilothermic animals.
(v)　　The most unique mammalian
characteristic is the presence of milk
producing mammary glands by which
the young ones are nourished.
(1) (i), (ii) and (iii) are true; (iv), (v) are
false
(2) (i), (ii) and (v) are true; (iii) and (iv) are
false
(3) (i), (iv) and (v) are true; (ii) and (iii) are
false
(4) (i), (ii) and (iv) are false; (iii) and (v) are
true
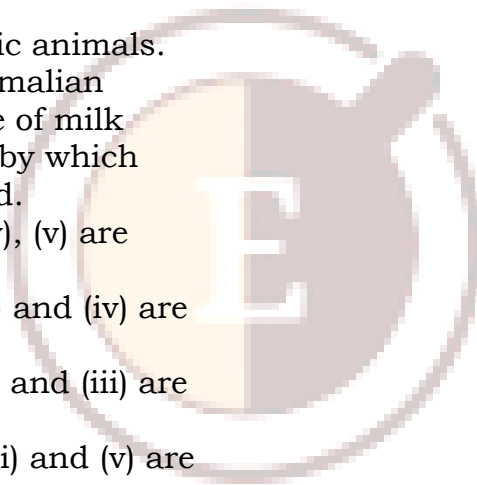
Solutions

Physics			
Section A		**Section B**	
1	2	36	4
2	3	37	1
3	4	38	3
4	3	39	2
5	4	40	2
6	2	41	1
7	3	42	1
8	1	43	3
9	1	44	3
10	4	45	3
11	2	46	3
12	2	47	3
13	4	48	2
14	2	49	4
15	2	50	1
16	3		
17	2		
18	4		
19	3		
20	4		
21	2		
22	4		
23	2		
24	4		
25	1		
26	4		
27	4		
28	1		
29	4		
30	1		
31	4		
32	2		
33	4		
34	3		
35	4		

chemistry			
Section A		**Section B**	
51	1	86	1
52	1	87	4
53	2	88	4
54	2	89	1
55	2	90	4
56	2	91	4
57	4	92	1
58	4	93	2
59	1	94	3
60	3	95	2
61	4	96	1
62	2	97	1
63	1	98	2
64	1	99	4
65	2	100	1
66	1		
67	4		
68	4		
69	2		
70	1		
71	2		
72	4		
73	3		
74	1		
75	4		
76	3		
77	4		
78	3		
79	2		
80	1		
81	3		
82	3		
83	1		
84	3		
85	4		

Botany			
Section A		Section B	
101	3	136	3
102	2	137	1
103	4	138	3
104	1	139	2
105	1	140	2
106	1	141	1
107	3	142	4
108	3	143	1
109	3	144	2
110	4	145	3
111	1	146	4
112	1	147	3
113	3	148	2
114	1	149	1
115	3	150	3
116	1		
117	4		
118	1		
119	2		
120	3		
121	2		
122	1		
123	3		
124	4		
125	1		
126	3		
127	1		
128	3		
129	2		
130	2		
131	3		
132	1		
133	4		
134	4		
135	1		

zoology			
Section A		**Section B**	
151	4	136	4
152	2	137	4
153	3	138	3
154	2	139	1
155	3	140	1
156	3	141	2
157	3	142	3
158	1	143	3
159	1	144	3
160	3	145	2
161	3	146	2
162	1	147	2
163	2	148	3
164	4	149	2
165	1	150	2
166	2		
167	1		
168	2		
169	1		
170	3		
171	2		
172	2		
173	1		
174	4		
175	3		
176	2		
177	1		
178	3		
179	2		
180	2		
181	1		
182	4		
183	4		
184	1		
185	2		

Physics solution
SECTION : A

1(2)

For mass →M

       For length (r)→L

       Force (F)→MLT^{-2}

From $F = \frac{GMm}{r^2}$

$G = \frac{Fr^2}{Mm}$

$= \frac{MLT^{-2}[L^2]}{[M][M]}$

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

2(3)

Height of tap = 5m and (g) = $10 m/sec^2$
For the first drop, $5 = ut + gt^2$
                $= (0 \times t) + \times 10t^2 v$
                $= 5t^2$ or t^2
                $= 1$ or $t = 1$.
It mean that the third drop leaves after
one second of the first drop. Or, each
drop leaves after every 0.5 sec.
Distance covered by the second drop in
0.5 sec.
$= (0.5)^2 = 1.25m$
Therefore, distance of the second drop
above the ground
$= 5 - 1.25$
$= 3.75m$

3(4)

$x = 8 + 12t - t^3$ The final velocity of the
particle will be zero, because it retarded.
$V = 0 + 12 - 3t^2 = 0$
$\Rightarrow 3t^2 = 12$
$\Rightarrow t = 2$ sec
Now the retardation a = dv/ dt = 0 – 6t
a [t= 2] = – 12 m/s²
retardation = 12 m/s²

4(3)

Let the speed of water = $\vec{u}$
Speed of swimmer = $\vec{v}$ = 0.5m/sec
Angle between = $\vec{v}$ and = $\vec{u}$ is 120°. Then
$\sin\theta = \frac{\vec{v}}{\vec{u}}$
$\Rightarrow \frac{u}{0.5} = \frac{1}{2}$ or u $= 0.25 ms^{-1}$
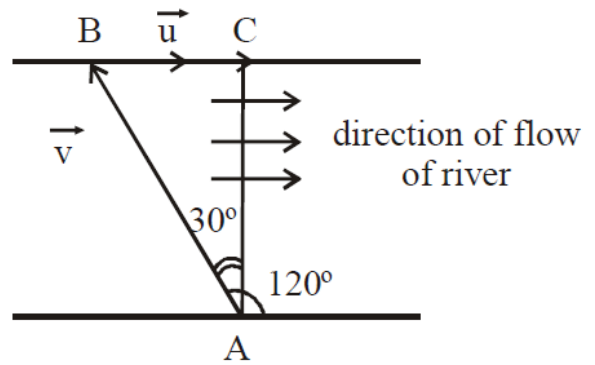
5(4)

$n = \sqrt{\epsilon_r u_r}$
$n = \frac{c}{v}$
$v = \frac{c}{n}$
$v = \left(\frac{c}{\sqrt{\epsilon_r u_r}}\right)$

6(2)

Mass of the rocket, m=5000 kg
The exhaust speed,v=800 ms⁻¹
Initial upward acceleration of
rocket, a=20 ms⁻²

Force due to gravitation, F=mg
=5000 kg×10 ms⁻²=50000 N

Net force responsible for
acceleration, F_{net}=5000 kg×20 ms⁻²
              =100000 N

Value of thrust force, $T_F = v\frac{dm}{dt}$
Net force responsible for
acceleration, $F_{Net} = T_F - F$
$100000 = 800$ ms⁻¹$\frac{dm}{dt}$ - 50000 N
$100000 = 800 \frac{dm}{dt}$ - 50000
$150000 = 800 \frac{dm}{dt}$
$\frac{dm}{dt} = 187.5$ kgs⁻¹

7(3)

Work done for small displacement can
be defined as:
 dW=Fdx   ....(1)

Total work done can be calculated by
integrating the equation (1) with
limits x=0 to x=5m
  $\int dW = \int_0^5 Fdx$

$\int dW = \int_0^5 (7 - 2x + 3x^2)dx$

$W = \left[7x - \frac{2x^2}{2} + \frac{3x^3}{3}\right]_0^5$

W=35−25+125

  =135 J

8(1)
h=60m
m /t =15kg/s
g=10m/s²
Loss due to friction force is 10%,
only 90% input is used to generate power,

$P = gh\frac{m}{t} \times \frac{90}{100}$

P=10×60×15×0.9

P=8.1kW

9(1)
L=mvr
  =5×3√2×4×cos45⁰
  =60√2 × $\frac{1}{\sqrt{2}}$
L=60 units
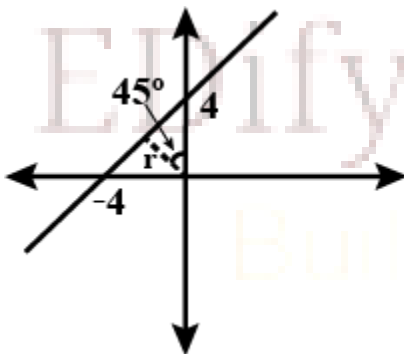
10(4)
The linear acceleration of centre of mass will be a=F/m where the force is applied. Hence acceleration will be same whatever the value of H may be.

11(2)
$I_0 + \frac{ML^2}{4}$
$I_{end} = I_{cm} + Md^2$
  $= I_0 + M\left(\frac{L}{2}\right)^2$
  $= I_0 + ML^2/4$

12 (2)

As we know that the escape velocity near the surface of earth is given by

$V_e = \sqrt{\frac{2GM}{R}}$

for new escape velocity,

$V'_e = \sqrt{\frac{2GM'}{R'}}$

from question, M'=2M; R'=R/2

$V'_e = \sqrt{\frac{2GM'}{\left(\frac{R}{2}\right)}} = 2\sqrt{\frac{2GM}{R}}R$

⇒ V'e = 2Ve =22.4 km/s

13(4)
Correct answer is (4) a linearly increasing function of distance r upto the boundary of the wire and then decreasing one with 1/r dependence for the outside region.
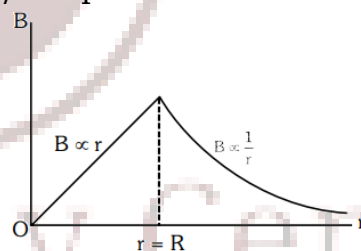
14(2)
Heat flow rate $\frac{dQ}{dt} = \frac{KA(T_1 - T_2)}{L} = Q$
When linear dimensions are double.
$A_1 \propto r_1^2, L_1 = L$
$A_2 \propto 4r_1^2, L_1 = 2L$
so $Q_2 = 2Q$

15(2)
Relation between specific heats per unit mass:
$C_P - C_V = r = R/M$
Hence, r=R/M
Here, M is molecular weight
Hydrogen:
$C_P - C_V = a$
$a = \frac{R}{M} = \frac{R}{2}$

Oxygen:
$C_P - C_V = b$

$\Rightarrow b = \frac{R}{M} = \frac{R}{32}$

Ratio of a and b:

$\frac{a}{b} = \frac{\frac{R}{2}}{\frac{R}{32}} = 16$

Hence, a=16b

16(3)

The First Law of Thermodynamics states that energy can be converted from one form to another with the interaction of heat, work and internal energy, but it cannot be created nor destroyed, under any circumstances. Mathematically, this is represented as

$\Delta H = \Delta U + \Delta nRT$

where,

ΔH is the heat exchanged between a system and its surroundings,

ΔU is the total change in internal energy of a system,

ΔnRT is the work done by or on the system.

Given,

$\Delta H = 2 Kcal = 8400J$

$W = 500J$

So, $\Delta U = 8400 - 500$

$\qquad = 7900J.$

17(2)

$\omega = 100$

$v = \frac{\omega}{2\pi} = \frac{100}{2\pi} = \frac{50}{\pi} Hz$

Resonance frequency

$v_0 = \frac{1}{2\pi\sqrt{C}} = \frac{1}{2\pi}\sqrt{\frac{1}{10 \times 10 \times 10^{-6}}}$

$\quad = \frac{50}{\pi} Hz$

18(4)

Given,

$x = A \sin(\omega t + \delta)$ ...(i)

and $y = A \sin(\omega t + \delta + \frac{\pi}{2})$

$= A \cos(\omega t + \delta)$ ...(ii)
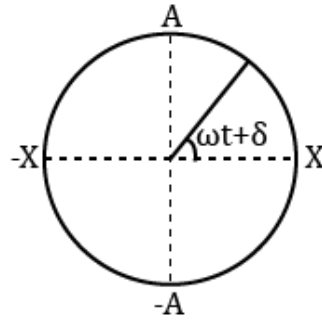
Squaring and adding Eqs. (i) and (ii), we get

$x^2 + y^2 = A^2[\sin^2(\omega t + \delta) + \cos^2(\omega t + \delta)]$

or $x^2 + y^2 = A^2$

which is the equation of a circle.

Now, at $(\omega t + \delta) = 0$, x=0, y=0

At $(\omega t + \delta) = \frac{\pi}{2}$, x=A, y=0

At $(\omega t + \delta) = \frac{\pi}{2}$, x=0, y=$-A$

At $(\omega t + \delta) = \frac{3\pi}{2}$, x=$-A$, y=0

At $(\omega t + \delta) = 2\pi$, x=A, y=0

From the above data, we can see that the motion of the particle is a circle transversed in clockwise direction.

19(3)

:Damping force, $F \propto v$ or $F = kv$

where k is the constant of proportionality

$\therefore k = F/v = M/ms^{-1}$

$\quad = kg\, ms^{-2}/ms^{-1}$

$\quad = kg\, s^{-1}$

20(4)

Sound wave equation is y = 0.0015 sin (62.4 x + 316t).

Comparing it with the general equation of

$y = A \sin 2\pi\left[\frac{x}{\lambda} + \frac{t}{T}\right]$

we get $\frac{2\pi}{\lambda} = 62.4$

or $\lambda = \frac{2\pi}{62.4} = 0.1$ unit

21(2)

The period of oscillation = 0.05s

The velocity of the wave = 300m/s

We know that,

Path difference $= \frac{2\pi}{\lambda} \times$ path difference

Path difference between two points, $\Delta x = 15 - 10$

=5m

Time period, T = 0.5s

frequency $v = \frac{1}{T} = 0.051 = 20$Hz

Velocity v = 300m/s

$\therefore$ Wavelenght $\lambda = \frac{v}{n} = 300/20 = 15$m

Hence, phase difference

$\Delta\phi = \frac{2\pi}{\lambda} \times x$

$= \frac{2\pi}{15} \times 5$

$= 32\pi$

22(4)

As we have,

If r>1

$P_{axi} = \frac{1}{4\pi E_0} \frac{2P}{r^3}$

Wherein,

Angle between P_{axi} and P is 0.

$E_{equatorial} = \frac{kp}{r^3}$.

$E \propto p$

And

$P \propto r^{-3}$

23(2)

The potential at the centre of the sphere is 80V because it remains same at each point under the metallic hollow sphere.

24(4)

The electric field in between two parallel metal plate is

$E = \frac{\sigma}{\epsilon} = \frac{Q}{A\epsilon}$

 where

A= area of plates and

ϵ= permeability of medium in between the plates.

The permeability of kerosene is more that of air. As ϵ increases, E decreases.

25(1)

The principle of conservation of electric charge implies that: at any node (junction) in an electrical circuit , the sum of currents flowing into that node is equal to the sum of currents flowing out of that node. This is known as Kirchhoff's current law.

26(4)

$R = \frac{v^2}{p}$

$R \propto V^2$

$R^1 = R \propto \left[\frac{v^1}{v}\right]^2$

$= \frac{110 \times 110}{220 \times 220}$

$= \left[\frac{R}{4}\right]$

27(4)

Given,

$E = 30\theta - \frac{\theta^2}{15}$

At neutral temperature $\frac{dE}{d\theta} = 0$

$\therefore 30 - \frac{2\theta}{15} = 0$

$\theta = 225^0$ C

28(1)

A current carrying coil has magnetic dipole moment.

Hence a torque $p_m \times B$ acts on it in magnetic field.

29(4)

Electromagnets are made of soft iron because: Soft iron has high retentivity-When the magnetising field is reduced to zero, soft iron retains magnetisation. andLow coercive force-To demagnetise thesoft iron, a small force is required .
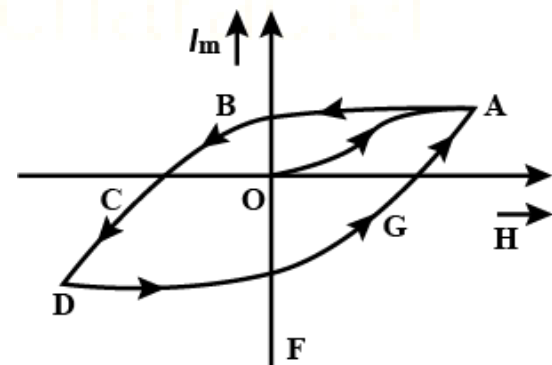
30(1)

B=0.025

$\frac{dr}{dt} = 1$mm/s

EMF e_r = 2cm =

$e = \frac{d\phi}{dt} = \frac{d}{dt}(B\pi r^2)$

$$=2\pi rB\frac{dr}{dt}$$

$$=2\times\pi\times2\times10^{-2}\times2.5\times10^{-2}\times2\times10^{-3}$$

$$=2\pi\times10^{-6}\pi V$$
$$=2\pi\mu V$$

31(4)
Maximum current flows in the circuit in resonance condition Current in the LCR circuit

$$i = \frac{V}{\sqrt{R^2+(X_L- X_C)^2}}$$

For current to be maximum denominator should be minimum

$(X_L−X_C)^2=0$

$\Rightarrow X_L=X_C$

$\Rightarrow \omega L = \frac{1}{\omega C}$

$\therefore L = \frac{1}{\omega^2 C} = \frac{1}{(100^2)\times10\times10^{-6}}$

$L = \frac{1}{10}H$

$=0.1H$

$=100mH$

32(2)
The greenhouse effect is a process that occurs when gases in Earth's atmosphere trap the sun's heat.
Some of the infrared radiation from the sun passes through the atmosphere, but most is absorbed and re-emitted in all directions by greenhouse gas molecules and clouds.
The effect of this is to warm the Earth's surface and the lower atmosphere

33(4)
Velocity of light in a medium, v= c/n
where, n is the refractive index, c is the velocity of light in vacuum.
Distance travelled = thickness = t
Therefore,

Time $=t/ v= \frac{nt}{c}$

34(3)
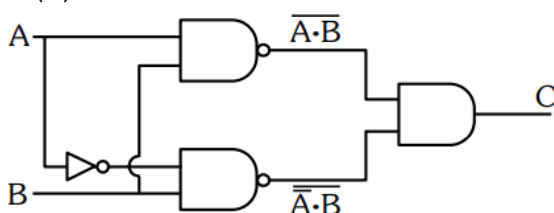
$C = \overline{A \cdot B}\cdot \ \overline{A}\cdot B$
using De-Morgan Theorem
$C= \overline{A \cdot B + \bar{A} \cdot \bar{B}}$
$C= \overline{B(A + \bar{A})} = \bar{B}$
Therefore

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

35(4)
Resultant intensity of two periodic waves is given by

$I=I_1+I_2+2\sqrt{I_1I_2}cos\delta$

where δ is the phase difference between the waves.
For maximum intensity,
$\delta=2n\pi; n=0,1,2,...$etc.
Therefore, for zero order maxima, $cos\delta=1$
$I_{max} = I_1+I_2+2I_1I_2 =(I_1+I_2)^2$
For minimum intensity,
$\delta=(2n−1)\pi; n=1,2,...$etc.
Therefore, for Ist order minima, $cos\delta=−1$
$I_{min}=I_1+I_2−2\sqrt{I_1I_2}$
$=\left(\sqrt{I_1} − \sqrt{I_2}\right)^2$
Therefore,

$I_{max}+I_{min} =\left(\sqrt{I_1} + \sqrt{I_2}\right)^2+ \left(\sqrt{I_1} − \sqrt{I_2}\right)^2$

$=2(I_1+I_2)$

SECTION : B

36(4)

$E = \dfrac{hc}{\lambda} = \dfrac{6.6 \times 10^{-34} \times 3 \times 10^8}{21 \times 10^{-2}}$

$= 0.94 \times 10^{-24}$

$\approx 10^{-24}$ J

37(1)

when the potential increases, the Potential difference between the electrodes increase and the flow of electrons also increases.

38(3)

When the electron jumps from any orbit to second orbit, then wavelength of line obtained belongs to Balmer series.

39(2)

Conservation of mass no. and charge holds true

$A \rightarrow B$

$Z_B = Z_A - 2$

$M_B = M_A - 4$

$B \rightarrow C + 2e$

$Z_C = Z_B + 2 = Z_A$

$M_C = M_B = M_A - 4$

Different mass, but same atomic No. Therefore, A and C are isotopes.

40(2)

At highest point only horizontal component of velocity remains

$\Rightarrow u_x = u \cos q$

$u_x = u \cos q$

$\theta = 90° - 60° = 30°$
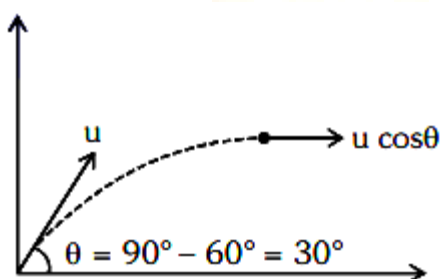
$U_x = u \cos \theta = 10 \cos 30^0$

$= 5\sqrt{3}$ ms^{-1}

41(1)

The isotones have same number of neutrons.

In given options $_{34}Se^{74}$ has $74 - 34 = 40$,

$_{31}Ga^{71}$ has $71 - 31 = 40$,

$_{38}Sr^{84}$ has $84 - 38 = 46$,

$_{38}Sr^{86}$ has $86 - 38 = 48$,

$_{42}Mo^{92}$ has $92 - 42 = 50$,

$_{40}Zr^{92}$ has $92 - 40 = 52$,

$_{20}Ca^{40}$ has $40 - 20 = 20$,

and $_{34}Se^{74}$ has $32 - 16 = 16$ neutrons.

Hence isotonic pair is of $_{34}Se^{74}, _{31}Ga^{71}$

42(1)

Half-life of X

$\Rightarrow T_X = 20$ years

$\dfrac{N}{N_0} = \dfrac{1}{1+7} = \dfrac{1}{8} = \dfrac{1}{2^n} = \dfrac{1}{2^3}$

$n = 3 = \dfrac{1}{T} = \dfrac{1}{20}$

$t = 60$ years

43(3)

If A=1 and B=1 then the output Y=0, For all remaining combinations of input, the output is 1

We can see that Y=$\overline{AB}$ will satisfy the given truth table.

Therefore the given truth table represents NAND gate,

44(3)

The output of a OR gate is $\gamma = A + B$.

45(3)

Base current changes from 100μ A to 300 μ A

Current changes from 10 mA to 20 mA

So, we can write now

$\Delta I_B = 200 \mu A$

$\Delta I_C = 10 mA$

Now,

Current gain $(\beta) = \dfrac{\Delta I_C}{\Delta I_B} = \dfrac{10 \times 10^{-3}}{100 \times 10^{-6}} = \dfrac{10^{-2}}{10^{-4}}$

$= 100$

46(3)

When the new mas is hanged to the wire, the force exerted on the wire is:

F=mg

The initial length of the wire is L and the new length is L_1.

We know that the Young's modulus is given as:

$Y = \dfrac{FL_0}{A\Delta l}$

Here, L_0 is the initiallength of wire and Δl is the chnage in length of wire.

Substitute the values:

$Y = \dfrac{mg \times L}{A \times (L_1 - L)}$

So, $Y = \dfrac{mg \times L}{A \times (L_1 - L)}$

$\therefore v_2 = 4v$

47(3)

Acceleration due to gravity at height h,

$g_h = g_0\left(1 - \dfrac{2h}{R}\right)$

Acceleration due to gravity at depth d,

$g_d = g0\left(1 - \dfrac{d}{R}\right)$

$g_h = g_d$

$g_0\left(1 - \dfrac{2h}{R}\right) = g_0\left(1 - \dfrac{d}{R}\right)$

$d = 2h$

$d = 2 \times 1$ km

$d = 2$ km

48(2)

Out put of AND gates are $A \cdot \overline{B}$ and $\overline{A} \cdot B$.

Hence output of NOR gate will
be $A \cdot B + A \cdot B$.
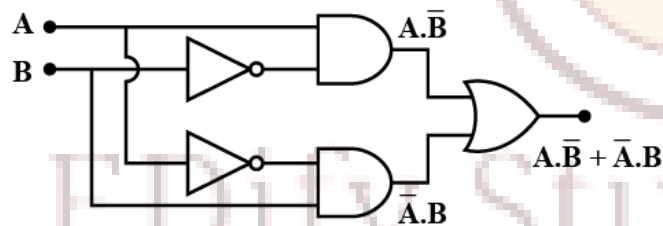
49(4)

Fuse wire has less melting point so when
excess current flows, due to heat
produced in it, it melts.

50 (1)

Escape velocity from the Earth's surface,

$v_e = \sqrt{\dfrac{2GM}{R}} = \sqrt{\dfrac{2G}{R} \times \dfrac{4}{3}\pi R^3 \rho}$

$\Rightarrow v_e = \sqrt{\dfrac{8\pi G\rho}{3}} R^2$

$\therefore v_e \propto R$ \qquad (For same density)

$\dfrac{v_1}{v_2} = \dfrac{R_1}{R_2}$

$\dfrac{v}{v_2} = \dfrac{R}{4R}$

51(1)
At STP, 22.4 LH_2 = 6.023 x 10^{23}
molecules

52(1)
Ionisation $= \frac{13.6Z^2}{n^2} = \frac{13.6 \times 2^2}{1^2}$ = 54. 4 eV

53(2)
In an atom, for any value of n, the values
of l = 0 to (n - 1).
For a given value of l, the values of ml = -
l to 0 to +l and the value of s = +1/2 or -
1/2.
In option (b), l = 2 and m_l = -3
This is not possible, as values of la,
which are possible for l = 2 are -2, -1, 0,
+1 and +2 only.

54(2)
Na^+, Mg^{2+}, O^{2-} and F^- all are isoelectronic
but Mg $^{2+}$
 have 12 protons in his nucleus, so the
attraction force on last shell is maximum
and hence it have smallest size.

55(2)
Sigma bond is stronger than π-bond
because of better overlap. All single
bonds are σ bonds and all multiple
bonds contain one σ and other π bonds.

56(2)
Correct answer is (b) 3-Methylbut-1-ene
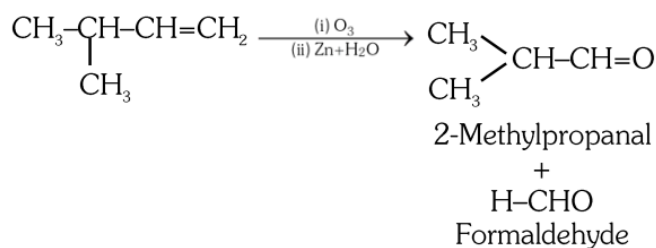
57(4)
Like O_2 molecule, sulphur (atomic
number = 16) exists as S_2 molecule in a
vapour state and it is paramagnetic due
to the presence of two unpaired electrons
in antibonding π molecule orbitals.

58(4)
Going from N_2 to N_2^+ , bond order
decreases from 3 to 2.5.
Going from C_2 to C_2^+ , bond order
decreases from 2 to 1.5.
Going from N_O to NO^+, bond order
increases from 2.5 to 3, and the
magnetic behavior changes from
paramagnetic to diamagnetic.
Going from O2 to O_2^+ , bond order
increases from 2 to 2.5, but magnetic
behavior does not change. Both of these
species are paramagnetic.

59(1) According to Boyle's Law, we know
that:

$P_1V_1 = P_2V_2$
Here, P_1 = 400 torr
V_1 = 500 mL = 0.5 L   [1mL = 0.001L]
V_2 = 3L
To find P_2

$P_2 = (P_1V_1)/V_2$
= (400*0.5)/3 torr
= 66.67 torr

Again P_1' = 600 torr
V_1' = 666.6 mL = 0.6666 L

So, P_2' = $(P_1'V_1')/V_2$
       = (600*0.6666)/3 torr
       = 133.32 torr

Total pressure = $P_2 + P_2'$
            = (66.67 + 133.32) torr
            = 200 torr

60(3)
A → Products
Initial conc. A_0 = 0.1M
Conc. After $5minA_t$= 0.001M
t=5min.
For first order reaction
$K= \frac{2.303}{t}\log\left(\frac{A_0}{A_t}\right)$
$= \frac{2.303}{t}\log\left(\frac{0.1}{0.001}\right)$
$K=0.9212min^{-1}$

61(4)
$Br_{2\ (l)}+Cl_{2(g)} \rightarrow 2BrCl(g)$

$\triangle H = 30 KJ/mol = 30 \times 10^3$ J/mol
$\triangle S = 105 J/K/mol$
Since, $\triangle G = 0$, then only system is at equilibrium.
So, $\triangle G = \triangle H - T\triangle S$

At equilibrium, $\triangle H = T\triangle S$

$T_{eq} = \dfrac{\Delta H}{\Delta S} = \dfrac{30 \times 10^3}{105} = 285.7K$

62(2)
Correct answer is (b) +7 to +4

$$KMnO_4 + I^- \xrightarrow[\text{or weak alkaline medium}]{\text{Neutral}} MnO_2 + IO_3^-$$
$$\underset{+7}{\downarrow} \qquad\qquad\qquad\qquad \underset{+4}{\downarrow}$$

Change +7 to +4

63(1)
V=10L
$W_{O_2} = 64g$
T=2⁰C → $T = 2^0C$
$n_{O_2} = 2$
R=0.083.L bar $K^{-1}mol^{-1}$

Ideal gas equation PV=nRT
$P = \dfrac{2 \times 0.0831 \times 300}{10}$
P=4.9 bar

64(1)
$BaCl_2$ is made up of $Ba(OH)_2$ and HCl. $AlCl_3$ is made up of $Al(OH)_3$ and HCl. LiCl is made up of LiOH and HCl. $BeCl_2$ is made up of $Be(OH)_2$ and HCl. $Ba(OH)_2$ is strongest base among the given options thus have maximum pH.

65(2)
Water is a polar solvent and have dielectric constant 80.
As NaCl is a polar compound and like dissolves like so, forces of attraction between Na^+ and Cl^- ion will reduce to 1/80 in water.

66(1)
In case of $MgSO_4$ hydration energy is higher than the lattice energy. Hydration enthalpies of alkaline earth metal ions decrease with increase in ionic size down the group. Lattice energy also decreases as the size of cation increases. But in case of large size anion such as SO_4^{2-} and the small changes in cation size do not alter the lattice energy, i.e., lattice energies are about the same. For $BeSO_4$ and $MgSO_4$
, hydration enthalpies of Be^{2+} and Mg^{2+} ions are higher than that of their lattice enthalpies.

67(4)
Boron Nitride (BN) resembles the structure of graphite.

Boron nitride   **Graphite**

68(4)
1^0 ,2^0,3^0 Alcohol are distinguished by Lucas test on the basis of the time taken for turbidity to appear

$$R-CH_2-OH \xrightarrow{\text{Conc. HCl + Anhy.ZnCl}_2} R-CH_2-Cl$$
1° alcohol   (Turbidity in 30 min.)

$$\underset{R}{\overset{R}{>}}CH-OH \xrightarrow{\text{Conc. HCl + Anhy.ZnCl}_2} \underset{R}{\overset{R}{>}}CH-Cl$$
2° alcohol   (Turbidity in 5 min.)

$$\underset{R}{\overset{R}{\underset{|}{R}}}CH-OH \xrightarrow{\text{Conc. HCl + Anhy.ZnCl}_2} \underset{R}{\overset{R}{\underset{|}{R}}}C-Cl$$
3° alcohol   (Immediate turbidity appears)

Reactivity of alcohol towards Lucas reagent

$\Rightarrow 3^0 > 2^0 > 1^0$ Alcohol

69(2)

$$\overset{1}{C}H_2 = \overset{2}{C}H - \overset{3}{C}H_2 - \overset{4}{C}H_2 - \overset{5}{C} \equiv \overset{6}{C}H$$

The double bond gets priority over triple bond. Therefore correct IUPAC name is 1-hexene-5-yne.

70(1)

Both geometrical isomerism (cis-trans form) and optical isomerism is possible in the given compound.
No. of optical isomer = 2^n = 2' = 2(n = no. of asymmetric carbon)
Total no. of stereoisomers = 2 + 2 = 4

71(2)
$$3O_2(g) \rightleftharpoons 2O_3(g)$$
$$K_c = \frac{[O_3]^2}{[O_2]^3}$$
$$3 \times 10^{-59} = \frac{[O_3]^2}{(4 \times 10^{-2})^3}$$

$$[O_3]_2 = 3 \times 10^{-59} \times 64 \times 10^{-6}$$

$$= 19.2 \times 10^{-64}$$
$$= 4.38 \times 10^{-32}$$

72(4)
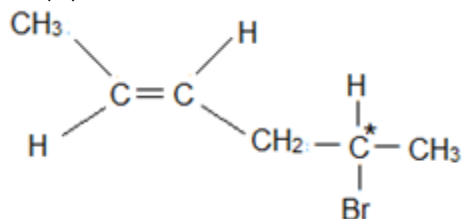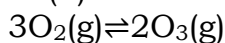- Huckel's rule states that, for a compound to be aromatic, the compound should be planar, cyclic, and should have (4n+2) pi electrons that should be in continuous delocalization or an uninterrupted cyclic pi-electron cloud should be there. Here n=0,1,2......
So if we put n=0,we get 2 pi electrons
If we put n=1, we get 6 pi electrons
If we put n=2, we get 10 pi electrons and so on

- Benzyl free radical is aromatic as per Huckel's rule it has 6 electrons present in the p-orbital of carbon atoms involved in the formation of the benzene ring (Aromatic nature).
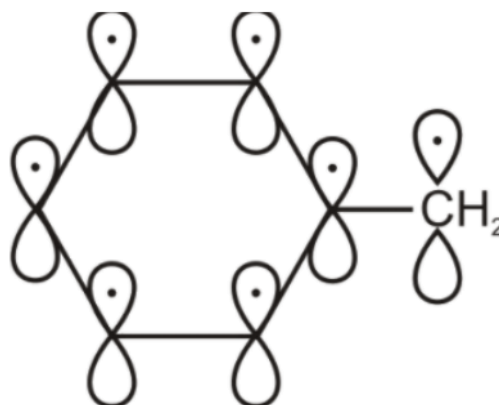
- In the above case, it is aromatic, because it is planar, cyclic, and has 6 pi electrons which are in continuous delocalization. And hence satisfying the condition of Huckle's rule of aromaticity that is why the radical does not involve in the resonance.

73(3)
Here given unit cell is shared equally by six faces n the fcc which is shared equally by six different unit cells.
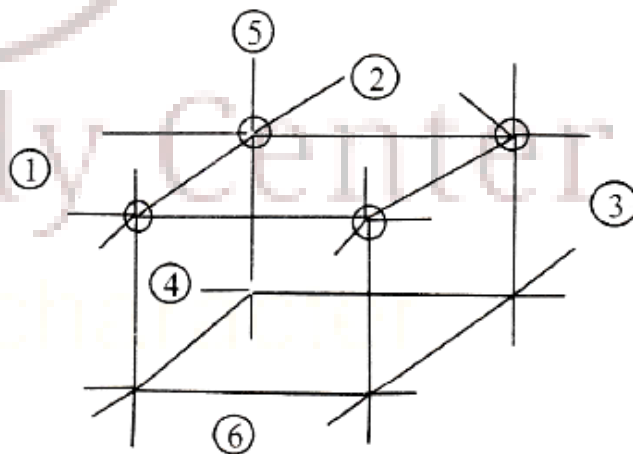
74(1)
As,
$$\frac{P^0 - P}{P^0} = \frac{\frac{w}{m}}{\frac{w}{m} + \frac{W}{M}}$$

P^0 = vapour pressure of pure component
P = vapour pressure in solution
w = mass of solute,
m = mol. wt. of solute
W = mass of solvent,
M = mol. wt. of solvent

$$\Rightarrow \frac{121.8-120.2}{121.8} = \frac{\frac{15}{m}}{\frac{250}{78}}$$

$$\Rightarrow m = 356.7g$$

75(4)

$$\pi v = \frac{W}{m} RT$$

$$2.57\times10^{-3}\times\frac{200}{1000} = \frac{1.26}{m}\times0.083\times300$$

$$m = 61038 \text{ gm mol}^{-1}$$

76 (3)

More – I , - M more acidic.

77(4)

Since a catalyst affects equally both forward and backward reactions, therefore it does not affect equilibrium constant of reaction.

78(3)

More than ΔH

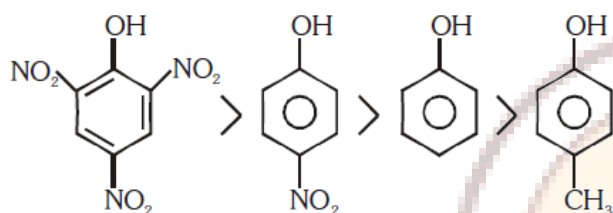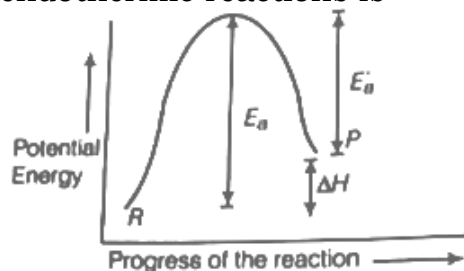In endothermic reactions, energy of reactants is less than that of the products. Potential energy diagram for endothermic reactions is

Where

E_a = activation energy of forward reaction

E'_a = activation energy of backward reaction

ΔH = enthalpy of the reaction.

From the above diagram,

$E_a = E'_a + \Delta H$

Thus, $E_a > \Delta H$

79 (2)

$$\lambda = \frac{c}{v}$$

$$\lambda = \frac{3\times10^8}{1368\times10^3} = 219.298 \text{ m} = 219.3 \text{ m}$$

80(1)

$PH_4I + NaOH \rightarrow NaI + PH_3 + H_2O$
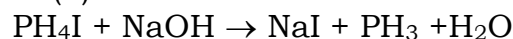
81(3)

Ammonium sulphate is a salt of strong acid (H_2SO_4) and weak base (NH_4OH). Therefore, repeated use of ammonium sulphate would increase the concentration of sulphuric acid, while ammonia from NH_4OH is used up by the plant. Hence the acidity of soil will increase.

82(3)

Let the Ox. no. of Cr in $K_2Cr_2O_7$ be x.

We know that, Ox. no. of K=+1

Ox. no. of O=−2

So, 2(Ox.no.K)+2(Ox.no.Cr)+7(Ox.no.O)=0

2(+1)+2(x)+7(−2)=0

or +2+2x−14=0

or 2x=+14−2=+12

or x=+12/2 =+6

Hence, oxidation number of Cr in $K_2Cr_2O_7$ is +6.

83(1)

$Cr^{3+} = 3d^3 =$ coloured

$Ti^{3+} = 3d^1 =$ coloured

$V^{3+} = 3d^2 =$ coloured

Sc^{3+} has electron configuration of [Ar] $4s^03d^0$. Therefore without any unpaired electrons it forms a colorless solution in aqueous medium.

84(3)

In the electrochemical series, Cu is below hydrogen.

Hence, it has positive value of standard reduction potential ($E_{M^{2+}/M}$).

The standard reduction potentials are given below.

Ni(Z=28)   - 0.257 V

Cu(Z=29)   + 0.337 V
Fe(Z=26)   - 0.440 V
Co(Z=27)   - 0.280 V

85(4)
All metal carbonyls are diamagnetic
cyanide complexes are also diamagnetic.
Cyanide ion and Carbonyls are strong
field ligands causing d-orbital electrons
of metal ion to pair up.

SECTION : B

86(1)
Number of octahedral and tetrahedral voids formed by N closed packed atoms are N and 2N respectively.

Each hexagonal unit cell contains 6 atoms therefore, number of tetrahedral and octahedral voids are 12 and 6 respectively.
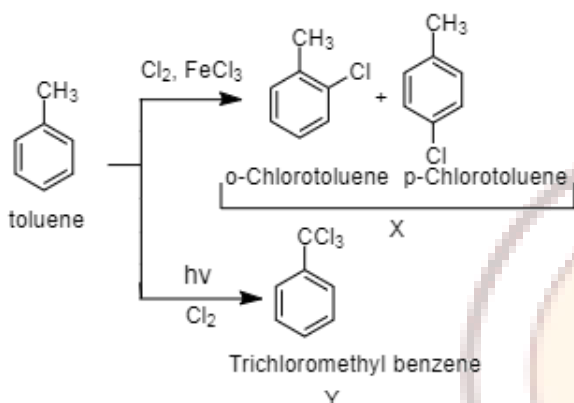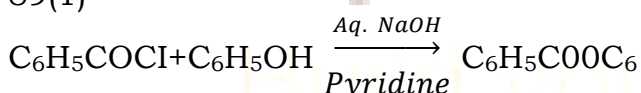
87(4)

88(4)
Dimethylammonium acetate is a salt of weak acid and weak base whose pH can be calculated as

pH = 7 + $\frac{1}{2}$(pK$_a$ − pK$_b$)

= 7 + $\frac{1}{2}$ (4.77-3.27)

= 7.75

89(1)

$C_6H_5COCI+C_6H_5OH \xrightarrow[Pyridine]{Aq.\ NaOH} C_6H_5COOC_6H_5+HCI$

90(4)
Acetaldehyde reacts with hydrogen cyanide (HCN) to form cyanohydrin (CH$_3$CH(OH)CN) which on hydrolysis forms a racemic mixture of α− hydroxy acid (CH$_3$CH(OH)COOH)

As the cyanohydrin of acetaldehyde contains chiral centre so we will get racemic mixture.

91(4)
When R=CH$_3$−CH$_2$− group in aliphatic amine, the basic strength in aqueous phase would be 2^0 >3^0 > 1^0 > NH$_3$

The basicity of an amine in aqueous solution depends upon the stability of the ammonium cation, which in turn depends upon a combination of the following three factors:
(1) +I effect of the alkyl group
(2) Extent of hydrogen bonding with water molecules.
(3) Steric effect of the alkyl groups

In the aqueous phase, the substituted ammonium cations gets stabilized not only by (+I) effect of the alkyl group but also by solvation with water molecules.

92(1)
As (A) gives alcohol on treatment with nitrous acid thus, it should be primary amine. C$_3$H$_9$N has two possible stuctures with −NH$_2$ group.

$$CH_3 - CH_2 - CH_2 - NH_2 \text{ or } CH_3 - CH - NH_2$$
$$\overset{|}{CH_3}$$
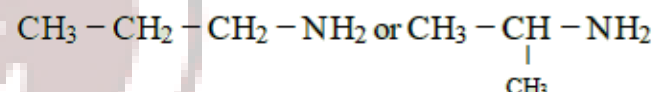
As it gives isopropylmethyl amine thus it should be isopropyl amine not n-propyl amine.

93(2)
=> Enzymes are made of a chain of proteins.
=> These chains are called amino acids.
=> Amino acids are linked together by peptide bonds that exist in a linear chain.
=> Such a structure is often referred to as the peptide chain or the primary structure.
=> When amino acids are formed, the resulting chain structure becomes a polypeptide chain due to the linking of many no. of peptide chains to form a protein.
=> Each peptide chain is endowed with a specific activity to hasten the pace of bio chemical reaction and with a distinct function.
=> A specific order of the amino acid in a protein is encoded in the DNA sequence of the corresponding gene.
=> Enzymes act as a means to detoxify the body and form molecular bonds.

94(3)
Bakelite is the commercial name for the polymer obtained by the polymerization of phenol and formaldehyde. These are one of the oldest polymers that were synthesized by man. Phenol is made to react with formaldehyde.

Also Bakelite is a polymer obtained by the condensation reaction between phenol and formaldehyde. It is a condensation polymer and basic unit of Bekelite is Novolac.

95(2)
Diphenyl hydramine is employed as antihistamine. Other antihistamines used are ranitidine, cimetidine, terfenadine, brompheniramine etc. These drugs prevent the interaction between histamine and receptors in the stomach wall, releasing less amount of acid.

96(1)
$t_{1/2} = \frac{0.693}{10^{-2}}$ seconds
For the reduction of 20 g of reactant to 5 g, two $t_{1/2}$ is required.
$\therefore$ t = $\frac{0.693}{10^{-2}}$ second
=138.6 seconds

97(1)
Dinitrogen Pentaoxide (N_2O_5) is an oxide of Nitrogen which is not a common Pollutant. Dinitrogen pentoxide is an unstable and dangerous oxidiser, which contains only nitrogen and oxygen. It is formed when oxygen and nitrogen react. In the atmosphere it attracts NOX gases that cause depletion of the ozone layer.

98(2)
As we go from left to right in a period ionisation energy increases. 'Be' and 'N' comparatively more stable valence subshell than 'B' and 'O'.
Hence, the correct order of first ionisation enthalpy is:
Li<B<Be<C<O<N<F<Ne
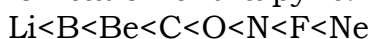
99(4)
Paper Chromatography is a type of partition chormatography. Chormatography paper contains water trapped in it, which acts as the stationary phase. The paper selectively retains different components according to their differing partition in two phases.

100(1)
$N_2 + 3H_2 \leftrightharpoons 2NH_3$ $\qquad$ K_1 ....(1)
$N_2 + O_2 \leftrightharpoons 2NO$ $\qquad$ K_2 ...(2)

$H_2 + \frac{1}{2} O_2 \rightarrow H_2O$ $\qquad$ K_3....(3)
For reaction,

$2NH_3 + \frac{5}{2} O_2 \underset{\longleftarrow}{\overset{K}{\longrightarrow}} 2NO + 3H_2O$ ...(4)
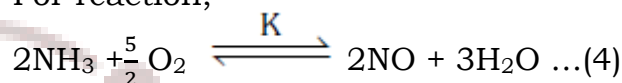
Equation (4) = equation(2) + 3 × equation(3) – equation (1)

$K = \frac{K_2 K_3^3}{K_1}$

Botany
SECTION : A

101(3)
There are three systems of classification, namely artificial, natural and phylogenetic. In natural system of classification, a large number of traits are considered. It is based on morphological, anatomical, cytological, physiological and biochemical characteristics of the organisms. The artificial system of classification is based on observable characteristics of the organisms. The phylogenetic system of classification is based on genetic and phylogenetic relationships between organisms.

102(2)
Zooflagellates are protozoan parasites which possess one to several flagella for locomotion. They are generally uninucleate (occasionally multinucleate), body is covered by a firm pellicle, e.g. Trypanosoma, Leishmania, Trichomonas, etc.

103(4)
Many blue-green algae occur in thermal springs or hot water springs. Temperature tolerance of these thermal blue-green algae is due to homopolar bonds in their proteins. These homopolar bonds help them to survive in extreme temperatures.

104(1)
A plasmid is a small DNA molecule within a cell that is physically separated from a chromosomal DNA and can replicate independently. They are most commonly found as small circular, double-stranded DNA molecules in bacteria.

105(1)
Plasmid is a piece of circular DNA molecule (mostly in bacteria but in yeast also) which is not part of the normal chromosomal DNA of a cell, and is capable of replicating independently.

106(1)
Bacterial leaf blight of rice is caused by Xanthomonas oryzae a bacterium which is gram- negative, aerobic, capsulated, and motile with a single polar flagellum. Primary infection is carried through the infected seeds. The entry of the pathogen occurs through wounds and stomata. The symptoms of the disease is the appearance of linear, yellow to straw coloured stripes, usually on both the edges of the leaf. As the disease progresses, the drying and twisting of the leaf tip occurs. The most destructive phase of the disease is the 'Ikresek' or wilt resulting from early systematic infection.

107(3)
All fungi are heterotrophs as they derive nutrition from other organisms, living or dead. If from living organisms the nutrition is parasitic and if from dead and decaying matter it is saprophytic

108(3)
The winges of seed of Pihus is thin, membranous diploid and develops.jointly from the basal upper surface (adaxial) of ovuliferous scale and outer layer of integurmet of the ovule.

109(3)
Cycas with largest antherozoids and ovule, and the largest plant Sequoia belong to gymnosperms.
Gymnosperm is a group of necked seeded plants i.e., their ovules are not enclosed by ovary walls. Ovules of gymnosperms are directly borned on the megasporophyll.

110(4)
Algae are photosynthetic organisms of the kingdom Plantae.
They possess cell walls made up of cellulose, hemicellulose, and pectins.
The inner layer is made up of cellulose, the middle layer of hemicellulose, and the outer layer of pectins

111(1)

Epipetalous stamens with free filaments and fused anthers occur in asteraceae. Asteraceae possess five stamens with free filaments. This family shows syngenesious condition in which anthers are united forming a tube around the style.

112(1)

Single cotyledon of embryo in cereal grain is represented by scutellum. Coleoptile represents the covering of stem. Coleorrhiza represents the covering of root.

113(3)

The mode of arrangement of the sepals or petals with respect to one another in the floral bud is termed as aestivation. Aestivation is of different types - valvate, twisted or contorted, imbricate, quincuncial, vexillary, convolute, and plicate. In valvate aestivation, sepals or petals or tepals just touch each other without any overlapping. Calotropis, tulip, Asparagus, Colchicum, Petunia, mustard and tobacco have valvate aestivation.

114(1)

Sap wood will decay faster. Sap wood is less durable because it is susceptible to attack by pathogen and insects.

115(3)

Pollen exine is resistant to enzyme acition. The pollen wall is consisted of two layers, the outer exine and inner intine. The exine is chiefly made up of sporopollenin, which is derived by the oxidative polymerisation of carotenoids. Sporopollenin is one of the most resistant biological materials known. Exine is thin in beginning but become very thick with maturity.

116(1)

They are the most abundant and widely distributed in the body of complex animals.
They are named connective tissues because of their special function of linking and
supporting other tissues/organs of the body.
They range from soft connective tissues to specialized types, which include cartilage, bone,
adipose, and blood.
They are composed of extracellular fibres, a matrix called ground substance, and cells
such as macrophages, mast cells, fibroblast,

117(4)

From the given four options cell junctions come across most frequently in the preparation of ciliated epithelium. A cell junction is a structure within a tissue of a multicellular organism. Cell junctions are especially abundant in epithelial tissues. They consist of protein complexes and provide contact between neighbouring cells, between a cell and the extracellular matrix, or they built up the paracellular barrier of epithelia and control the paracellular transport. Ciliated epithelium is a region of epithelium consisting of columnar or cuboidal cells bearing hairlike appendages that are capable of beating rapidly. Ciliated epithelium performs the function of moving particles or fluid over the epithelial surface in such structures as the trachea, bronchial tubes, and nasal cavities. It often occurs in the vicinity of mucus-secreting goblet cells. The other three (thrombocytes, tendon and hyaline cartilage) belongs to connective tissue. Connective tissue is widely distributed and has many functions including support, packing, defence and repair. Thrombocytes or platelets aid the formation of blood clots by releasing various protein substances. Tendon attaches a muscle to a bone and hyaline cartilage consists largely of glycosaminoglycan, giving a shiny glass

like appearance and gives flexibility and support at the joints.

118(1)
The numerical aperture of a microscope objective lens is a measure of its ability to accept the light and resolve fine specimen detail at a fixed object distance. It is an important parameter to any optic fibers. It determines the resolving power of the objective. The higher the NA of the total system, the better the resolution. The magnification does not depend on numerical aperture.

119(2)
glyoxylate cycle

120(3)
Proline is a secondary amino acid which is not found in plasma membrane.

121(2)
Glycocalyx or pericellular matrix is a carbohydrate-enriched coating of glycoprotein and a glycolipid that covers the cell membranes of few bacteria, epithelial cells and other cells.
It is mainly used in the recognition of the cell (distinguish between healthy and diseased cells) and also regulates the endothelial vascular tissues.

122(1)
Microtubules are one of the essential protein filaments of the cytoskeletons of probably all eukaryotic cells and their cilia, flageIla, basal bodies, centroles and mitosis and meiosis spindles. Each microtubule is made up of a hollow cylinder of 13 protofilaments of the tubulin protein. The diameter of each microfibril is 25 nm. The function of microtubule is to guide organelle and chromosome movement in the cell, cause cell elongation and help in movements of cilia/flagella.

123(3)
Water movement between cells is due to DPD. If a cell is placed in pure water it shows endosmosis and as a result water enters into the cell. Thus, the osmotic entry of water is due to high osmotic pressure of the cell sap. The inward movement of water is, therefore due to the fact that it's OP > TP. The net force with which water is drawn into a cell is equal to the difference of OP and TP, known as diffusion pressure deficit. DPD = OP - TP.

124(4)
Sulphur is an important nutrient for optimum growth and productivity in Pulse crops. Sulphur is constituent of certain amino acids. The amino acids form the protein by polymerisation. The pulses are rich in protein.

125(1)
Boron is required by plants for (i) uptake and utilisation of Ca^{2+} (ii) pollen germination and cell differentiation (iii) carbohydrate translocation.

126(3)
A chlorophyll molecule consists of two parts, the porphyrin ring (head) 15 x 15Å and a phytol tail (20Å).

127(1)
Cholophyll has a tetrapyrrole porphyrin head and a long chain alcohol called phytol tail. Each pyrrol is a 5 member ring with one nitrogen and four carbon. A non-ionic Mg atom lies in the centre of porphyrin, attached to nitrogen atoms of pyrrole rings. Chlorophyll -α has methyl group at carbon 3 of pyrrole ring and Chlorophyll -β has formyl (aldehyde) group attached to this atom.

128(3)
Light reaction of the photosynthesis starts from the excitation of chlorophyll by a photon. When a photon of light energy falls on chlorophyll molecule, it gets excited and moves on to a higher level called excited singlet state. The electron gap in the photosystem is further filled by the process of photolysis. The extra pigments capture light energy and pass on the captured light energy to

a specific chlorophyll a molecule called as reaction centre. The reaction centre of photosystem II is called P_{680}, whereas reaction centre of photosystem I is called P_{700}. In photosystem II the electrons emitted by reaction centre are first captured by pheophytin whereas in photosystem I, the electrons emitted by reaction centre are first captured by iron sulphur protein.

129(2)
Aerobic respiration is the process of complete oxidation of organic foods into carbon dioxide and water in presence of oxygen. It has three steps: Glycolysis - occurs in the cytoplasm, common in both aerobic and anaerobic respiration. One glucose molecule is broken into two molecules of pyruvates. The net ATP produced is 8. Krebs cycle - it is the citric acid cycle and the process of oxidation and degradation of acetate which is obtained from pyruvate. The net ATP produced is 24 ATP. Terminal oxidation - It has different carriers of electrons which creates an electron gradient in the membranous matrix. So, the correct option is ' 38 ADP molecules and 38 ATP molecules'.

130(2)
Complete oxidation of one mole of glucose yields = 686 kcal.
Chemical energy available in high energy phosphate bonds of one mole of ATP = 12 kcal.
ATP molecules maximally generated from one molecule of glucose = 686/12 = 57 ATP molecules.

131(3)
Ethylene is a hormone which is used for ripening of fruit. In case of unripe banana, it can be made to ripe before proper time if they are kept in ethylene atmosphere. Uncontrolled application of this gas many spoil the fruits. Ethylene is produced in mature but unripe fruits and then it initiates a chain of reactions that finally lead to ripening

132(1)
Phytochromes are the plant chromoproteins, containing protein pigment existing in two inter-convertible forms-Pr (absorbs red light -660 nm) and Pfr (absorbs far red light-730 nm). It controls flowering, seed dormancy, etc.

133(4)
The device which can remove particulate matter present in the exhaust from a thermal power plant is Electrostatic Precipitator.

134 (4)
Homologous chromosomes are similar in gene position but may contain different alleles (different versions of the same gene). Offspring receives one homologous chromosome from the mother; the other is inherited from the father. The homologous chromosome pairs during prophase I of meiosis. This pairing is known as synapsis.

135(1)
The process of fusion between the haploid male nucleus and egg nucleus is known as amphimixis. It is also known as syngamy or fertilization which leads to the formation of a diploid zygote. It leads to the recombination of character which causes variation. It is a mode of sexual reproduction.
The fusion of cytoplasm takes place in the process of plasmogamy. The cytoplasm of two parent cells fuses together without the fusion of nuclei, effectively bringing two haploid nuclei close together in the same cell.
The process of fusion of two similar spores or gametes is known as isogamy. The process of fusion of two dissimilar spores or gametes is known as anisogamy.

SECTION : B

136(3)

Archesporium is a cell or cell structure in a sporophyte from which spores may later develop during the alternate generation. Archesporium cell divides into the primary parietal cell which later forms the anther wall and primary sporogenous cells which form the microspore mother cell.

137(1)

One hypodermal nucellar cell of the micropylar region of ovule differentiates as the sporogenous cell. It forms a diploid megaspore mother cell or megasporocyte. The megaspore mother cell undergoes meiosis and forms a row of four haploid megaspores. Only the chalazal megaspore remains functional while the other three degenerate.

138(3)

A typical and usual yeast chromosome contains 5 to 7x 10^8 daltons of DNA. It is a eukaryote. It is also used as a cloning vector.

139 (2)

Any of the over 144,000 species of fungi, which also includes yeasts, rusts, slime molds, mildews, and mushrooms. Additionally, there are several fungus-like species that do not actually belong to the kingdom of Fungi but are frequently referred to as fungi, such as slime molds and oomycetes (water molds).
Eukaryotic, non-vascular, immobile, heterotrophic creatures are fungi.
They might be filamentous or unicellular.
They spread spores to reproduce.
The phenomenon of generational alternation is seen in fungi.
Since fungi lack chlorophyll, they are unable to carry out photosynthesis.

140(2)

Carbon monoxide when inhaled combines with haemoglobin more rapidly than oxygen. It blocks the oxygen transport by forming stable compound carboxyhaemoglobin. Its prolonged inhalation may lead to death.

141(1)

Due to heavy industrialization and transportation (modernization), CO_2 concentration is increasing day by day in the atmosphere. CO_2 has capacity of absorbing heat radiations and thus increases temperature. This increase in global temperature (global warming) is mainly due to CO_2 concentration and is called 'green house effect'. Besides CO_2 other important gases associated with green house effect are CH_4 (methane), oxides of nitrogen (NOv), CFCs (chlorofluorocarbons) and O_3 (ozone) and these are called 'green house gases'. Relative contribution of these gases to global warming are: CO_2 (50%), CFCs (20%), CH4 (16%), O_3 (8%), nitrous oxide (6%).

142(4)

Genes for flower colour in snapdragon shows incomplete dominance which is an exception of Mendel's first principle i.e. Law of dominance. Whereas Law of segregation is universally applicable.

143(1)

Volvox is a unicellular green alga found in freshwater bodies. It is photosynthetic in nature. It forms colonies of around 50,000 cells which are spherical in shape.

144(2)

Diatoms are chief producers in the oceans.
Dinoflagellates are marine but they are responsible for red tides and they also release toxins that kill marine animals such as fish.
Majority of euglenoids are freshwater organisms found in stagnant water.

145(3)

The ciliates are a group of protozoans characterized by the presence of hair-like organelles called cilia. Cilia are used for locomotion and food gathering. Another

characteristic of ciliates that differ from all other protozoans is having two types of nuclei, namely somatic macronucleus and germline micronucleus.

146(4)
Relative contribution of various greenhouse gases to total global warming is
· CO_2 =60%
· CH_4 =20%
· CFC=14%
· N_2O=6%
⇒ Therefore CO_2 and CH_4 are the major greenhouse gases.

147(3)
In Pteridophyte, megaspore is retained for some times in female gametophyte, however the permanent retention is required for seed formation in Gymnosperms.
That's why Pteridophytes exhibit precursor to seed habit only.

148. (2)
(A) Sporophyte is more developed in mosses rather than liverwort.
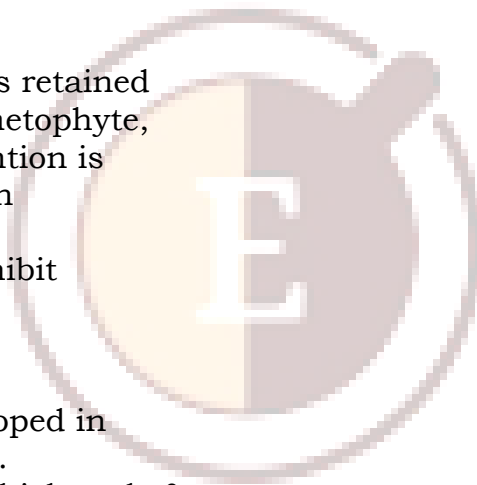(C) Pinus is monoecious in which male & female cones are borne on different branches.

149. (1) sweet pea, bignonia, Nepenthes, Utricularia

150 (3)
The correct sequence for transport of sperm cells in male reproductive system is

Seminiferous tubules →→ Rete testis →→ Vasa efferentia →→ Epididymis →→ Vas deferens →→ Ejaculatory duct →→ Urethra →→ Urethral meatus

ZOOLOGY SOLUTION
SECTION : A

151(4)
Gambusia sp. of fish is used in biological control of mosquitoes This fish acts as a biocontrol by eating the larvae of mosquitoes.

152(2)
Organisms that give rise to young ones are called viviparous and organisms that lays egg are called oviparous. Mammals generally give birth to young ones. Oviparous mammal is platypus and echidna.

153(3)
Closed circulatory system occurs in cuttle fish, i.e. Sepia, cephalopods are the only molluscs with a closed circulatory system. They have two gill hearts (also known as bronchial hearts) that move blood through capillaries of the gill. A single systemic heart pumps the oxygenated blood through rest of the body .

154(2)
The unique feature of mammals is the presence of diaphragm. It is a membrane that separates thoracic cavity from abdominal cavity. The cavity of other animals is not divided into thoracic and abdominal cavities. Homeothermy, four chambered heart and rib cage are the characters of mammals as well as some other animals also.

155(3)
Ascidians are tunicates that belong to the phylum Chordata. They contain notochord in their larval stage and gradually replaced by a single elongated solid nerve ganglion called cerebral ganglion.
All the vertebrates fishes, amphibians, reptiles, birds, mammals have the notochord in the developing stage but replaced by vertebral column later.

The larval stage of frog has notochord which is replaced by the vertebral column in adult front.
In humans notochord is present in foetal life.
Amphioxus is a cephalochordate which has notochord throughout its life.

156(3)
Autoradiography is the study of labelled precursors like 3H by knowing the movement of radioactivity with the help of photographic films and emulsions at short intervals. Radioactive material like tritiated thymidine which is formed by replacing normal hydrogen of thymidine with H^3 (heavy isotope of hydrogen). Thymidine only is used for this purpose because RNA will not be labelled by this.

157(3)
Endonucleases hydrolyse internal phosphodiester bonds in a polynucleotide chain. Function of nucleases is to break phosphodiester bond. A nuclease is an enzyme capable of cleaving the phosphodiester bonds between the nucleotide subunits of nucleic acids. Nucleases are usually further divided into endonucleases and exonucleases, although some of the enzymes may fall in both categories.

158(1)
Brunner's glands are present in the duodenum region of small intestine. They secretes two hormones secretin and cholecystokinin. Secretin is secreted by cells in the duodenum when they are exposed to the acidic contents of the emptying stomach. It stimulates the exocrine portion of the pancreas to secrete bicarbonate into the pancreatic fluid (thus neutralizing the acidity of the intestinal contents). Cholecystokinin (CCK), a mixture of peptides, is secreted by cells in the duodenum when they are exposed to food. It acts- - on the gall bladder stimulating it to contract and force its contents of bile into the intestine. - on the pancreas stimulating

the release of pancreatic digestive enzymes into the pancreatic fluid.

159(1)
After digestion, most of the monosaccharides are absorbed into the body via active transport using sodium ions. Fructose is absorbed via facilitated diffusion. Amino acids are absorbed via secondary active transport using sodium ions. Chylomicrons cannot enter blood capillaries and hence enter lacteals. Only 5% of starch is hydrolyzed in the mouth. Proenzyme pepsinogen is secreted by chief cells in the stomach.

160(3)
Inspiratory Capacity (IC) is the maximum amount of air that can be inspired after a normal expiration IC = TV + IRV. It is 3500 mL in adult male and 2400 mL in adult female. Residual Volume (RV) is the amount of air remaining in the lungs after a forced exhalation. It average value is 1200 mL and 1100 mL in adult male and female respectively.

161(3)
Lymph is a fluid, which contains plasma and WBC, and it is characterized by absence of RBCs, presence of more WBCs and insoluble proteins and it is a part of tissue fluid. It's main function is to return intestinal fluid back to the blood.
Transport of oxygen and CO_2 takes place with the help of blood.

162(1)
Blood serum does not contain fibrinogen and a few other clotting factors, so it will not coagulate.

163(2)
Uric acid is least soluble nitrogenous waste and 1 g of it needs only 10 mL of water to be expelled out of body. Another advantage of it is that it is least toxic among all nitrogenous wastes and can be retained in the body for longer period, so it is of greater advantage to animals

which have limited access to water like birds and lizards.

114(1)
When someone drinks a lot of water, ADH release is suppressed Antidiuretic hormone (ADH) or vasopressin increases the reabsorption of water in the distal convoluted tubule, collecting tubules and collecting ducts of the nephrons in the kidneys. As a result, the reabsorption of water from the glomerular filtrate is increased. When someone drinks a lot of water, requirement of absorption of water decreases, so ADH release is suppressed.

165(1)
The pelvic girdle is formed by two innominate bones (hip bones). Each innominate bones consists of three separate bones, ilium, ischium and the pubis.

166(2)
Anesthetic molecules interact with the sodium channels directly, from the inner side of the nerve membrane. It binds within sodium channels that have opened during membrane depolarization, preventing the normal sodium ion flux. Thus, it prevents the action potential and conduction of signals.

167(1)
When a person entering an empty room suddenly finds a snake in front, epinephrine and norepinephrine will be secreted from adrenal medulla. They act as neurotransmitters and activate sympathetic nervous system which will induce fight or flight responses in the body. This will lead to increase in alertness, heartbeat and strength of heart contraction.

168(2)
Cleavage is a succession of rapid mitotic cell division of zygote after fertilization resulting in the formation of multicellular blastula. In cleavage division, the interphase is short and does not involve growth. Thus, the resulting blastomeres

become smaller in size as their number increases.

169(1)
Seminal plasma in human males is rich in fructose and calcium because it provides nourishment and protection to spam and also provides a medium for transport.

170(3)
In the process of development of the test-tube baby programme, the fusion of gametes occurs outside the body.
The fusion is performed in a petri dish and then after the formation of 8-celled blastomere, which is a zygotic stage, it is implanted in the woman.
This is called intra-uterine transfer where the zygote is directly introduced in the fallopian tube called zygote intra-fallopian structure (ZIFT).
After ZIFT, the zygote develops inside the mother.

171(2)
Self breeding – fusion of male and female gametes of same plants.
Inbreeding – crossing of two parents of same varities.
Hybridisation – Crossing two parents of different species or genera is called Hybridisation.
Heterosis – Superior of the progeny over parents in all aspects is called Heterosis.

172(2)
Homologous structures have the same embryonic origin and basic structure, though they mayor may not perform the same function. Homologous structures shows that the animal which possess them have common ancestory and show evolution by divergence from the ancestral type. Vestigial organs are those which have ceased to be any use to their possessor but still persist generation after generation in a reduced form. They are retrogressive organs but were well developed and functional in the ancestors.

173(1)
Convergent evolution is the process through which organisms that are not closely related gain comparable traits independently as a result of needing to adapt to similar environments or ecological niches.
When distinct species independently develop similar features, this is known as convergence in evolution. Sharks and dolphins, for instance, resemble each other somewhat while being completely unrelated.

174(3) AIDS (acquired immunodeficiency syndrome) is caused by the HIV virus.
HIV (Human immunodeficiency virus)belongs to the special class of viruses called retrovirus.with in this class HIV is placed in a subgroup called lentivirus.
HIV consists of a viral envelope.with in the viral envelope 2 identical copies of single-stranded RNA are a present and reverse transcriptase enzyme. Hence HIV has a protein coat and a genetic material which is ss RNA.

175(3)
Antibody are members of a class of proteins known as immunoglobulins. Immunoglobulins are glycoproteins in the immunoglobulin superfamily. The terms antibody and immunoglobulin are often used interchangeably. They are found in the blood and tissue fluids, as well as many secretions. In structure, they are globulins (in the y-region of protein electrophoresis). They are synthesized and secreted by plasma cells that are derived from the B cells of the immune system. B cells are activated upon binding to their specific antigen and differentiate into plasma cells. In some cases, the interaction of the B cell with a T helper cell is also necessary. They are used by the immune system to identify and neutralize foreign objects like bacteria and viruses. Each antibody recognizes a specific antigen unique to its target. Production of antibodies is

referred to as the humoral immune system.

176(2)
Escherichia coli possesses plasmid which encodes genes that may act as selectable markers in transformations. Agrobacterium tumefaciens possesses Ti plasmid that induces tumour formation. These have been used as vectors to transfer foreign genes of interest into the target animal and plant cells.

177(1)
The uptake of foreign DNA or transgenes by plant cells is called transformation. A variety of techniques are used to introduce transgenes into plant cells. One commonly used method is Agrobacterium-mediated gene transfer.

178(3)
The human corpus luteum is a temporary endocrine gland because it secretes progesterone for maintenance of early pregnancy. It develops after ovulation from the ruptured follicle during the luteal phase.

179(2)
Phellem is made up of dead cells.
It is suberised cork cells in which cork cambium or phellogen cut towards the outside.
Xylem parenchyma, collenchyma, and phloem are all made up of living cells.

180(2)
There are various features that are used to differentiate a male cockroach from a female cockroach. These are:
(i) The body of male cockroach is smaller than a female cockroach.
(ii) The abdomen of male cockroach is slender.
(iii) The wings of male cockroach are larger than that of the females.
(iv) The antennae of male cockroach are smaller than that of the females.
(v) Presence of small, unjointed anal styles on the 9th sternum of the abdomen.

(vi) Presence of long, palp-like jointed anal cerci on the 10th tergum of the abdomen.

181(1)
The correct sequence of organs in the alimentary canal of cockroach starting from mount is:
Pharynx → Oesophagus → Crop → Gizzard → Ileum → Colon → Rectum.
So, the correct answer is 'Pharynx → Oesophagus → Crop → Gizzard → Ileum → Colon → Rectum

182(4)
The Bt brinjal is a suite of transgenic brinjals (also known as an eggplant or aubergine) created by inserting a crystal protein gene (Cry1Ac) from the soil bacterium Bacillus thuringiensis into the genome of various brinjal cultivars. The insertion of the gene, along with other genetic elements, such as promoters, terminators and an antibiotic resistance marker gene into the brinjal plant is accomplished using Agrobacterium-mediated genetic transformation. The Bt brinjal has been developed to give resistance against lepidopteron insects, in particular the brinjal fruit.

183 (4) Thrombin is the principal enzyme of hemostasis. It catalyzes the conversion of fibrinogen to fibrin and activates procoagulant factors V, VIII, XI, and XIII.

So, the correct answer is 'XI, VIII, V'.

184(1)
Blood serum does not contain fibrinogen and a few other clotting factors, so it will not coagulate.

185(2)
In mammals, the acrosome reaction releases hyaluronidase and acrosin.
The acrosomal reaction begins when the sperm comes into contact with the oocyte's zona pellucida. Upon coming into contact with the zona pellucida, the acrosomal enzymes begin to dissolve and

the actin filament comes into contact with the zona pellucida.
Hyaluronidase enzymes present on the surface of the sperm helps sperm to enter into the ova through the layer of granulosa cells.

SECTION : B

186. (4)
When the set point of hypothalamus is disturbed by high temperature, it stimulates vasodilation and sweating while in low temperature there is vasoconstriction and shivering.

187 (4)
Total sum of physio-electrochemical changes that takes place along the length
of nerve fibre is known as nerve impulse. Change in potential due to stimulation of nerve fibre is called action potential. During propagation of nerve impulse, Na+ enters
inside so (+ve) change is formed inside the membrane. K+ ions come out.

188. (3) Parietal bone and the temporal bone of the skull are joined fibrous joint.

189. (1) Antiparallel strands of DNA have two strands having phosphate groups at same
positions in space

190. (1)
When some one drinks lots of water, kidney release of ADH is suppressed.

191 (2) (iv) (iii) (ii) (i)

192 (3)
CH_4, H_2 , NH_3 and water vapor at 800°C

193(3)
Filariasis is the disease caused by Wuchereria bancrofti, filarial worm. Amoebiasis/Amoebic dysentery is caused by a protozoan parasite Entamoeba histolytica in the large intestine of human.
Pneumonia is caused by bacteria like Streptococcus pneumoniae and Haemophilus influenzae.
Ringworm is caused by fungi belonging to genera Microsporum, Trichophyton and Epidermophyton.

194 (3) (i) (iii) (ii) (iv)

195 (2)
• Placenta — Human Chorionic Gonadotropin (hCG)
• Zona pellucida — Layer of the ovum
• Bulbo urethral glands — Lubrication of the penis
• Leydig cells — Androgens

196 (2) pO_2 in alveoli is 10^4 mm Hg and pCO_2 in alveoli is 40 mmHg.
In atmosphere, pO_2 is 159 mm Hg and pCO_2 is 0.3 mm Hg. In deoxygenated blood, pO_2 is 40 mmHg and pCO_2 is 45 mmHg.
In oxygenated blood, pO_2 is 95 mmHg and pCO_2 is 40 mmHg.

197(2) (iv) (i) (ii) (iii)

198 (3)
• Ileum opens into caecum.
• Serosa is the outermost layer of alimentary canal.
• Vermiform appendix arises from caecum.

199(2)
(a), (b) and (c) are correct

200.(2)
(i), (ii) and (v) are true; (iii) and (iv) are false

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