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**NEET
PRELIMINARY ROUND
2023
SOLUTION**
(with explanation)
Date: 29.04.2023 Saturday

**NEET PERSONAL BATCH BY
EXPERTS @206 Gangotri Icon,
Nilamber Circle, Vasna -Bhayali
Road, Vadodara Gujarat**

Neesh Upadhyay 9898966050

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(Click on the link#SOURAV GANGULI talks about EDify Study Center)



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Important Instructions for Mock 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. If the initial tension on a stretched string is doubled, then the ratio of the initial and final speeds of a transverse wave along the string is

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

2. The velocity v of a particle at time t is given by $v = at + \frac{b}{t+c}$ where a, b and c are constants.

The dimensions of a, b and c are respectively :

- (1) L^2, T and LT^2
- (2) LT^2, LT and L
- (3) L, LT and T^2
- (4) LT^{-2}, L and T

3. The displacement of a particle varies with time (t) as: $s = at^2 - bt^3$. The acceleration of the particle at any given time (t) will be equal to

- (1) a/b
- (2) $a/3b$
- (3) $3b/a$
- (4) $2a/3b$

4. The displacement 'x' (in meter) of a particle of mass 'm' (in kg) moving in one dimension under the action of a force, is related to time 't' (in sec) by $t = \sqrt{x} + 3$. The displacement of the particle when its velocity is zero, will be

- (1) 2 m
- (2) 4 m
- (3) zero
- (4) 6 m

5. Two projectiles are fired from the same point with the same speed at angles of projection 60° and 30° respectively. Which one of the following is true?

- (1) Their maximum height will be same
- (2) Their range will be same
- (3) Their landing velocity will be same
- (4) Their time of flight will be same

6. A missile is fired for maximum range with an initial velocity of 20 m/s. If $g = 10 \text{ m/s}^2$, the range of the missile is

- (1) 40 m
- (2) 50 m

- (3) 60 m
- (4) 20 m

7. A person slides freely down a frictionless inclined plane while his bag falls down vertically from the same height. The final speeds of the man (VM) and the bag (VB) should be such that

- (1) $VM < VB$
- (2) $VM = VB$
- (3) they depend on the masses
- (4) $VM > VB$

8. Consider a car moving along a straight horizontal road with a speed of 72 km/h. If the coefficient of static friction between road and tyres is 0.5, the shortest distance in which the car can be stopped is

- (1) 30 m
- (2) 40 m
- (3) 72 m
- (4) 20 m

9. An engine pumps water continuously through a hose. Water leaves the hose with a velocity v and m is the mass per unit length of the water jet. What is the rate at which kinetic energy is imparted to water?

- (1) mv^2
- (2) $\frac{1}{2}mv^2$
- (3) $\frac{1}{2}m^2v^2$
- (4) $\frac{1}{2}mv^3$

10. The speed of a homogenous solid sphere after rolling down an inclined plane of vertical height h from rest without sliding is

- (1) $\sqrt{\frac{10}{7}gh}$
- (2) \sqrt{gh}

- (3) $\sqrt{\frac{6}{5}gh}$

- (4) $\sqrt{\frac{4}{3}gh}$

11. A ball rolls without slipping. The radius of gyration of the ball about an axis passing through its centre of mass is K . If radius of the ball be R , then the fraction of total energy associated with its rotational energy will be

- (1) $\frac{k^2}{K^2+R^2}$

- (2) $\frac{K^2+R^2}{R^2}$
 (3) $\frac{K^2}{R^2}$
 (4) $\frac{R^2}{K^2+R^2}$

12. When a mass is rotating in a plane about a fixed point, its angular momentum is directed along:

- (1) a line perpendicular to the plane of rotation
 (2) the line making an angle of 45° to the plane of rotation
 (3) the radius
 (4) the tangent to the orbit

13. The escape velocity on the surface of earth is 11.2 km/s. What would be the escape velocity on the surface of another planet of the same mass but $\frac{1}{4}$ times the radius of the earth?

- (1) 22.4 km/s
 (2) 44.8 km/s
 (3) 5.6 km/s
 (4) 11.2 km/s

14. A particle of mass 'm' is kept at rest at a height $3R$ from the surface of earth, where 'R' is radius of earth and 'M' is mass of earth. The minimum speed with which it should be projected, so that it does not return back, is (g is acceleration due to gravity on the surface of earth)

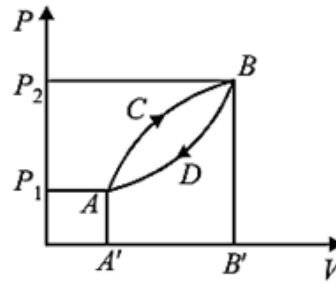
- (1) $\left(\frac{GM}{R}\right)^{\frac{1}{2}}$
 (2) $\left(\frac{GM}{2R}\right)^{\frac{1}{2}}$
 (3) $\left(\frac{gR}{4}\right)^{\frac{1}{2}}$
 (4) $\left(\frac{2g}{4}\right)^{\frac{1}{2}}$

15. Radiation from which of the following sources, approximates black body radiation best?

- (1) A tungsten lamp
 (2) Sodium flame
 (3) Hot lamp black
 (4) A hole in a cavity, maintained at constant temperature

16. A thermodynamic system is taken from state A to B along ACB and is brought back to A along BDA in the PV diagram. The net

work done during the complete cycle is given by the area :



- (1) $P_1 ACBP_2 P_1$
 (2) $ACBB'A'A$
 (3) $ACBDA$
 (4) $ADBB'A'A$

17. During an isothermal expansion, a confined ideal gas does -150 J of work against its surroundings. This implies that

- (1) 150 J heat has been removed from the gas
 (2) 300 J of heat has been added to the gas
 (3) no heat is transferred because the process is isothermal
 (4) 150 J of heat has been added to the gas

18. The amount of heat energy required to raise the temperature of 1g of Helium at NTP, from T_1 K to T_2 K is

- (1) $\frac{3}{2}Nk_B (T_2 - T_1)$
 (2) $\frac{3}{4}Nk_B (T_2 - T_1)$
 (3) $\frac{3}{4}Nk_B \frac{T_2}{T_1}$
 (4) $\frac{3}{8}Nk_B (T_2 - T_1)$

19. There is a body having mass m and performing S.H.M. with amplitude a. There is a restoring force $F = -kx$. The total energy of body depends upon

- (1) k, x
 (2) k, a
 (3) k, a, x
 (4) k, a, v

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

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

21. An organ pipe P1 closed at one end vibrating in its first overtone and another pipe P2, open at both ends vibrating in its third overtone are in resonance with a given tuning fork. The ratio of lengths of P1 and P2 respectively are given by

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

22. Each of the two strings of length 51.6 cm and 49.1 cm are tensioned separately by 20 N force. Mass per unit length of both the strings is same and equal to 1 g/m. When both the strings vibrate simultaneously the number of beats is

- (1) 7
- (2) 8
- (3) 3
- (4) 5

23. Curie is a unit of

- (1) energy of gamma-rays
- (2) half-life
- (3) radioactivity
- (4) intensity of gamma-rays

24. A free neutron decays into a proton, an electron and

- (1) a beta particle
- (2) an alpha particle
- (3) an anti-neutrino
- (4) a neutrino

25. If a soap bubble expands, the pressure inside the bubble

- (1) Decreases
- (2) Increases
- (3) Remains the same
- (4) Is equal to the atmospheric pressure

26. Three copper wires of lengths and cross sectional areas are (ℓ, A) , $(2\ell, A/2)$ and $(\ell/2, 2A)$. Resistance is minimum in:

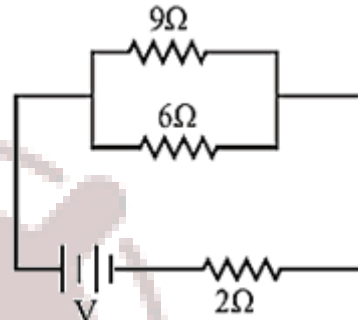
- (1) It is the same in all three cases
- (2) Wire of cross-sectional area $2A$
- (3) Wire of cross-sectional area A
- (4) Wire of cross-sectional area $1/2 A$

27. Resistances n , each of r ohm, when connected in

parallel give an equivalent resistance of R/n . If these resistances were connected in series, the combination would have a resistance in ohms, equal to

- (1) nR
- (2) $n^2 R$
- (3) R/n^2
- (4) R/n

28. If power dissipated in the 9Ω resistor in the circuit shown is 36 watt, the potential difference across the 2Ω resistor is



- (1) 4 volt
- (2) 8 volt
- (3) 10 volt
- (4) 2 volt

29. An electron enters a region where magnetic field (B) and electric field (E) are mutually perpendicular, then

- (1) it will always move in the direction of B
- (2) it will always move in the direction of E
- (3) it always possesses circular motion
- (4) it can go undeflected also

30. The magnetic moment of a diamagnetic atom is

- (1) equal to zero
- (2) much greater than one
- (3) 1
- (4) between zero and one

31. A coil of resistance 400Ω is placed in a magnetic field. If the magnetic flux ϕ (Wb) linked with the coil varies with time t (sec) as $\Phi = 50t^2 + 4$ The current in the coil at $t = 2$ sec is

- (1) 0.5 A
- (2) 0.1 A
- (3) 2 A
- (4) 1 A

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

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

33. We consider the radiation emitted by the human body. Which of the following statements is true?

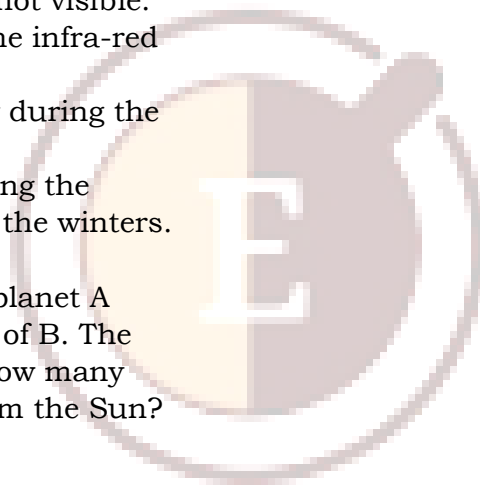
- (1) the radiation emitted lies in the ultraviolet region and hence is not visible.
- (2) the radiation emitted is in the infra-red region.
- (3) the radiation is emitted only during the day.
- (4) the radiation is emitted during the summers and absorbed during the winters.

34. The period of revolution of planet A around the Sun is 8 times that of B. The distance of A from the Sun is how many times greater than that of B from the Sun?

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

35. A converging beam of rays is incident on a diverging lens. Having passed through the lens the rays intersect at a point 15 cm from the lens on the opposite side. If the lens is removed the point where the rays meet will move 5 cm closer to the lens. The focal length of the lens is

- (1) - 10 cm
- (2) 20 cm
- (3) -30 cm
- (4) 5 cm



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SECTION : B

36. In Young's double slit experiment, the slits are 0 mm apart and are illuminated by photons of two wavelengths $\lambda_1 = 12000\text{\AA}$ and $\lambda_2 = 10000\text{\AA}$. At what minimum distance from the common central bright fringe on the screen 2 m from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other?

- (1) 6 mm
- (2) 4 mm
- (3) 3 mm
- (4) 8 mm

37. As the intensity of incident light increases

- (1) photoelectric current increases
- (2) K. E. of emitted photoelectrons increases
- (3) photoelectric current decreases
- (4) K.E. of emitted photoelectrons decreases

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

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

39. An electron changes its position from orbit $n = 2$ to the orbit $n = 4$ of an atom. The wavelength of the emitted radiations is ($R =$ Rydberg's constant)

- (1) $16/R$
- (2) $16/3R$
- (3) $16/5R$
- (4) $16/7R$

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

- (1) 5 m
- (2) $10/3$ m
- (3) $20/3$ m
- (4) 10 m

41. If the potential of a capacitor having capacity $6 \mu\text{F}$ is increased from 10 V to 20 V, then increase in its energy will be

- (1) 4×10^{-4} J
- (2) 4×10^{-4} J
- (3) 9×10^{-4} J
- (4) 12×10^{-6} J

42. In any fission process, the ratio $\frac{\text{mass of fission products}}{\text{mass of parent nucleus}}$ is

- (1) equal to 1
- (2) greater than 1
- (3) less than 1
- (4) depends on the mass of the parent nucleus

43. When two monochromatic lights of frequency, ν and $\nu/2$ are incident on a photoelectric metal, their stopping potential becomes $V_s/2$ and V_s respectively. The threshold frequency for this metal is

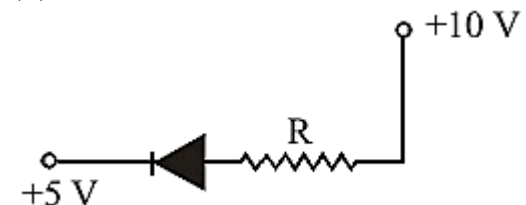
- (1) 2ν
- (2) 3ν
- (3) $2/3\nu$
- (4) $3/2\nu$

44. The transfer ratio β of a transistor is 50. The input resistance of the transistor when used in the common emitter configuration is $1\text{k}\Omega$. The peak value of the collector A.C current for an A.C input voltage of 0.01 V peak is

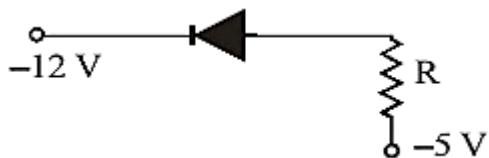
- (1) $100\mu\text{A}$
- (2) $0.01\mu\text{A}$
- (3) 0.25mA
- (4) $500\mu\text{A}$

45. Of the diodes shown in following diagrams, which one is reverse biased?

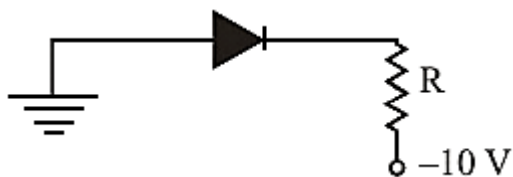
(1)



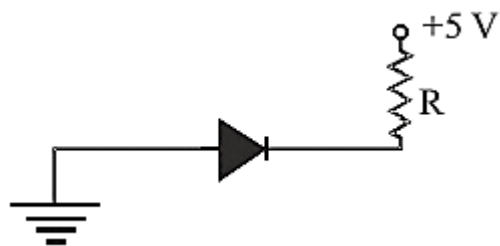
(2)



(3)



(4)



- (1) $\frac{1}{\sqrt{2} n^2 \pi d^2}$
- (2) $\frac{1}{\sqrt{2} n^2 \pi^2 d^2}$
- (3) $\frac{1}{\sqrt{2} n \pi d}$
- (4) $\frac{1}{\sqrt{2} n \pi d^2}$

50. A convex lens 'A' of focal length 20 cm and a concave lens 'B' of focal length 5 cm are kept along the same axis with a distance 'd' between them. If a parallel beam of light falling on 'A' leaves 'B' as a parallel beam, then the distance 'd' in cm will be

- (1) 30
- (2) 25
- (3) 15
- (4) 50

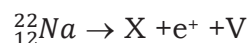
46. A thin prism having refracting angle 10° is made of glass of refractive index 1.42. This prism is combined with another thin prism of glass of refractive index 1.7. This combination produces dispersion without deviation. The refracting angle of second prism should be

- (1) 6°
- (2) 8°
- (3) 10°
- (4) 4°

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

- (1) 6.28×10^{-2} T
- (2) 12.56×10^{-2} T
- (3) 12.56×10^{-4} T
- (4) 6.28×10^{-4} T

48. In the given nuclear reaction, the element X is



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

49. The mean free path for a gas, with molecular diameter d and number density n can be expressed as :

Chemistry
SECTION : A

51. The root mean square speeds at STP for the gases H_2 , N_2 , O_2 and HBr are in the order:

- (1) $H_2 < N_2 < O_2 < HBr$
- (2) $HBr < O_2 < N_2 < H_2$
- (3) $H_2 < N_2 = O_2 < HBr$
- (4) $HBr < O_2 < H_2 < N_2$

52. Identify the incorrect statement from the following.

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

53. In the photo-electron emission, the energy of the emitted electron is

- (1) greater than the incident photon
- (2) same as than of the incident photon
- (3) smaller than the incident photon
- (4) proportional to the intensity of incident photon.

54. The total number of atomic orbitals in fourth energy level of an atom is:

- (1) 8
- (2) 16
- (3) 32
- (4) 4

55. Correct order of first IP among following elements Be, B, C, N, O is

- (1) $B < Be < C < O < N$
- (2) $B < Be < C < N < O$
- (3) $Be < B < C < N < O$
- (4) $Be < B < C < O < N$

56. In compound X, all the bond angles are exactly $109^\circ 29'$; X is

- (1) Chloromethane
- (2) Carbon tetrachloride
- (3) Iodoform
- (4) Chloroform.

57. The incorrect statement regarding chirality is

- (1) A racemic mixture shows zero optical rotation

(2) S_N1 reaction yields 1 : 1 mixture of both enantiomers

(3) The product obtained by S_N2 reaction of haloalkane having chirality at the reactive site shows inversion of configuration

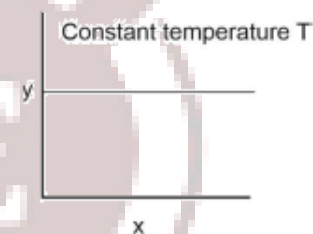
(4) Enantiomers are superimposable mirror images on each other

58. Which of the following is not isostructural with

$SiCl_4$?

- (1) SO_4^{2-}
- (2) PO_4^{3-}
- (3) NH_4^+
- (4) SCl_4

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



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

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

60. The surface tension of which of the following liquid is maximum?

- (1) C_2H_5OH
- (2) CH_3OH
- (3) H_2O
- (4) C_6H_6

61. Adiabatic expansions of an ideal gas is accompanied by

- (1) decrease in ΔE
- (2) increase in temperature
- (3) decrease in ΔS
- (4) no change in any one of the above properties

62. Given that bond energies of H-H and Cl-Cl are 430 kJ mol^{-1} and 240 kJ mol^{-1} respectively and $\Delta_f H$ for HCl is -90 kJ mol^{-1} . Bond enthalpy of HCl is :

- (1) 380 kJ mol^{-1}
- (2) 425 kJ mol^{-1}
- (3) 245 kJ mol^{-1}
- (4) 290 kJ mol^{-1}

63. The pH value of blood does not appreciably change by a small addition of an acid or a base, because the blood

- (1) is a body fluid
- (2) can be easily coagulated
- (3) contains iron as a part of the molecule
- (4) contains serum protein which acts as buffer

64. Given below are two statements

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

Statement II: Primary aromatic amines react with HNO_2 to form diazonium salts which are stable even above 300 K . In the light of the above statements, choose the most appropriate answer from the options given below

- (1) 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.

65. Identify the correct order of solubility in aqueous medium:

- (1) $\text{ZnS} > \text{Na}_2\text{S} > \text{CuS}$
- (2) $\text{Na}_2\text{S} > \text{CuS} > \text{ZnS}$
- (3) $\text{Na}_2\text{S} > \text{ZnS} > \text{CuS}$
- (4) $\text{CuS} > \text{ZnS} > \text{Na}_2\text{S}$

66. Match List-I with List-II.

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

Choose the correct answer from the options given below

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

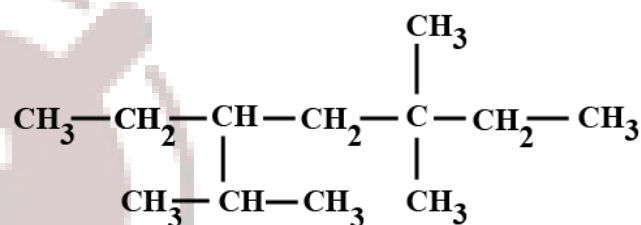
67. Which of the following alkaline earth metal sulphates has hydration enthalpy higher than the lattice enthalpy?

- (1) CaSO_4
- (2) BeSO_4
- (3) BaSO_4
- (4) SrSO_4

68. How many chain isomers could be obtained from the alkane C_6H_{14} ?

- (1) Four
- (2) Five
- (3) Six
- (4) Seven

69. The correct IUPAC name of the structure is:



- (1) 3-isopropyl-5, 5-dimethyl heptane
- (2) 5- Ethyl - 3, 3 , 6 - trimethyl heptane
- (3) 3,3-Dimethyl- 5 - isopropyl heptane
- (4) 3- Ethyl-2 , 5 - 5- trimethyl heptanes

70. The correct order of reactivity towards the electrophilic substitution of the compounds aniline (i) benzene (II) and nitrobenzene (III) is

- (1) $\text{I} > \text{II} > \text{III}$
- (2) $\text{III} > \text{II} > \text{I}$
- (3) $\text{II} > \text{III} > \text{I}$
- (4) $\text{I} < \text{II} > \text{III}$

71. For a reaction in which all reactants and products are liquids, which one of the following equations is most applicable?

- (1) $\Delta H < \Delta E$
- (2) $\Delta H = \Delta S$
- (3) $\Delta H = \Delta E$
- (4) $\Delta H = \Delta G$

72. When 3, 3-dimethyl 2-butanol is heated with H_2SO_4 , the major product obtained is

- (1) 2,3-dimethyl 2-butene
- (2) 3, 3-dimethyl 1- butene
- (3) 2, 3-dimethyl 1- butene
- (4) cis & trans isomers of 2, 3-dimethyl 2-butene

73. Which of the following is/are the hazardous pollutant present in automobile

exhaust gases? N₂ (ii) CO (iii) CH₄ (iv) Oxides of nitrogen

- (1) (ii) and (iii)
- (2) (I) and (ii)
- (3) (ii) and (iv)
- (4) (I) and (iii)

74. Which of the following anions is present in the chain structure of silicates?

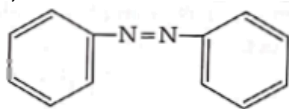
- (1) (Si₂O₅²⁻)_n
- (2) (SiO₃²⁻)_n
- (3) SiO₄⁴⁻
- (4) Si₂O₇⁶⁻

75. A 5% solution of cane sugar (mol. wt. = 342) is isotonic with 1% solution of a substance X. The molecular weight of X is

- (1) 34.2
- (2) 171.2
- (3) 68.4
- (4) 136.8

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

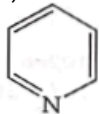
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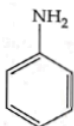
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(3)



(4)



77. The compound A on treatment with Na gives B, and with PCl₅ gives C. B and C react together to give diethyl ether. A, B and C are in the order

- (1) C₂H₅OH, C₂H₆, C₂H₅Cl
- (2) C₂H₅OH, C₂H₅Cl, C₂H₅ONa
- (3) C₂H₅OH, C₂H₅ONa, C₂H₅Cl
- (4) C₂H₅Cl, C₂H₆, C₂H₅OH

78. The plot of concentration of the reactant vs. time for a reaction is a straight line with a negative slope. The reaction follows a

- (1) zero order rate equation
- (2) first order rate equation
- (3) second order rate equation
- (4) third order rate equation

79. The unit of rate constant for a zero order reaction is

- (1) mol L⁻¹ s⁻¹
- (2) L mol⁻¹ s⁻¹
- (3) L² mol⁻² s⁻¹
- (4) s⁻¹

80. The following reactions take place in the blast furnace in the preparation of impure iron. Identify the reaction pertaining to the formation of the slag.

- (1) Fe₂O₃(s) + 3CO(g) → 2Fe(l) + 3CO₂(g)
- (2) CaCO₃(s) → CaO(s) + CO₂(g)
- (3) CaO(s) + SiO₂(s) → CaSiO₃(s)
- (4) 2C(s) + O₂(g) → 2CO(g)

81. Sugarcane on reaction with nitric acid gives

- (1) CO₂ and SO₂
- (2) (COOH)₂
- (3) 2HCOOH
- (4) No reaction.

82. Nitrogen forms N₂, but phosphorus is converted into P₄ from P, the reason is

- (1) Triple bond is present between phosphorus atom
- (2) P_π - P_π bonding is strong
- (3) P_π - P_π bonding is weak
- (4) Multiple bond is formed easily.

83. While extracting an element from its ore, the ore is ground and leached with dil. potassium cyanide solution to form the soluble product potassium argento cyanide. The element is

- (1) Lead
- (2) Chromium
- (3) Manganese
- (4) Silver

84. General electronic configuration of lanthanides is

- (1) (n - 2) f¹⁻¹⁴(n - 1) d⁰⁻¹ ns²
- (2) (n - 2) f¹⁰⁻¹⁴(n - 1) d⁰⁻¹ ns²
- (3) (n - 2) f⁰⁻¹⁴(n - 1) d¹⁰ ns²
- (4) (n - 2) d⁰⁻¹(n - 1) f¹⁻¹⁴ ns²

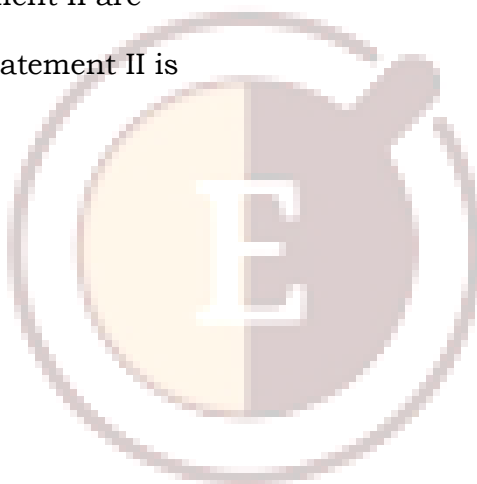
85. Given below are two statements :

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

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

In the light of the above statements, choose the most appropriate answer from the 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



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SECTION B

86. According to IUPAC nomenclature sodium nitroprusside is named as

- (1) Sodium pentacyanonitrosyl ferrate (III)
- (2) Sodium nitroferrocyanide
- (3) Sodium nitroferrocyanide
- (4) Sodium pentacyanonitrosyl ferrate (II)

87. An excess of AgNO_3 is added to 100 mL of a 0.01 M solution of dichlorotetraaquachromium (iii) chloride. The number of moles of AgCl precipitated would be:

- (1) 0.002
- (2) 0.003
- (3) 0.01
- (4) 0.001

88. Lucas reagent is

- (1) Conc. HCl and anhydrous ZnCl_2
- (2) Conc. HNO_3 and hydrous ZnCl_2
- (3) Conc. HCl and hydrous ZnCl_2
- (4) Conc. HNO_3 and anhydrous ZnCl_2

89. When glycerol is treated with excess of HI , it produces:

- (1) glycerol triiodide
- (2) 2-iodopropane
- (3) allyl iodide
- (4) propene

90. $(\text{CH}_3)_3\text{C}-\text{CHO}$ does not undergo Aldol condensation due to

- (1) three electron donating methyl groups
- (2) cleavage taking place between $-\text{C}-\text{CHO}$ bond
- (3) absence of alpha hydrogen atom in the molecule
- (4) bulky $(\text{CH}_3)_3\text{C}-$ group

91. Reduction of aldehydes and ketones into hydrocarbons using zinc amalgam and conc. HCl is called

- (1) Cope reduction
- (2) Dow reduction
- (3) Wolf-Kishner reduction
- (4) Clemmensen reduction.

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

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

93. On hydrolysis of starch, we finally get

- (1) Glucose
- (2) Fructose
- (3) Both
- (4) and

94. Chargaff's rule states that in an organism

- (1) Amounts of all bases are equal
- (2) Amount of adenine is equal to that of thymine and the amount of guanine is equal to that of cytosine
- (3) Amount of adenine is equal to that of guanine and the amount of thymine is equal to that of cytosine
- (4) Amount of adenine is equal to that of cytosine and the amount of thymine is equal to that of guanine

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

Assertion (A): ICI is more reactive than I_2 .

Reason (R): $\text{I}-\text{Cl}$ bond is weaker than $\text{I}-\text{I}$ bond.

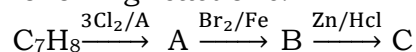
In the light of the above statements, choose the most appropriate answer from the options given below:

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

96. An example of a sigma bonded organometallic compound is :

- (1) Grignard's reagent
- (2) Ferrocene
- (3) Cobaltocene
- (4) Ruthenocene

97. The compound C_7H_8 undergoes the following reactions:



The product 'C' is

- (1) m-bromotoluene
- (2) o-bromotoluene
- (3) p-bromotoluene
- (4) 3-bromo-2,4,6-trichlorotoluene

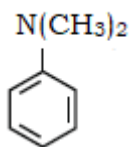
98. Which of the following diatomic molecular species has only π bonds according to Molecular Orbital Theory?

- (1) O_2
- (2) N_2

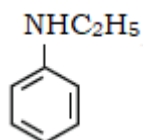
- (3) C_2
(4) Be_2

99. Which of the following amine will give the carbylamine test?

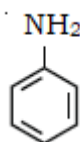
(1)



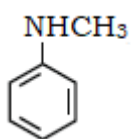
(2)



(3)



(4)



100. The pH of the solution containing 50 mL each of 0.10 M sodium acetate and 0.01 M acetic acid is [Given pK_a of $CH_3COOH = 4.57$]

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



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BOTANY
SECTION : A

101. Static concept of species was put forward by

- (1) de Candolle
- (2) Linnaeus
- (3) Theophrastus
- (4) Darwin

102. Relative biological effectiveness (RBE) is usually referred to damages caused by

- (1) Low temperature
- (2) High temperature
- (3) Encephalitis
- (4) Radiation

103. Which fungal disease spreads by seed and flowers?

- (1) Loose smut of wheat
- (2) Corn stunt
- (3) Covered smut of barley
- (4) Soft rot of potato

104. Which one is the wrong pairing for the disease and its causal organism?

- (1) Black rust of wheat - *Puccinia graminis*
- (2) Loose smut of wheat - *Ustilago nuda*
- (3) Root-knot of vegetables - *Meloidogyne* sp
- (4) Late blight of potato - *Alternaria solani*

105. Sexual reproduction involving fusion of two cells in *Chlamydomonas* is

- (1) isogamy
- (2) homogamy
- (3) somatogamy
- (4) hologamy

106. Which of the following cannot fix nitrogen?

- (1) *Nostoc*
- (2) *Azotobacter*
- (3) *Spirogyra*
- (4) *Anabaena*

107. Floridean starch is found in

- (1) Chlorophyceae
- (2) Rhodophyceae
- (3) Myxophyceae
- (4) Cyanophyceae

108. *Cycas* and *Adiantum* resemble each other in

having:

- (1) Seeds
- (2) Motile Sperms

(3) Cambium

(4) Vessels

109. Photoreceptors of earthworm occur on

- (1) clitellum
- (2) many eyes
- (3) dorsal surface
- (4) lateral sides

110. Plant having column of vascular tissues bearing fruits and having a tap root system is

- (1) monocot
- (2) dicot
- (3) gymnosperm of dicot
- (4) gymnosperm or monocot

111. Pineapple (ananas) fruit develops from

- (1) a multipistillate syncarpous flower
- (2) a cluster of compactly borne flowers on a common axis
- (3) a multilocular monocarpellary flower
- (4) a unilocular polycarpellary flower

112. Inflorescence is racemose in

- (1) Soyabean
- (2) Brinjal
- (3) Tulip
- (4) Aloe

113. Procambium forms

- (1) only primary vascular bundles
- (2) only vascular cambium
- (3) only cork cambium
- (4) primary vascular bundles and vascular cambium

114. Palisade parenchyma is absent in leaves of:

- (1) mustard
- (2) soybean
- (3) gram
- (4) sorghum

115. Electron microscope has a high resolution power. This is due to

- (1) electromagnetic lenses
- (2) very low wavelength of electron beam
- (3) low wavelength of light source used
- (4) high numerical aperture of glass lenses used

116. The function of rough endoplasmic reticulum is

- (1) fat synthesis
- (2) lipid synthesis

- (3) protein synthesis
- (4) steroid synthesis

117. In terrestrial habitats, temperature and rainfall conditions are influenced by

- (1) water transformations
- (2) transpiration
- (3) thermoperiodism
- (4) translocation

118. Which one of the following statements is correct?

- (1) Both Azotobacter and Rhizobium fix atmospheric nitrogen in root nodules of plants.
- (2) Cyanobacteria such as Anabaena and Nostoc are important mobilizers of phosphates and for plant nutrition in soil
- (3) At present it is not possible to grow maize without chemical fertilizers
- (4) Extensive use of chemical fertilizers may lead to eutrophication of nearby water bodies.

119. The deficiencies of micronutrients, not only affects growth of plants but also vital functions such as photosynthetic and mitochondrial electron flow.

Among the list given below, which group of three elements shall affect most, both photosynthetic and mitochondrial electron transport:

- (1) Co, Ni, Mo
- (2) Ca, K, Na
- (3) Mn, Co, Ca
- (4) Cu, Mn, Fe

120. Greatest producers of organic matter are

- (1) crop plants
- (2) forests
- (3) plants of the land area
- (4) phytoplankton of oceans

121. NADPH is generated through

- (1) photosystem I
- (2) photosystem II
- (3) anerobic respiration
- (4) glycolysis

122. The C₄ plants are photosynthetically more efficient than C₃ plants because:

- (1) the CO₂ compensation point is more
- (2) CO₂ generated during photorespiration is trapped and recycled through PEP carboxylase

- (3) the CO₂ efflux is not prevented
- (4) they have more chloroplasts

123. End product of citric acid/Krebs cycle is

- (1) citric acid
- (2) lactic acid
- (3) pyruvic acid
- (4) CO₂ + H₂O

124. The overall goal of glycolysis, krebs cycle and the electron transport system is the formation of

- (1) ATP in one large oxidation reaction
- (2) sugars
- (3) nucleic acids
- (4) ATP in small stepwise units.

125. Apical dominance is caused by

- (1) abscisic acid in lateral bud
- (2) cytokinin in leaf tip
- (3) gibberellin in lateral buds
- (4) auxin in shoot tip

126. Plants deficient of element zinc, show its effect on the biosynthesis of plant growth hormone

- (1) abscisic acid
- (2) auxin
- (3) cytokinin
- (4) ethylene

127. What is common between vegetative reproduction and apomixis?

- (1) Both are applicable to only dicot plants
- (2) Both bypass the flowering phase
- (3) Both occur round the year
- (4) Both produces progeny identical to the parent

128. A population of genetically identical individuals, obtained from asexual reproduction is

- (1) Callus
- (2) Clone
- (3) Deme
- (4) Aggregate

129. A fruit developed from hypanthodium inflorescence is called

- (1) Sorosis
- (2) Syconus
- (3) Caryopsis
- (4) Hasperidium

130. Albuminous seeds store their reserve food mainly in

- (1) Perisperm
- (2) Endosperm
- (3) Cotyledons
- (4) Hypocotyl

131. A man of A-blood group marries a woman of AB blood group. Which type of progeny would indicate that man is heterozygous A?

- (1) AB
- (2) A
- (3) O
- (4) B

132. A fruitfly exhibiting both male and female traits is

- (1) heterozygous
- (2) gynandromorph
- (3) hemizygous
- (4) gynander

133. Phenomenon of 'Industrial melanism' demonstrates

- (1) natural selection
- (2) induced mutation
- (3) geographical isolation
- (4) reproductive isolation

134. Which one of the following traits of garden pea studied by Mendel was a recessive feature?

- (1) Round seed shape
- (2) Axial flower position
- (3) Green seed colour
- (4) Green pod colour

135. How many different kinds of gametes will be produced by a plant having the genotype AABbCC?

- (1) Four
- (2) Nine
- (3) Two
- (4) Three



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SECTION : B

136. If both parents are carriers for thalassemia, which is an autosomal recessive disorder, what are the chances of pregnancy resulting in an affected child?

- (1) 50%
- (2) 25%
- (3) 100%
- (4) no chance

137. Out of A-T, G-C pairing, bases of DNA may exist in alternate valency state owing to arrangement called

- (1) analogue substitution
- (2) tautomerisational mutation
- (3) frame-shift mutation
- (4) point mutation

138. At time of organogenesis genes regulate the process at different levels and at different time due to

- (1) promoter
- (2) regulator
- (3) intron
- (4) exon

139. In which mode of inheritance do you expect more maternal influence among the offspring?

- (1) Cytoplasmic
- (2) Y-linked
- (3) X-linked
- (4) Autosomal

140. Which of the following is not a property of the genetic code?

- (1) Universal
- (2) Non-overlapping
- (3) Ambiguous
- (4) Degeneracy

141. The new varieties of plants are produced by

- (1) selection and hybridization
- (2) mutation and selection
- (3) introduction and mutation
- (4) selection and intro

142. Compared to a bull a bullock is docile because of

- (1) higher levels of cortisone
- (2) lower levels of blood testosterone
- (3) lower levels of adrenaline/ noradrenaline in its blood
- (4) higher levels of thyroxine.

143. *Trichoderma harzianum* has proved a useful microorganism for

- (1) bioremediation of contaminated soils
- (2) reclamation of wastelands
- (3) gene transfer in higher plants
- (4) biological control of soil-borne plant pathogens

144. Animals that can tolerate a narrow range of salinity are

- (1) stenohaline
- (2) euryhaline
- (3) anadromous
- (4) catadromous

145. Biochemical Oxygen Demand (BOD) in a river water

- (1) has no relationship with concentration of oxygen in the water.
- (2) gives a measure of Salmonella in the water.
- (3) increases when sewage gets mixed with river water.
- (4) remains unchanged when algal bloom occurs.

146. Which one of the following is not used for construction of ecological pyramids?

- (1) Number of individuals
- (2) Rate of energy flow
- (3) Fresh weight
- (4) Dry weight

147. Of the following, which instrument is most commonly used to observe the external features of a grasshopper's abdomen?

- (a) Ultracentrifuge
- (b) Microdissection instrument
- (c) Dissecting microscope
- (d) Electron microscope

148. Which of the following options gives the correct sequence of events during mitosis ?

- (1) Condensation → nuclear membrane disassembly → arrangement at equator → centromere division → segregation → telophase
- (2) Condensation → crossing over → nuclear membrane disassembly → segregation → telophase
- (3) Condensation → arrangement at equator → centromere division → segregation → telophase
- (4) Condensation → nuclear membrane disassembly → crossing over → segregation

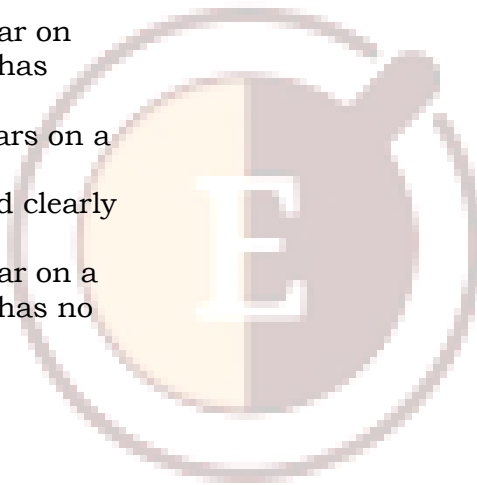
→ telophase

149. Which of the following statements is incorrect?

- (1) Viroids lack a protein coat.
- (2) Viruses are obligate parasites.
- (3) Infective constituent in viruses is the protein coat.
- (4) Prions consist of abnormally folded proteins.

150. Now a days it is possible to detect the mutated gene causing cancer by allowing radioactive probe to hybridise its complimentary DNA in a clone of cells, followed by its detection using autoradiography because :

- (1) mutated gene does not appear on photographic film as the probe has complementarity with it
- (2) mutated gene partially appears on a photographic film
- (3) mutated gene completely and clearly appears on a photographic film
- (4) mutated gene does not appear on a photographic film as the probe has no complementarity with it



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ZOOLOGY

SECTION : A

151. The infective stage of malarial parasite Plasmodium that enters human body is

- (1) merozoite
- (2) sporozoite
- (3) trophozoite
- (4) minuta form

152. Nitrogen fixer soil organisms belong to

- (1) mosses
- (2) bacteria
- (3) green Algae
- (4) soil Fungi

153. Two bacteria found to be very useful in genetic engineering experiments are

- (1) Escherichia and Agrobacterium
- (2) Nitrobacter and Azotobacter
- (3) Rhizobium and Diplococcus
- (4) Nitrosomonas and Klebsiella

154. Ascaris larva is called

- (1) cysticercus
- (2) rhabditiform
- (3) hexacanth
- (4) onchosphere

155. A common characteristic of all vertebrates is

- (1) presence of skull
- (2) division of body into head, neck, trunk and tail
- (3) presence of two pairs of functional appendages
- (4) body is covered with an exoskeleton

156. Which one of the following characters is not typical of the class Mammalia?

- (1) Thecodont dentition
- (2) Alveolar lungs
- (3) Ten pairs of cranial nerves
- (4) Seven cervical vertebrae

157. Which one of the following pairs of animals are similar to each other pertaining to the feature stated against them?

- (1) Pteropus and Ornithorhynchus - Viviparity
- (2) Garden lizard and Crocodile - Three chambered heart
- (3) Ascaris and Ancylostoma - Metameric segmentation
- (4) Sea horse and Flying fish - Cold blooded (poikilothermal)

158. Component of blood responsible for producing antibodies is

- (1) Thrombocytes
- (2) Monocytes
- (3) Erythrocytes
- (4) Lymphocytes

159. The epithelial tissue present on the inner surface of bronchioles and fallopian tube is:

- (1) glandular
- (2) ciliated
- (3) squamous
- (4) cuboidal

160. Cellulose is the major component of cell walls of

- (1) Pythium
- (2) Xanthomonas
- (3) Pseudomonas
- (4) Saccharomyces

161. In double helix of DNA, the two DNA strands are

- (1) coiled around a common axis
- (2) coiled around each other
- (3) coiled differently
- (4) coiled over protein sheath

162. The enormous diversity of protein molecules is due mainly to the diversity of

- (1) amino groups on the amino acids
- (2) R groups on the amino acids
- (3) amino acid sequences within the protein molecule
- (4) peptide bonds

163. An organic substance bound to an enzyme and essential for its activity is called

- (1) Holoenzyme
- (2) Apoenzyme
- (3) Isoenzyme
- (4) Coenzyme

164. Pancreas produces

- (1) three digestive enzymes and one hormone
- (2) three types of digestive enzymes and two hormones
- (3) two digestive enzymes and one hormone
- (4) three digestive enzymes and no hormone

165. The food having fully undergone mechanical and chemical digestion inside the stomach, is called

- (1) Chyle
- (2) Bolus

(3) Amino acid

(4) Chyme

166. Two friends are eating together on a dining table. One of them suddenly starts coughing while swallowing some food. This coughing would have been due to improper movement of:

(1) epiglottis

(2) diaphragm

(3) neck

(4) tongue

167. Which of the following are the correct statement for respiration in human

(1) Cigarette smoking may lead of inflammation of bronchi

(2) Neural signals from pneumotaxic centre in pons region of brain can increase the duration of inspiration

(3) Workers in grinding and stone – breaking industries may suffer from lung fibrosis

(4) About 90% of carbon dioxide (CO₂) is carried by haemoglobin as carbamino haemoglobin.

168. The blood cancer is known as

(1) leukaemia

(2) thrombosis

(3) haemolysis

(4) haemophilia

169. The most active phagocytic white blood cells are:

(1) neutrophils and eosinophils

(2) lymphocytes and macrophages

(3) eosinophils and lymphocytes

(4) neutrophils and monocytes

170. In ureotelic animals, urea is formed by the

(1) Arginine cycle

(2) Cori's cycle

(3) Ornithine cycle

(4) EM pathway

171. The maximum amount of electrolytes and water (70 - 80 percent) from the glomerular filtrate is reabsorbed in which part of the nephron?

(1) Ascending limb of loop of Henle

(2) Distal convoluted tubule

(3) Proximal convoluted tubule

(4) Descending limb of loop of Henle

172. Select the correct statement regarding the specific disorder of muscular or skeletal

system :-

(1) Muscular dystrophy - age related shortening of muscles.

(2) Osteoporosis - decrease in bone mass and higher chance of fractures with advancing age.

(3) Myasthenia gravis - Auto immune disorder which inhibits sliding of myosin filaments

(4) Gout - inflammation of joints due to extra deposition of calcium.

173. Neuroglia consist of cells found in the

(1) liver

(2) kidney

(3) central nervous system and ganglia

(4) testes

174. Which hormone possesses anti-insulin effect?

(1) Cortisol

(2) Calcitonin

(3) Oxytocin

(4) Aldosterone

175. Melanocyte stimulating hormone (MSH) is produced by

(1) parathyroid

(2) pars intermedia of pituitary

(3) anterior pituitary

(4) posterior pituitary

176. Which one of the following pairs is incorrectly matched?

(1) Glucagon - Beta cells (source)

(2) Somatostatin - Delta cells (source)

(3) Corpus luteum - Relaxin (secretion)

(4) Insulin - Diabetes mellitus (disease)

177. The first movements of the foetus and appearance of hair on its head are usually observed during which month of pregnancy?

(1) Fourth month

(2) Fifth month

(3) Sixth month

(4) Third month

178. Artificial insemination mean:

(1) Transfer of sperms of husband to a test tube containing ova

(2) Artificial introduction of sperms of a healthy donor into the vagina

(3) Introduction of sperms of a healthy donor directly into the ovary

(4) Transfer of sperms of a healthy donor to a test tube containing ova

179. Identify the correct sequence in which the following substances have appeared during the course of evolution of life on earth

- (1) Glucose, amino acids, nucleic acids, proteins
- (2) Ammonia, amino acids, proteins, nucleic acids
- (3) Water, amino acids, nucleic acids, enzymes
- (4) Amino acids, ammonia, phosphates, nucleic Acids

180. In which era reptiles were dominant?

- (1) Coenozoic era
- (2) Mesozoic era
- (3) Palaeozoic era
- (4) Archaeozoic era

181. When two species of different genealogy come to resemble each other as a result of adaptation, the phenomenon is termed

- (1) microevolution
- (2) co-evolution
- (3) convergent evolution
- (4) divergent evolution

182. Cellulose, the most important constituent of plant cell wall is made of

- (1) unbranched chain of glucose molecules linked by α -1, 4 glycosidic bond
- (2) branched chain of glucose molecules linked by β -1, 4 glycosidic bond in straight chain and α -1, 6 glycosidic bond at the site of branching
- (3) unbranched chain of glucose molecules linked by β -1, 4 glycosidic bond
- (4) branched chain of glucose molecules linked by α -1, 6 glycosidic bond at the site of branching.

183. Random unidirectional change in allele frequencies that occurs by chance in all populations and especially in small populations is known as

- (1) Mutation
- (2) Migration
- (3) Natural selection
- (4) Genetic drift

184. Vaccines are

- (1) treated bacteria or viruses or one of their proteins
- (2) MHC (major histocompatibility complex) proteins
- (3) curative medicines
- (4) monoclonal antibodies

185. Increased asthmatics attacks in certain seasons are related to

- (1) eating fruits preserved in tin containers
- (2) inhalation of seasonal pollen
- (3) low temperature
- (4) hot and humid environment.

SECTION : B

186. Which one of the following statements is correct with respect to immunity?

- (1) Preformed antibodies need to be injected to treat the bite by a viper snake.
- (2) The antibodies against small pox pathogen are produced by T – lymphocytes.
- (3) Antibodies are protein molecules, each of which has four light chains.
- (4) Rejection of a kidney graft is the function of Blymphocytes.

187. DNA or RNA segment tagged with a radioactive molecule is called

- (1) Vector
- (2) Probe
- (3) Clone
- (4) Plasmid

188. The genetically-modified (GM) brinjal in India has been developed for:

- (1) insect-resistance
- (2) enhancing shelf life
- (3) enhancing mineral content
- (4) drought-resistance

189. The formula for exponential population growth is

- (1) $dN/rN = dt$
- (2) $rN/ dN = dt$
- (3) $dN/ dt = rN$
- (4) $dt/ dN = rN$

190. Diversification in plant life appeared

- (1) due to long periods of evolutionary changes
- (2) due to abrupt mutations
- (3) suddenly on earth
- (4) by seed dispersal

191. The process of separation and purification of expressed protein before marketing is called :

- (1) Downstream processing
- (2) Bioprocessing
- (3) Postproduction processing
- (4) Upstream processing

192 Which of the following terms describe human dentition?

- (1) Thecodont, Diphyodont, Homodont
- (2) Thecodont, Diphyodont, Heterodont
- (3) Pleurodont, Diphyodont, Heterodont
- (4) Pleurodont, Monophyodont, Homodont

193. Identify the vertebrate group of animals characterized by crop and gizzard in its digestive system

- (1) Amphibia
- (2) Reptilia
- (3) Osteichthyes
- (4) Aves

194. Which one of these animals is not a homeotherm?

- (1) Macropus
- (2) Chelone
- (3) Psittacula
- (4) Camelus

195. Which part of the brain is responsible for thermoregulation?

- (1) Cerebrum
- (2) Hypothalamus
- (3) Corpus callosum
- (4) Medulla oblongata

196. Consider following features

- (a) Organ system level of organisation
- (b) Bilateral symmetry
- (c) True coelomates with segmentation of body

Select the correct option of animal groups which possess all the above characteristics

- (1) Annelida, Arthropoda and Chordata
- (2) Annelida, Arthropoda and Mollusca
- (3) Arthropoda, Mollusca and Chordata
- (4) Annelida, Mollusca and Chordata

197. Select the correctly written scientific name of Mango which was first described by Carolus Linnaeus :

- (1) *Mangifera indica* Car. Linn.
- (2) *Mangifera indica* Linn.
- (3) *Mangifera indica*
- (4) not of the above

198. Following statements describe the characteristics of the enzyme Restriction Endonuclease. Identify the incorrect statement.

- (1) The enzyme cuts DNA molecule at identified position within the DNA.
- (2) The enzyme binds DNA at specific sites and cuts only one of the two strands.
- (3) The enzyme cuts the sugar-phosphate backbone at specific sites on each strand.
- (4) The enzyme recognizes a specific palindromic nucleotide sequence in the DNA.

199. You are required to draw blood from a patient and keep it in a test tube for analysis of blood corpuscles and plasma. You are also provided with the following four types of test tubes. Which of them will you not use for this purpose?

- (1) Test tube containing Calcium Chloride.
- (2) Test tube containing Heparin.
- (3) Test tube containing EDTA.
- (4) Test tube containing Sodium Citrate.

200.

Which one of the following four secretions is correctly matched with its source, target and nature of action?

	Secretion	Source	Target	Action
a	Gastrin	Stomach lining	Oxyntic cells	Production of HCl
b	Inhibin	Sertoli cells	Hypothalamus	Inhibition of secretion of gonadotropin releasing hormone
c	Enterokinase	Duodenum	Gall bladder	Release of bile juice
d	Atrial Natriuretic Factor (ANF)	SA Node	Juxtaglomerular apparatus (JGA)	Inhibition of release of

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

Solutions

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

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

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

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

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Physics solution
SECTION : A

1 (3)

$$v = \sqrt{\text{Tension}}$$

$$\frac{v_1}{v_2} = \sqrt{\frac{T_i}{T_f}}$$

$$\frac{v_1}{v_2} = \sqrt{\frac{T}{2T}}$$

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

2(4)

According to the principle of dimensional homogeneity

Dimension of v = dimension of at
= dimension of t+cb

$$\text{Dimension of } a = \frac{[v]}{[t]} = \frac{LT^{-2}}{T} = [LT^{-2}]$$

$$\text{Dimension of } b = [v][t] = [LT^{-1}T] = [L]$$

$$\text{Dimension of } c = [t] = [T]$$

3(2)

Acceleration at time T, a=0.

Displacement equation, $x=at^2-bt^3$

$$a = \frac{d^2x}{dt^2}$$

$$\frac{dx}{dt} = 2at-3bt^2$$

$$\frac{d^2x}{dt^2} = 2a-6bt$$

Substitute 0 for d^2x/dt^2 and T for t in above acceleration expression:

$$2a - 6bT = 0$$

$$T = \frac{2a}{6b}$$

$$T = \frac{a}{3b}$$

4(3)

Displacement is described because the extrade in function of an item. It is a vector amount and has a path and magnitude. It is represented as an arrow that factors from the beginning function to the very last function. For example- If an item movements from A function to B, then the item's function changes.

Velocity is basically a vector amount. It is the price of extrade of distance. It is the price of extrade of displacement. Speed of an item transferring can by no means be negative.

The pace of a transferring item may be zero
Velocity (v) is a vector amount that measures displacement (or extrade in function, Δs) over the extrade in time (Δt), represented with the aid of using the equation $v = \Delta s / \Delta t$.

$$\text{Given } t = \sqrt{x} + 3$$

$$\sqrt{x} = 3 - t$$

squaring both sides we get

$$x = (t-3)^2$$

velocity v = dx/dt

$$= d/dt (t-3)^2 = 2(t-3)$$

velocity of particle becomes zero when

$$2(t-3) = 0$$

$$t = 3s$$

at t = 3s

$$x = (3-3)^2$$

$$x = 0$$

5(2) The horizontal range is the same when angle of projection is θ or $(90^\circ - \theta)$.

6(1)

$$\text{Range} = \frac{u^2 \sin 2\theta}{g} = \frac{20 \times 20}{10} = 40m$$

because $\theta = 90^\circ$ for maximum range

157(2)

By conservation of energy

$$\frac{1}{2}mv^2 = mgh$$

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

v does not depend on masses

$$\text{So } v_m = v_b$$

8(2)

$$\text{Speed} = 72 \text{ km/h} = 20 \text{ m/s}$$

Coefficient of the kinetic friction = 0.5

$$\text{Acceleration} = 0.5 \times 10 = -5 \text{ m/s}^2$$

From the equation of motion

We know,

$$v^2 = u^2 + 2as$$

Putting all the values

$$0^2 = 20^2 - 2 \times 5 \times s$$

After solving

$$s = 40 \text{ m}$$

9(4)

Here, $m = \frac{M}{L}$ is the mass per unit length.

$$\text{Rate of mass per second} = \frac{dm}{dt} = \frac{mx}{t} = mv$$

$$\text{Rate of K.E.} = \frac{1}{2} \frac{dm}{dt} (v^2)$$

$$= \frac{1}{2} (mv)v^2 = 12mv^3.$$

10(1)

P.E. = total K.E

$$Mgh = \frac{7}{10}mv^2$$

$$v = \sqrt{\frac{10}{7}gh}$$

11(1)

$$RE = \frac{1}{2} mK^2\omega^2$$

$$TE = \frac{1}{2} mR^2\omega^2 + 12mk^2w^2$$

$$RE/TE = K^2/(R^2+K^2)$$

12(1)
 => Rotational motion has angular momentum, angular velocity and MOI.
 => The third law of motion states that angular momentum is conserved.
 => The angular momentum stays conserved only until torque acting on the body is zero.
 => It is given that the mass is rotating in a plane about a fixed point, this directs the angular momentum in the axial direction.
 Hence, (a) A line perpendicular to the plane of rotation is the correct option.

13(1)
 Escape velocity, $v_e = \sqrt{\frac{2GM_e}{R_e}} = 11.2 \text{ km/s}$

For $R' = \frac{R_e}{4}$ $M' = M_e$
 $V'_e = \sqrt{\frac{2GM_e}{\frac{R_e}{4}}} = 2v_e$
 $= 22.4 \text{ km/s}$

14(2)
 As we know, the minimum speed with which a body is projected so that it does not return back is called escape speed, which is given by

$$v_e = \sqrt{\frac{2GM}{r}}$$

Where r is the distance from the centre of the earth,
 given, $r = R + 3R = 4R$

$$\Rightarrow v_e = \sqrt{\frac{2GM}{4R}}$$

$$\therefore v_e = \sqrt{\frac{GM}{2R}}$$

15(4) A hole in a cavity, maintained at constant temperature

16(3)
 Work done during the complete cycle is given by the area enclosed by the curve / cycle. Which in this case is ACBDA.

17(4)
 $Q = \Delta U + W$ For an isothermal process, $\Delta U = 0$ therefore, $Q = W$ Given $W = 150$ Therefore, $Q = 150$ When Q is positive, the heat is added to the gas

18(4)
 Number of moles in 1 gm of He = $\frac{1}{4}$
 Amount of heat energy required to raise its temperature from T_1 K to T_2 K is, (assuming the process takes place at constant volume)
 $Q = nC_v\Delta T$

For a mono atomic gas, $C_v = \frac{3}{2}R$
 $\therefore Q = \left(\frac{1}{4}\right)\left(\frac{3}{2}R\right)(T_2 - T_1)$
 $= \frac{3}{8}Nk_B(T_2 - T_1)$

19(2)
 The total energy of the body performing SHM is given as:

Total energy $U = \frac{1}{2}Ka^2$

20(3)
 Momentum of the system would remain conserved.

Initial momentum = 0
 Final momentum should also be zero.
 Let masses be $2m$, $2m$ and m
 Momentum along x-direction = $2mv\hat{i}$
 Momentum along y-direction = $2mv\hat{j}$
 Net momentum = $\sqrt{(2mv)^2 + (2mv)^2} = \sqrt{2} \cdot 2mv$

Now, $2\sqrt{2}mv = mv'$
 $v' = 2\sqrt{2}v$

21(3)
 Both pipes are in resonance with a given tuning fork, therefore, both pipes will have the same frequency of vibrations.

For organ pipe closed at one end,
 First overtone ($n=3$),

$$f = \frac{3V}{4l_1} \dots\dots\dots(1)$$

For organ pipe open at both ends,
 Third overtone ($n=4$),

$$f = \frac{4V}{2l_2} \dots\dots\dots(2)$$

From (1) and (2),

$$\frac{3V}{4l_1} = \frac{4V}{2l_2}$$

$$\Rightarrow \frac{l_1}{l_2} = 3/8$$

22(1)
 The number of beats will be the difference of frequencies of the two strings.

frequency of first string

$$f_1 = \frac{1}{2l_1} \sqrt{\frac{T}{M}}$$

$$= \frac{1}{2 \times 51.6 \times 10^{-2}} \sqrt{\frac{20}{10^{-3}}}$$

similarly, frequency of second string

$$= \frac{1}{2 \times 49.1 \times 10^{-2}} \sqrt{\frac{20}{10^{-3}}}$$

$$\text{Number of beats} = f_2 - f_1$$

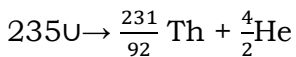
$$= 144 - 137$$

$$= 7 \text{ beats}$$

23(3) Curie is a unit of radioactivity.

24(3) alpha decay forms new elements with too fewer protons and two fewer neutrons.

Example of Alpha decay:



Beta decay forms new element with and one fewer neutron.

example of beta decay:

Gamma decay forms no new elements elements has less energy because energy is released as gamma rays.

example of gamma decay:

A true Neutron decays into a proton and an Antineutrino.

25(1)

$$P = P_0 + \frac{4T}{R}$$

$\Rightarrow R$ increases and P decreases

26(2)

$$R \propto \frac{l}{A}$$

So, the resistance of the wire will be minimum when the area of cross-section is maximum and length is minimum.

27(2)

When n resistance of r ohm connected in parallel then their equivalent resistance is

$$\Rightarrow \frac{1}{R} = \frac{1}{r} + \frac{1}{r} + \frac{1}{r} + \dots \dots \dots n \text{ times}$$

$$\therefore \frac{1}{R} = \frac{n}{r}$$

$$\Rightarrow R = \frac{r}{n}$$

$$\Rightarrow R = nR$$

When these resistance connected in series

$$R_s = r + r + \dots \dots \dots n \text{ times}$$

$$= nr$$

$$= n \times nR$$

$$= n^2R$$

28(3)

Power dissipated across a resistor is $p = v^2/R$

Given Power dissipated across 9Ω resistor is

$$36 = v^2/9$$

$$v = 6 \times 3 = 18 \text{ Volt}$$

Current through 9Ω resistor is $i_1 = v/9 = 2 \text{ A}$

Current through 6Ω resistor is $i_2 = v/6 = 3 \text{ A}$

Current through 2Ω resistor is

$$i = i_1 + i_2 = 5 \text{ A}$$

Potential across 2Ω resistor is

$$V_2 = i(2) = 5 \times 2$$

$$= 10 \text{ V.}$$

29(4)

If the magnetic force balances the electric force then electron can go undeflected.

$$qE = q(v \times B)$$

When electrons enter in a region where there is only magnetic field, then force exerted by the magnetic field will deflect the electron in a direction perpendicular to its motion and also perpendicular to the magnetic field.

Whereas in the presence of electric field, force exerted by the electric field is in a direction opposite to the direction of electric field.

As a result, electron deflected by magnetic field is nullified by the deflection by electric field. As a result, electron moves undeflected.

30(1)

The magnetic moment of a diamagnetic atom is equal to zero

31(1)

The magnitude of induced emf is

$$|\varepsilon| = \left| - \frac{d\phi}{dt} \right| = 100t$$

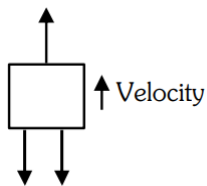
By Ohm's law, current at $t=2$ is

$$I = \frac{\varepsilon}{R} = 100t/400 = 100(2)/400 = 0.5 \text{ A}$$

32 (3)

Constant velocity $\Rightarrow a=0$

$$\begin{aligned} \Rightarrow T &= W + f \\ &= 20000 + 3000 \\ &= 23000 \text{ N} \end{aligned}$$



$$\begin{aligned} \Rightarrow \text{Power} &= Tv \\ &= 23000 \times 1.5 \\ &= 34500 \text{ watts} \end{aligned}$$

33(2)

Not only the human body, but everything emits radiation. But the wavelength of this radiation depends on temperature.

The wavelength actually comes from the frequency of atom vibrations. If atom is hot it moves faster and generates higher frequencies of electromagnetic waves (shorter wavelength).

All atoms in your body have the temperature of your body and emit wavelength in your body frequency. All atoms outside your body also emit wavelength of its temperature. For human body, the wavelength lies in infrared region.

34(3)

The period of revolution of planet A around the sun is 8 times that of B

From the Kepler's third law

We know,

$T^2 \propto r^3$ Where T is the time period and r is the distance from the sun

We can write

$$\frac{T_A^2}{T_B^2} = \frac{r_A^3}{r_B^3}$$

After putting all the values

$$\left(\frac{8}{1}\right)^2 = \frac{r_A^3}{r_B^3}$$

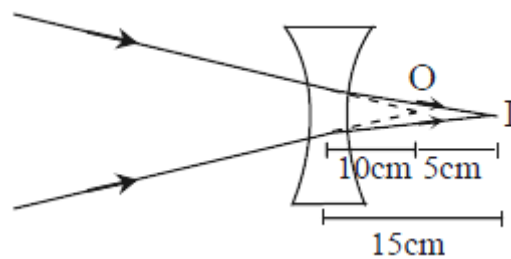
Or,

$$\frac{r_A}{r_B} = 4$$

$$\text{Or, } r_A = 4r_B$$

Hence radius of A is 4 times the radius of B

35(3)



From lens formula, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{15} - \frac{1}{10} = \frac{1}{f}$$

Focal length, $f = -30 \text{ cm}$

SECTION : B

36(1)

Let n_1 and n_2 are the orders of the bright bands of the wavelengths λ_1 and λ_2 respectively, which coincide.

$$\Rightarrow n_1\lambda_1 = n_2\lambda_2$$

Therefore,

$$\frac{n_1}{n_2} = \frac{\lambda_1}{\lambda_2} = \frac{10000}{12000} = 5/6$$

So, the minimum value n_1 and n_2 can have is 5 and 6 respectively.

Consider the interference pattern of λ_1 .

$$\begin{aligned} y_{\min} &= \frac{n_1\lambda_1 D}{d} = \frac{5(12000 \times 10^{-10})(2)}{2 \times 10^{-3}} \\ &= 6 \times 10^{-3} \text{ m} \\ &= 6 \text{ mm} \end{aligned}$$

37(1)

As the intensity of incident light increases, photoelectric current increases.

38 (3)

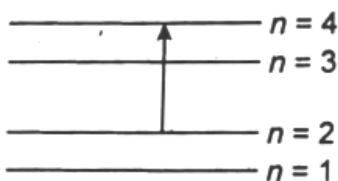
The angle between Electric field and an equipotential surface is always 90° .

This is because, when the potential becomes constant, the negative potential gradient also becomes zero, hence necessitating the need for Electric field to be always normal with surface.

39(2)

Wavelength of lines emitted is $\frac{1}{\lambda} = R \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$

Where R Rydberg's constant.



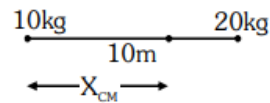
Given, $n_1=2$,

$n_2=4$

$$\therefore \frac{1}{\lambda} = R \left(\frac{1}{2^2} - \frac{1}{4^2} \right)$$

$$\begin{aligned} &= \frac{3R}{16} \\ \Rightarrow \lambda &= \frac{3R}{16} \end{aligned}$$

40 (2)



$$X_{CM} = \frac{20 \times 10}{20 + 10} = 20/3 \text{ cm}$$

41(3)

Given :

$$C = 6 \mu\text{F},$$

$$V_1 = 10 \text{ volt},$$

$$V_2 = 20 \text{ volt}$$

Increase in energy

$$\begin{aligned} E &= \frac{1}{2} CV_2^2 - \frac{1}{2} CV_1^2 \\ &= \frac{1}{2} C(V_2^2 - V_1^2) \\ &= \frac{1}{2} \times 6 \times 10^{-6} (20^2 - 10^2) \\ &= 3 \times 10^{-6} (20^2 - 10^2) \\ &= 3 \times 10^{-6} \times 300 \\ &= 9 \times 10^{-4} \text{ J} \end{aligned}$$

42(3)

In fission process, when a parent nucleus breaks into daughter products, then some mass is lost in the form of energy. Thus, mass of fission products < mass of parent nucleus

$$\frac{\text{Mass of fission products}}{\text{Mass of parent nucleus}} < 1$$

Note: 1. Nuclear fission was discovered by Ottohan and Strassman.

2. In each fission reaction a tremendous amount of energy ($\approx 190\text{MeV}$) is realised

43 (4) Using Einstein's photoelectric equation we can write,

For the first case,

$$h\nu = \Phi + e \left(\frac{V_s}{2} \right) \dots (1)$$

For second case,

$$h \frac{\nu}{2} = \Phi + e(V_s) \dots (2)$$

Using value of $e(V_s)$ from equation(2) in equation(1), we can write,

$$h\nu = \Phi + \frac{1}{2} \left(\frac{h\nu}{2} - \Phi \right)$$

$$h\nu = \Phi + \frac{h\nu}{4} - \frac{\Phi}{2}$$

$$\frac{\Phi}{2} = \frac{3h\nu}{4}$$

$$\Phi = \frac{3h\nu}{2}$$

As we know, $\Phi = hv_0$

$$\text{Therefore } V_0 = \frac{3v}{2}$$

44(4)

$$\beta = 50,$$

$$R_i = 1000 \Omega,$$

$$V_i = 0.01$$

$$V_\beta = i_c R_b,$$

$$i_b = V_i / R_i = 0.01 / 10^{-3} = 10^{-5} \text{A}$$

$$i_c = 50 \times 10^{-5} \text{A}$$

$$= 500 \mu\text{A}$$

45(4)

A diode is said to be reverse biased if p-type semiconductor of p-n junction is at low potential with respect to n-type semiconductor of p-n junction. It is so for circuit

46(1)

Dispersion without deviation this means that ray which is entering and the ray which is going out both are parallel,

As given,

$$A_1 = \text{refracting angle of first prism} = 10^\circ,$$

$$\mu_1 = 1.42,$$

$$\mu_2 = 1.7$$

$$A_2 = \text{refracting angle of second prism}$$

$$\text{As, } \delta = (\mu - 1)A$$

$$\text{So, } \delta_{\text{Total}} = \delta_1 - \delta_2 = 0$$

where δ is the deviation and in this case total deviation is zero.

$$\delta_1 = \delta_2$$

$$A_2(\mu_2 - 1) = A_1(\mu_1 - 1)$$

$$A_2(0.7) = 10(0.42)$$

$$A_2 = 60$$

47 (2)

$$B = \mu_0 n i = \mu_0 \frac{N}{l} i$$

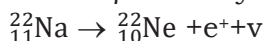
$$\therefore B = 4\pi \times 10^{-7} \times \frac{100}{10^{-3}} \times 1$$

$$= 12.56 \times 10^{-2} \text{T}$$

48(4)



This is β^+ - decay



49(4)

Mean free path for a gas sample $\lambda_m = \frac{1}{\sqrt{2} n \pi d^2}$

where d is diameter of a gas molecule and n is molecular density

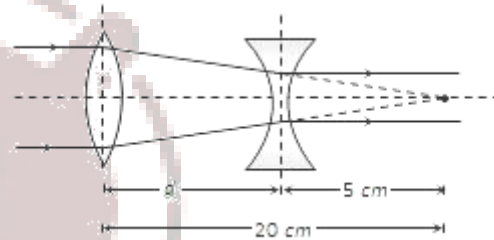
50(3)

In the absence of a concave lens, the parallel beam will be focussed at the focus F_2 of the convex lens i.e. at a distance of 20 cm. from lens A. The focal length of the concave lens is 5 cm. i.e. if this lens is placed at 5 cm from F_2 towards the left, then the beam will become parallel.

From figure, it is clear that separation between lenses

$$d = 20 - 5$$

$$= 15 \text{ cm.}$$



Chemistry solutions

SECTION : A

51 (2)

$$PV = \frac{1}{3} m N u^2 = \frac{1}{3} M u^2 \text{ or } u = \sqrt{3PV/M}$$

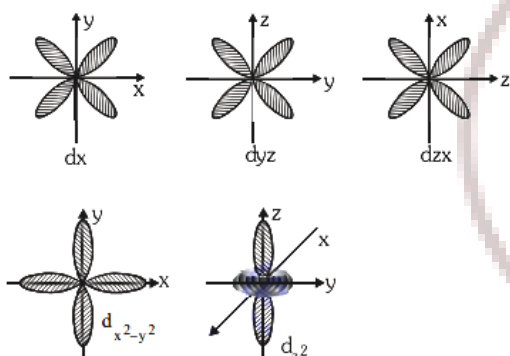
$$\text{At STP } u \propto \sqrt{\frac{1}{M}}$$

i.e. higher will be the molar mass lower will be the value of u_{rms} .

Molecular masses of H_2 , N_2 , O_2 and HBr are, 28, 32 and 81. Hence the correct order is $\text{HBr} < \text{O}_2 < \text{N}_2 < \text{H}_2$

52(1)

The shapes of d_{xy} , d_{yz} and d_{zx} orbitals are similar to each other; and $d_{x^2-y^2}$ and d_{z^2} are similar to each other.



53(4)

Intensity is the amount of flux present per unit area. As a result if the intensity is high the flux is also high.

Therefore the amount of energy that is emitted to the surface is also high hence the energy of the emitted electron increases with increase in the intensity of the incident photon.

This can be calculated by using the Planck's Constant and the wavelength of the photon.

54(2)

Number of atomic orbitals in an orbit = n^2 where, n = energy level

\therefore Number of atomic orbitals in fourth energy level = 4^2
= 16

Hence, the total number of atomic orbitals in fourth energy level of an atom is 16.

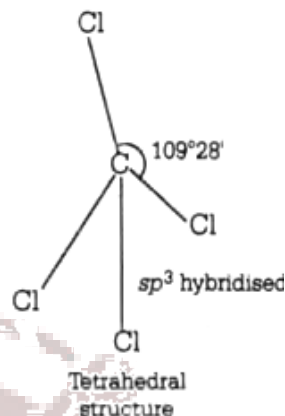
55(1)

The energy required to remove the most loosely bound electron from an isolated gaseous atom is called the ionisation energy. The ionisation potential decreases as the size

of the atom decreases. Atoms with fully or partly filled orbitals have high ionisation potential

56(2)

Carbon tetrachloride (CCl_4) has sp^3 hybridisation and a symmetrical structure, so it has all the bond angles of $109^\circ 28'$.



57(4)

Enantiomers are non-superimposable mirror images of each other.

58(4)

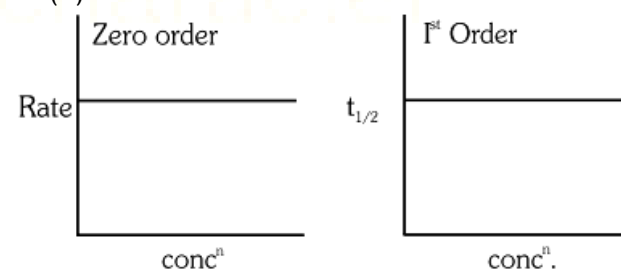
SCl_4 is not isostructural with SiCl_4 because it shows a square planar structure due to the involvement of repulsion between a lone pair and a bond pair of electrons.

SO_4^{2-} shows a tetrahedral structure due to sp^3 hybridisation.

PO_4^{3-} shows a tetrahedral structure due to sp^3 hybridisation.

NH_4^+ shows a tetrahedral structure due to sp^3 hybridisation.

59(4)



(i) The curve is suitable for zero order if y = rate and x = concentration because in the case of a zero-order reaction, the rate is constant and does not depend on concentration.

(ii) The curve is suitable for first order if $y = t_{1/2}$ and $x = \text{concn}$ because in the case of a first-order reaction, $t_{1/2}$ does not depend on concentration.

60(3)

Water molecules attract one another due to its polar property, the hydrogen ends

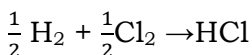
which are positive in comparison with the negative end of oxygen which makes water to stick together so water having maximum surface tension.

61(1)

Adiabatic expansions of an ideal gas is accompanied by decrease in ΔE

62(2)

Bond energies of H-H and Cl-Cl bonds which can be represented as follows :



$\Delta_f H_{\text{HCl}} = \Delta H_{\text{BE Reactant}} + \Delta H_{\text{BE Product}} - \text{BE of HCl}$

$$\Rightarrow -90 = \frac{1}{2} \times 430 + \frac{1}{2} \times 240 - \text{BE of HCl}$$

$$\Rightarrow \text{BE of HCl} = 215 + 120 + 90 = 305 + 120 = 425\text{kJmol}^{-1}$$

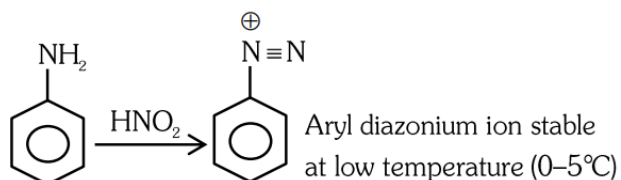
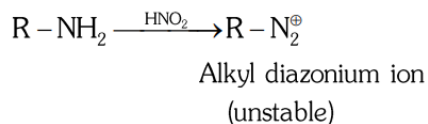
Where, BE= Bond enthalpy

63(4)

The pH value of the blood is maintained constant by buffer solution present in the blood itself. Buffer solutions resist the change in pH values.

64(4)

Correct answer is (d) Statement I is correct but Statement II is incorrect.



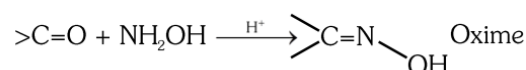
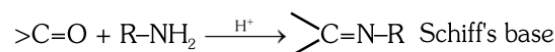
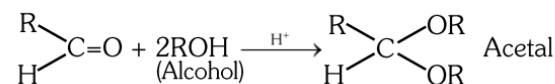
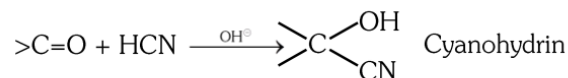
65(3)

The correct order of solubility of Na_2S , CuS and ZnS in aqueous medium is $\text{Na}_2\text{S} > \text{ZnS} > \text{CuS}$. Sodium salts are highly soluble in water and thus of Na_2S shows highest

solubility. The K_{sp} value of CuS is less than ZnS and thus, ZnS is more soluble than the former.

66(1)

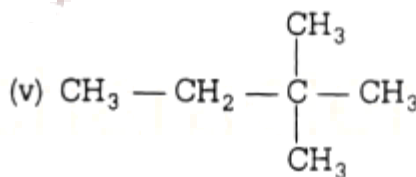
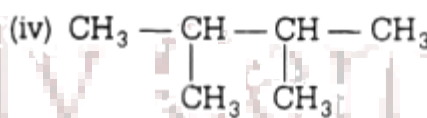
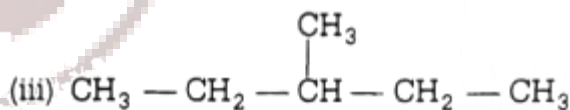
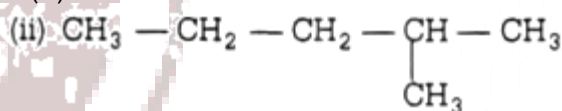
(a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)



67(2)

BeSO_4 has hydration enthalpy greater than lattice enthalpy.

68(2)

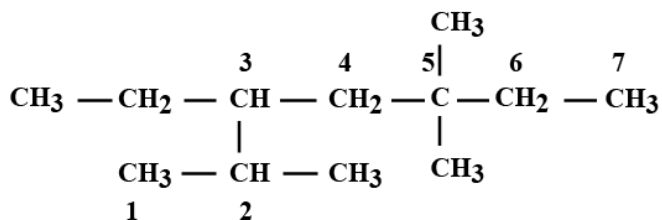


69(4)

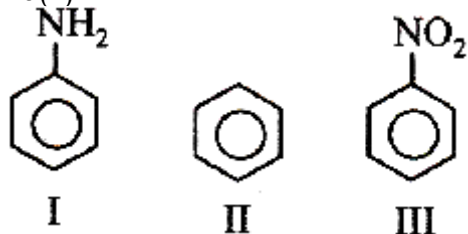
The correct IUPAC name of the structure is 3-ethyl-2,5,5-trimethyl heptane.

The parent hydrocarbon contains 7 carbon atoms and is called heptane. one ethyl group and 3 methyl groups are present as substituents.

The carbon atoms are numbered from that end which is nearest to the point of branching. The parent chain contains maximum number of substituents.



70(1)



-NH₂ group is electron donating hence increases electron density on ring. Benzene is also electron rich due to delocalisation of electrons. -NO₂ group is electron withdrawing hence, decreases electron density on ring. Thus, correct order for electrophilic substitution is I > II > III.

71(3)

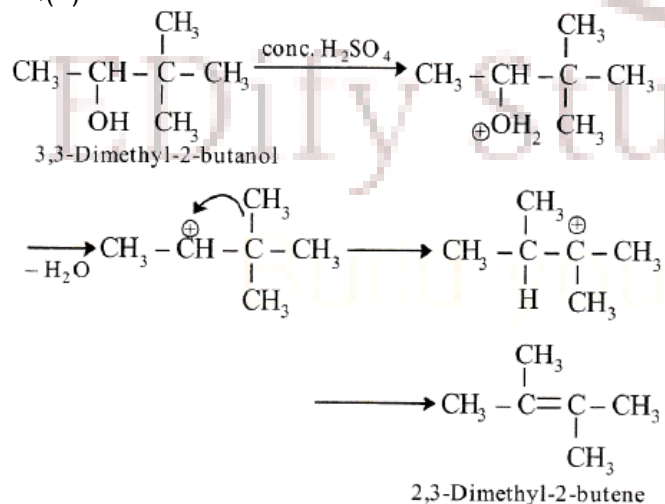
As all reactant and product are liquid

$$\Delta n_{(g)} = 0$$

$$\Delta H = \Delta E - \Delta nRT$$

$$\Delta H = \Delta E (\because \Delta n = 0)$$

72(1)



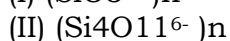
73(3)

CO and oxides of Nitrogen are poisonous gases present in automobile exhaust gases.

74(2)

Chain silicates are formed by sharing two oxygen atoms by each tetrahedron.

Anions of chain silicate have two general formula :



For example, spodumene LiAl(SiO₃)₂; enstatite MgSiO₃ are pyroxene type chain silicates.

75(3)

Given 5% solution of Cane Sugar

⇒ 5g of solute present in 100ml of solution

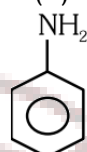
For isotonic solutions π₁ = π₂

$$\Rightarrow C_1 = C_2$$

$$\frac{5}{342 \times 0.1} = \frac{5}{M_2 \times 0.1}$$

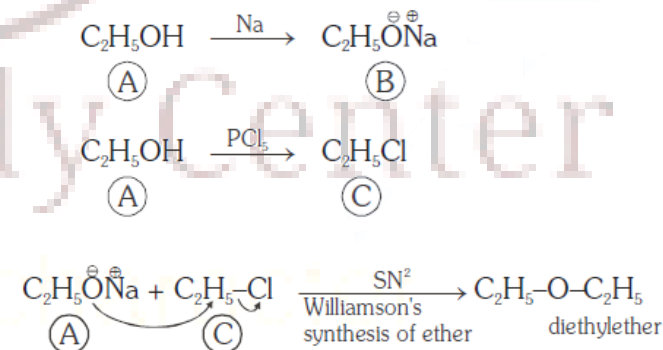
$$\Rightarrow M_2 = \frac{342}{5} = 68.4$$

76(4)



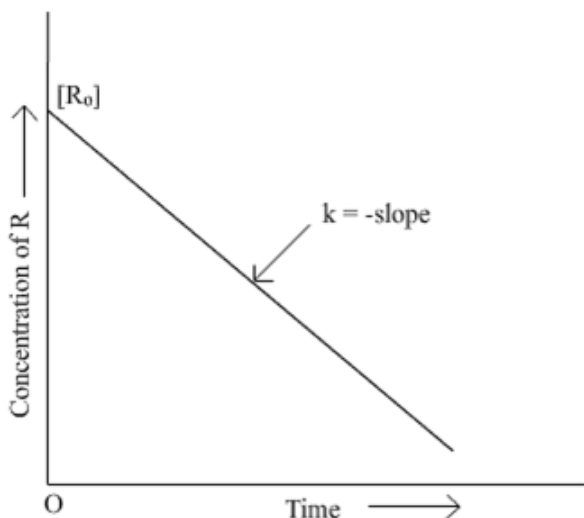
Kjeldahl's method is not applicable to the compounds containing nitrogen having nitro and azo group and nitrogen present in the ring (pyridine), as nitrogen of these compounds does not change to ammonium sulphate under these conditions.

77(2)



78(3)

For a zero order rate equation the plot of concentration versus time is a straight line with a negative slope.



79(1)

The rate law expression for the zero order

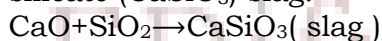
reaction is $\text{Rate} = k[A]^0$

$\text{mol L}^{-1}\text{sec}^{-1} = k \times (\text{mol L}^{-1})^0$

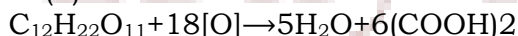
Unit of $k = \text{mol L}^{-1}\text{sec}^{-1}$

The unit of rate constant for a zero order reaction is $\text{mol L}^{-1}\text{s}^{-1}$.

80(3) A slag is an easily fusible material which is formed when gangue still present in the roasted or the calcined ore combines with the flux. For example, in the metallurgy of iron, CaO (flux) combines with silica gangue to form easily fusible calcium silicate (CaSiO_3) slag.



81(2)



Cane sugar From HNO_3 Oxalic acid

82(3) Due to larger atomic size P is unable to form pi bond and so it is tetra-atomic in which each P atom is linked with 3 other P atoms by 3 sigma bonds.

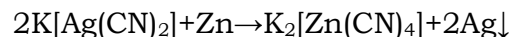
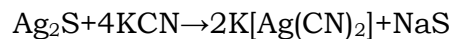
But, due to smaller atomic size N forms 1 sigma and 2 pi bonds i.e. triple bonds with other N atom and exists as diatomic molecules. Hence the bonding is responsible for that.

Phosphorous form P_4 because in P_2 pπ-pπ bond is weaker.

83(4)

Silver metal is extracted from the argenite ore Ag_2S . By cyanide process, in this method the concentrated ore is treated with dilute solution of potassium cyanide, then a soluble complex potassium

dicyanoargenate(I) is formed which when reacted with zinc, silver is extracted as a ppt.



84(1) In lanthanides (At no. of elements 58 to 71) the electronic configuration of three outermost shells are $(n-2)f^{1-14}(n-1)d^{0-1}ns^2$

85(2)

Boiling point of comparable molecular mass molecules

$\text{R-OH} > \text{Aldehyde} > \text{Ketone} > \text{Alkane}$

H-bonding Dipole-dipole interaction Non-polar strong molecular (weak molecular association)

SECTION : B

86(4)

The formula of sodium nitroprusside is $\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$.

The name of sodium cation is written first, the names of ligands are written in alphabetical order. hence "cyano" will be written prior to "nitrosyl". The name of iron metal is written as ferrate.

Oxidation state of Fe be "x"

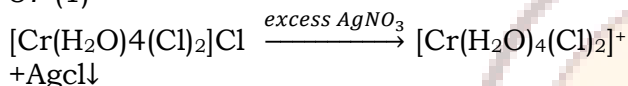
$$x + 5 \times (-1) + 1 \times (+1) = -2$$

$$x = +2$$

Therefore, name of the complex is sodium pentacyanonitrosylferrate(II).

The roman numeral (II) indicates oxidation state.

87 (1)



Using formula, Molarity = $\frac{\text{No of moles}}{\text{volume}} \times 1000$

$$0.01 = \frac{\text{No of moles}}{100} \times 1000$$

$$\text{No. of moles of AgCl} = 0.001$$

88(1)

Conc. HCl and anhydrous ZnCl_2 - Lucas reagent.

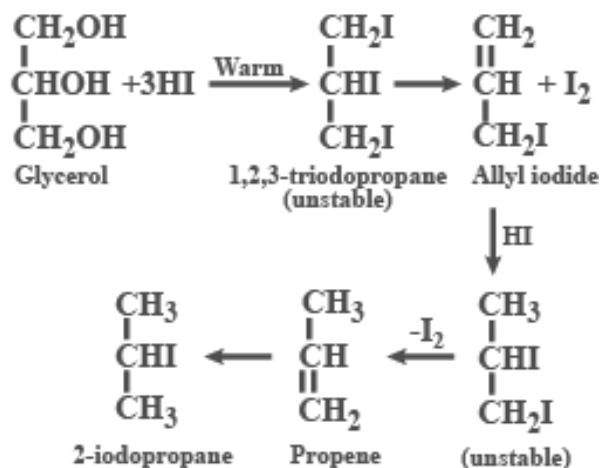
89(2)

When glycerol is treated with an excess of HI, it produces 2-iodopropane.

In the first step, a molecule of glycerol reacts with 3 HI molecules to form unstable 1,2,3-triiodopropane. This loses a molecule of iodine to form allyl iodide.

Allyl iodide adds a molecule of HI to obtain an unstable molecule which loses a molecule of iodine to form propene.

A molecule of HI is added to propene to form 2-iodopropane

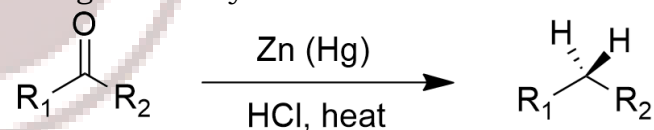


90 (3)

Aldol condensation is given by the compounds which contain α - hydrogen atom. As the given compound does not contain α - hydrogen, so it does not undergo aldol condensation

91(4)

Clemmensen reduction is a chemical reaction described as the reduction of aldehydes or ketones to alkanes using zinc amalgam and hydrochloric acid



92(3)

$$m = \frac{\text{moles of solute}}{\text{weight of solvent (g)}} \times 1000$$

$$1 = \frac{0.5}{\text{weight of solvent (g)}} \times 1000$$

$$\text{Weight of solvent (g)} = 500\text{g}$$

93(1)

Starch is a polymer of D-glucose units, thus on hydrolysis it only gives glucose.

94(2)

Chargaff's rule states that DNA from any cell of all organisms should have a 1:1 ratio (base pair rule) of pyrimidine and purine bases and, more specifically the amount of guanine is equal to cytosine and the amount of adenine is equal to thymine.

95(2)

Interhalogen compound group 17th

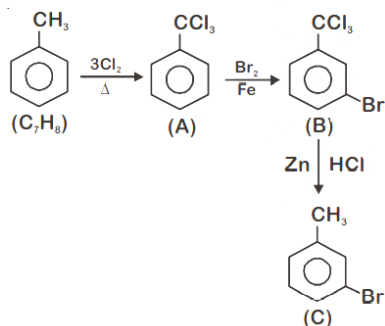
ICl is more reactive due to polar bonds.

From NCERT - X-X' bond is weaker than X-X bond except F₂

96(1)

An example of a sigma bonded organometallic compound is Grignard's reagent. Grignard's reagent is represented by R-MgX. An example is methylmagnesium iodide. A sigma bond is present between C atom and Mg atom.

97(1)



98(3)

MO configuration C₂ is $\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \pi 2p_x^2 = \pi 2p_y^2$; so C₂ molecule contains only π - bonds according to MOT.

99(3)

Carbylamine test - The Carbylamine test is used for the detection of primary amine either aromatic or aliphatic.

In this test, primary amine is reacted with alcoholic chloroform (CHCl₃ + KOH).

Formation of isocyanide, with a foul smell, indicates the presence of a primary amine.

100(2)

Weak acid (CH₃COOH) and salt of weak acid-strong base (CH₃COONa) form an acidic buffer. Sodium acetate (CH₃COONa) = 0.10 M; Acetic acid (CH₃COOH) = 0.01 M; pH of acidic buffer solution is given by

$$\begin{aligned} \text{pH} &= \text{pK}_a + \log \frac{[\text{salt}]}{[\text{Acid}]} \\ &= 4.57 + \log \frac{0.1}{0.01} \\ &= 5.57 \end{aligned}$$

Botany solution

SECTION : A

101(2)

Linnaeus, 1758 developed 'Binomial system of nomenclature', de Candolle gave the term taxonomy. Theophrastus, father of botany, gave names and descriptions of 480 plants in his book. 'Historia plantarum' and Darwin proposed the theory of natural selection or origin of species.

102(4)

RBE (Relative Biological Effectiveness) is a comparison of the dose of the radiation being studied with the dose of standard radiation producing the same effect.

103(1)

Fungal disease, loose smut of wheat spreads by seed and flowers. The causal organism of this disease is *Ustilago* fungus. It is an internal parasite. It has a dikaryotic mycelium which remains within the intercellular spaces of the host tissue. This fungus infects the ovary of the host flower as a result of which the masses of teliospores or brand spores are formed in place of grains, Teliospores are not surrounded by any wall hence, called loose smut.

104(4)

Late blight of potato disease is caused by *Phytophthora infestans*. It is a phycomyces fungus. *Alternaria solani* is the causal organism of early blight of potato disease.

105(2)

In *Chlamydomonas*, hologamy involves the fusion of two young individuals directly, e.g. *C. snowiae* and isogamy involves fusion of gametes which are similar in size, structure and physiology, e.g. *C. euganetos*.

106(3)

Azotobacter, *Anabaena*, *Nostoc* are the nitrogen fixing prokaryotes in lichens, azolla, *Cycas* while *Spirogyra* is a green algae which does photosynthesis. It does not fix nitrogen.

107(2)

Floridean starch (α -1,4-glucan) is the storage polysaccharide or stored form of food found in Red algae i.e. *Rhodophyceae*. It is stored in the cytosol in the form of grains outside the chloroplast. Structurally,

Floridean starch is very similar to amylopectin but it is more highly branched than amylopectin.

108(2)

Adiantum known as Maiden hair fern is a pteridophyte resembles cycas (gymnosperm) in having motile sperm. Seeds, cambium are common in gymnosperms and absent in pteridophytes. True vessels are absent in both pteridophytes and gymnosperms

109(3)

Photo-receptors restricted only to dorsal surface, are more numerous on prostomium and peristomium of earthworm and gradually reduce in number towards posterior end of body. They are totally absent in clitellum. Each photoreceptor consists of a single ovoid cell, with a nucleus and clear cytoplasm containing a network of neurofibrillae and a small transparent L-shaped lens or optic organelle or phaosome, made up of a hyaline substance. Photoreceptors enable worms to judge the intensity and duration of light.

110(2)

Dicotyledoneae is the group of angiosperm with two cotyledons, flower bi or pentamerous, leaves net-vened, stem with Open collateral vascular bundle arranged in a ring and roots form tap root system.

111(2)

The fruit of *Ananas comosus* (pineapple or ananas) is sorosis, (a type of multiple fruits), developing from spike, spadix or catkin. In this type, the flowers associate by their succulent tepals, the axis bearing them grows and becomes fleshy or woody, thus, the whole inflorescence turns into a compact fruit.

112(1)

Inflorescence is of two types racemose and cymose. Cymose inflorescence, in which the main axis terminates into a flower and has limited growth. The flowers are borne in a basipetal order. Example *Solanum* (brinjal), *Dianthus*, *Begonia*, tulip, aloe and teak. Racemose inflorescence in which, the shoot axis continue to grow indefinitely and the flowers are borne in acropetal succession. Example is *sesbania*, *trifolium*, legumes

(soybean) and brassica (mustard and radish).

113(4)

The meristematic tissue which forms the primary xylem and phloem is known as procambium. The term procambium is used to indicate the meristematic tissue that give rise to the morphological vascular units.

114(4)

Mesophyll cells form a layer just below the epidermis of the leaf. It is generally arranged in two layers which are an upper palisade parenchyma and a lower spongy parenchyma. Dorsiventral leaves are main characteristics of dicots. In isobilateral leaf, mesophyll is ground tissue that occurs between the two epidermal layers. It is composed of many layers of loosely arranged, spherical or oval chlorenchyma cells. Intercellular spaces are prominent. The presence of undifferentiated mesophyll. Palisade parenchyma is absent. Isobilateral leaves are characteristics of monocots. Sorghum is a monocot. Gram, mustard, and soybean are dicots.

115(2)

Electron microscope has a high resolution power. This is due to very low wavelength of electron beam (0.005 μ) of the electron beam used as light source. It is produced when a metal filament is heated in a vacuum tube at high temperature, i.e., 50,000 volts.

116(3)

Rough Endoplasmic Reticulum (RER) provides surface for ribosomes for synthesis of secretory (serum proteins), lysosomal and membrane proteins, glycoproteins and helps in packaging of polypeptide chains into enzymes/proteins. It also provides membrane to Golgi bodies for forming vesicles and lysosomes.

117(2)

In terrestrial habitats, temperature and rainfall conditions are influenced by transpiration. The rate of transpiration is directly proportional to the saturation deficit of atmosphere. Plants growing in region where transpiration is meagre do not show over heating. So transpiration prevents overheating.

118(4)

=> At present, it is possible to grow Maize without chemical fertilizers by using organic manures and compost. This is known as organic farming.

=> Excessive use of chemical fertilizers contaminate water bodies due to runoff of excess water and lead to increased algal growth due to nutrient enrichment of the water bodies. This is known as eutrophication.

=> Azotobacter is a free-living bacteria in soil that fixes nitrogen whereas Rhizobium forms a symbiotic association with the root nodules of the plants and fix nitrogen.

=> Cyanobacteria Anabaena and Nostoc have specialized cells known as Heterocyst which help in nitrogen fixation. Hence, these cyanobacteria are important mobilizers of nitrogen.

119(4)

Manganese is essential for activity of some enzymes of Krebs cycle. The enzyme is required in photosynthetic O_2 evolution. Iron is the component of cytochromes and non-heme iron proteins of photosynthesis and respiration. Copper is component of enzymes of redox reactions of electron oxidative phosphorylation and photophosphorylation.

120(4)

Phytoplanktons (algae) of oceans are the highest producers of organic matter.

121(1)

Photosystem I is the second photosystem in the photosynthetic light reactions of algae, plants and some bacteria. Photosystem I is so named because it was discovered before photosystem II. It produces $NADPH_2$.

122(2)

Due to high rate of photosynthesis and reduced rate of photorespiration, C_4 plants are more efficient than C_3 plants. C_4 plants have special leaf anatomy called 'Kranz anatomy'. It have less CO_2 compensation points and chlorophyll concentration is more than in C_3 plants.

Atmospheric CO_2 is fixed by PEP carboxylase in mesophyll cells and is accepted by phosphoenolpyruvate (PEP) in the mesophyll cells to produce 4 carbon organic oxaloacetic acid.

123(4)

The end product of glycolysis is pyruvic acid whereas acetyl CoA is the connecting link between glycolysis and Krebs' cycle. The TCA cycle was first described by Krebs, 1937 as a cyclic process in which acetyl coA is oxidised to CO₂ and water. Acetyl CoA combines with oxalo acetic acid to form citric acid. After a series of cyclic reactions OAA is recycled back.

124(4)

The overall goal of glycolysis, Krebs cycle and electron transport system is the formation of ATP step-wise. The three processes are involved in cellular respiration of f

125(4)

According to Thimann and co-workers, auxin is responsible for the dominance of apical bud. The apical dominance is due to interaction between auxin and cytokinin. If the auxin concentration is higher than cytokinin, the apical bud will dominate the growth.

126(2)

Zinc is a necessary element required for the synthesis of IAA (Indole-3- acetic acid), a type of auxin. So, deficiency of Zn will reduce its production.

So, the correct answer is 'Auxin'

127(4)

Both apomixis and vegetative reproduction produces progeny identical to parent. Apomixis was defined by Hans Winkler as replacement of the normal sexual reproduction by asexual reproduction, without fertilization.

128(2)

=> Callus is unorganized actively dividing the mass of cells maintained in culture. It has a meristematic cell which has ample amount of cytoplasm to trigger cell division. It is treated with the growth hormones to allow the cell division and differentiation. => A population of genetically identical individuals, obtained from asexual reproduction is a clone because fusion of gametes does not take place in vegetative propagation so there is no chance of recombination and variation. The parent cell divides to form daughter cell by mitosis due to which the offspring are genetically identical to the parent. The offspring

produced are clones of their parent and have the same number of chromosomes.

=> Deme is the basic unit of an animal population can interbreed among themselves. It consists of two or more subspecies which can interbreed amongst itself. It shares its own distinct genetic pool. In isolation, the demes turn into distinct species or subspecies. => Aggregate is form or group into a class or cluster.

129(2)

Syconus fruit develops from hypanthodium inflorescence, e.g. Ficus carica, F. religiosa, F. benghalensis. The flask shaped receptacle encloses female flowers that gives rise to achene-like fruitlets. This fruit possesses a small pore protected by scaly leaves. The receptacle that becomes fleshy is edible.

130(2)

Seeds, which store food materials in their cotyledons are called non- endospermic or exalbuminous seeds.

Seeds, which store food materials in their endosperm are called endospermic or albuminous seeds.

Cotyledons- It store food material in exalbuminous seed.

Hypocotyl- The portion of the axis between the radicle and cotyledonary node is called hypocotyl.

It is a persistent nucellus.

Endosperm- It store food material in the albuminous seed.

131(4)

Genotype of a heterozygous man with A blood group I^A I and that of a homozygous man with A blood group I^A I^A.

A cross between heterozygous man with A blood group and woman of AB blood group produce progeny with A, AB and B blood groups.

Gametes	I ^A	I
I ^A I ^B	I ^A I ^A	I ^A I
I ^B	I ^A I ^B	I ^B I

On the other hand, a cross between homozygous man with A blood group, I^A I^A and woman of AB blood group, I^A I^B produce

progeny with A, AB blood groups, none of the child will have B blood group.

Gametes		
$I^A I^A$	I^A	I^A
$I^A I^B$		
I^A	$I^A I^A$	$I^A I^A$
I^B	$I^A I^B$	$I^A I^B$

Hence, a child with B blood group would indicate that man is heterozygous A.

132(2)

An individual exhibiting both male and female sexual characteristics in the body is known as Gynandromorph (The term gynandromorph, from Greek "gyne" female, "andro" male, and "morphé" form).

The cases of gynandromorphism have been reported in man, Drosophila, silkworm, bees, butterflies, beetles, etc.

133(1)

Industrial melanism in the peppered moth (*Biston betularia*) provides a well studied example of directional selection (natural selection) from nature. Directional selection produces a regular change with in a population in one direction in respect to certain characteristic. In geographical isolation two populations of the same species are separated by some physical or geographic barriers or they occupy different geographical areas. Reproductive isolation is the failure of interbreeding between closely related species.

134(3)

Mendel worked on garden pea and choose seven characters for this. Green seed colour is the recessive character in his experiment and the dominant character for seed colour is yellow. Axial flower position, green pod colour and round seed shape are all dominant characters.

135(1)

$AaBbCC$ will produce 4 types of gametes which are as follows- ABC, AbC, aBC, abC. The number of gametes formed is decided by the number of heterozygous alleles present in the given genotype. 2^n is the formula

used to find it out, where n=number of heterozygous alleles present in the genotype. Say for example, in the above genotype Aa & Bb are the 2 heterozygous alleles, so here $n=2$. Putting the values in the formula , we get $2^2=4$. Hence 4 types of gametes are formed.

SECTION : B

136(2)

Thalassemia-autosomal-linked resessive
AA-Normal
Aa-Carrier
aa-Disease
Affected=41=25%

An autosomal recessive disorder like thalassemia is caused by abnormalities in both members of a pair of genes. Both parents may carry a single dose of the gene on one chromosome but have a normal gene on the other chromosome, which prevents the appearance of the disease in the carrier parent. A child must get one abnormal gene from each parent in order to be affected by the disease. Parents who are both carriers of an autosomal recessive disorder have a 25% risk of producing an offspring affected by the disease and a 50% risk of producing normal-appearing carriers.

137(2)

Nitrogen bases are aromatic cyclic ketones with amine or imine group. Tautomers are a type of structural isomers which are formed by shifting of pi-bonds between functional groups. They are also called as keto-enol isomers and are inter-convertible into each other as " $-C=C-C-OH$ " change to " $C-C-C=O$ ". Tautomerization converts the amino ($-NH_2$) group of cytosine and adenine into amino ($-NH$) group and keto ($C=O$) of thymine and guanine into enol group ($-OH$). This results in the pairing of tautomeric thymine with normal guanine and of cytosine with adenine. The resultant mutation is caused by tautomeric mutations.

138(4)

In eukaryotes, the regulation of gene expression involves splicing together of exonic portions of RNA to give rise to functional m-RNA. Introns are DNA sequences lying within a coding sequence, but not usually encoding cell product. Exon is a DNA sequence encoding and gives rise to a translated polypeptide sequence (protein).

139(1)

The more maternal influence can be expected in the cytoplasmic inheritances (ie, the inheritance of genes contained in the cytoplasm of a cell, rather than the nucleus).

The reason is that the female reproductive cell or the egg has large amount of cytoplasm containing many organelles which contain their own genes and can reproduce independently (eg, mitochondria and chloroplast) and which are consequently incorporated into the cytoplasm of all the cells of the embryo. The male reproductive cell (sperm or pollen) consists almost solely of a nucleus. Cytoplasmic organelles are thus, not inherited from the male parent. This is why, the cytoplasmic inheritance is also called maternal inheritance.

Genes located on Y-chromosome are called Y-genes and their inheritance is called Y-linked inheritance. This carries the paternal influences.

A gene located in the X-chromosome is said to be X-linked and its inheritance is called X-linked inheritance. In this, a male transmits his X-chromosome only to his daughters while a female transmits one of her X-chromosome to the offspring of both sexes.

140(3)

Genetic code is non-ambiguous. Non-ambiguous code means that there is no ambiguity about a particular code. One codon specifies only one amino acid and not any other. There are 64 codons. Out of 64, 3 are stop codons or nonsense codons, i.e., these do not code for any amino acid and rest 61 code for one of the 20 amino acids. Neither of them code for more than one amino acids except GUG which normally code for valine but in certain conditions it also codes for N-formyl methionine as initiation codon.

141(4)

As a part of agriculture, man started rearing plants and animals to meet his requirements. This is when humans started to learn how to influence the process of natural evolution, so as to breed plant or animals. Slowly and gradually, this process of expedited evolution, through selection and cultivation of plants, acquired the form of a routine endeavor called as plant breeding. In this, heredity, which refers to the passage of various characteristic features from the main plant (the parent) to the plantlets (the progeny), plays an important role. The effects of heredity had been apparent to early man and he had taken advantage of them ever since the advent of agriculture. Various methods have evolved in plant breeding.

One of the most important methods is that of selection. After the selection of parents with desired characteristics, they can be hybridized to yield better offsprings with both the parent characteristics. So, the correct answer is 'selection and hybridization'

142(2)

Compared to a bull a bullock is docile because of lower levels of blood testosterone. A bullock is a castrated bull. Bulls have castrated to make them more meek and docile. Castration is any action, surgical, chemical, or otherwise, by which a male loses the functions of the testes or a female loses the functions of the ovaries. Castration is the removal or destruction of one or both testicles and results in sterility, decreased sexual desire, and inhibition of secondary sex characteristics. It is performed for the purpose of improving the quality of meat and decreasing the aggressiveness of farm animals; in pet animals it prevents unwanted mating behaviour, reproduction, and wandering.

143(4)

Some common fungal inhabitants of soil help to combat diseases caused by soil borne plant pathogens. These include *Trichoderma harzianum* which are found in damp soils. They have an inhibitory effect on the growth of the mycelium of *Pythium*. They serve to suppress fungi causing damping of disease of the seedlings and thereby influence favourably the growth of crops.

144(1)

Animals that can tolerate only a small range of salinity are stenohaline.

145(3)

Biochemical oxygen demand (BOD) is the amount of oxygen taken up by microorganisms that decompose organic waste matter in water. It is therefore used as a measure of the amount of certain types of organic pollutant in water.

146(3)

An ecological pyramid is a graphical representation of relationship between different organisms. It shows the biomass at each trophic level of an ecosystem. It is of three types, pyramid of numbers, pyramid of

energy and pyramid of biomass. Pyramid of numbers indicates the total number of individuals at each trophic level. Pyramid of energy indicates the rate of energy flow. Pyramid of biomass indicates the dry weight of living organisms at each trophic level.

147 (3) Dissecting microscope

148 (1)

Mitosis is the equational division of nucleus in which chromatin fibers first condense to form chromosome at prophase and nuclear membrane start to disappear. During metaphase, all the chromosome aligned at the equator and attached to the spindle fiber with centromere of the chromosome. During anaphase, division of centromere and segregation of chromosome occurs at opposite pole of the nucleus and then telophase occurs.

149 (3)

The true infectious part of any virus is its nucleic acid, either DNA or RNA but never both.

150(3)

A single stranded DNA or RNA, tagged with a radioactive molecule (probe) is allowed to hybridise to its complementary DNA in a clone of cells followed by detection using autoradiography. The clone having the mutated gene will hence not appear on the photographic film, because the probe will not have complementarity with the mutated gene.

ZOOLOGY SECTION A

151(2)

When the mosquito bites humans it ingests blood cells containing gametocytes.

The mosquito digests the blood cells, releasing the male and female gametes, which fuse together and burrow into the mosquito's gut wall, where they mature inside oocysts.

After 8-15 days (depending on the species) the oocysts burst and sporozoites are released into the body cavity of the mosquito.

From there, they travel to the salivary glands. When the mosquito bites these infective sporozoite enters the blood of the humans.

Hence sporozoites are the infective stages of the malaria parasite is found in salivary glands of the mosquitoes.

152(2)

The atmospheric nitrogen() is not available for the plants. By the process of nitrogen fixation, atmospheric nitrogen is converted into ammonia() and made available for plants. The nitrogen fixer soil organisms belong to bacteria.

Examples of free-living nitrogen-fixing bacteria include cyanobacteria, Azotobacter, Clostridium.

153(1)

Till today, the most important in genetic engineering of plants has been the Ti plasmid of soil bacterium, Agrobacterium tumefaciens. E.Coli has been extensively used as "work horse" for genetic engineering e.g., production of humulin, somatotropin. E. coli is one of the most thoroughly studied of all living things. It is a favorite organism for genetic engineering as cultures of it can be made to produce unlimited quantities of the product of an introduced gene. Several important drugs (insulin, for example) are now manufactured in E. coli.. Nitrosomonas, Klebsiella, Nitrobacter, Azotobacter, Rhizobium and Diplococcus are not used in genetic engineering.

154(2)

Ascaris is monogenetic since it has only one host, a man in which infection occurs directly. Cleavage is spiral, determinate and holoblastic. The first larva is formed 10-14

days after cleavage and is called rhabditiform larva or first larva which is not an infective stage. In another week, it molts to become the second larva, which is capable of infecting the host.

155(1)

Vertebrates have well developed cranium (skull) hence, they are also called as Craniata.

156(3)

Mammals have twelve pair of cranial nerves. Ten pairs of cranial nerves are present in fish and amphibians. Reptiles and birds also have 12 pairs of cranial nerves.

157(4)

=> Garden lizard has three-chambered heart and crocodile has a four-chambered heart.

=> Ascaris and Ancylostoma have pseudo segmentation.

=> Sea horse and flying fish are cold-blooded or poikilothermic animals.

=> Pteropus is viviparous and Ornithorhynchus is oviparous.

Hence option C has the correct pair. So, the correct answer is 'Sea horse and Flying fish - Cold blooded (poikilotherm)'.

158(4) Lymphocytes are one of the main types of immune cells. Lymphocytes are divided mainly into B and T cells. B lymphocytes produce antibodies - proteins (gamma globulins) that recognize foreign substances (antigen) and attach themselves to them. B lymphocytes (or B cells) are each programmed to make one specific antibody.

159(2) ciliated

160(1)

Pythium is a genus in the class Oomycetes, which are also known as water molds. Oomycetes are not true fungi, as their cell walls are made of cellulose.

161(1)

Deoxyribo Nucleic Acid (DNA) is helically coiled macromolecule, made up of two antiparallel polydeoxyribonucleotide chains held together by hydrogen bonds. The chains are interlocked and are coiled around a common axis. DNA has a diameter of 20 Å One turn of spiral has a distance of 34 Å containing 10 nucleotides in each turn.

162 (3)

There are only 20 amino acids . These can be arranged in different order in the polypeptide chain to form a diverse array of proteins.

163(4)

Coenzyme is a non proteinaceous organic compound. It can be inorganic, organic and metallic complex compound which mainly binds with the apoenzyme and make it active for enzymatic functions and thus also called as an enzyme helper.

164(2)

The pancreas produces majorly three types of digestive enzymes:

Proteases: to digest proteins.

Lipase: to break down fats.

Amylase: for the digestion of carbohydrates.

The pancreas maintains the body's blood glucose (sugar) balance. Primary hormones of the pancreas include insulin and glucagon, and both regulate blood glucose. Insulin: This hormone regulates blood glucose by allowing many of your body's cells to absorb and use glucose. In turn, this drops blood glucose levels.

Glucagon: Glucagon helps insulin maintain normal blood glucose by working in the opposite way of insulin. It stimulates your cells to release glucose, and this raises your blood glucose levels.

165(1)

Chyme is a thick semifluid mass of partially digested food and digestive secretions that is formed in the stomach and intestine during digestion.

166(1)

The openings of oesophagus and trachea are controlled by epiglottis, which remains closed while swallowing foods. If epiglottis remains open while eating, food particles may enter trachea and obstruct airway. The cough reflex helps trachea to remove food particles and clear the pathway.

167(3)

Cigarette smoking causes an immunogenic response. It results in increased levels of inflammatory markers. It may result in the development of irreversible narrowing of bronchial tubes due

to inflammation and scarring. It causes cancer, chronic lung disease. The pneumotaxic centre in the pons region of the brainstem moderates the functions of the respiratory rhythm centre. It reduces the duration of inspiration and therefore alters the respiratory rate.

Workers in grinding and stone-breaking industries may suffer from lung fibrosis. Exposure to environmental pollutants like silica, metal dust, bacteria and animal proteins can lead to lung fibrosis. Carbon dioxide is carried in the blood as bicarbonate, dissolved CO₂ and carbaminohemoglobin. About 29% of it is carried as carbaminohaemoglobin.

168(1)

Leukemia is a group of cancers that usually begin in the bone marrow and result in high number of abnormal white blood cells. It is a basically, blood cancer.

Thrombosis is the formation of a blood clot inside a blood vessel.

Hemophilia is a group of hereditary disease in which the blood clotting does not take place.

Hemolysis is the rupture or destruction of the red blood cells.

169(4)

Eosinophils are a type of WBCs. They are granulocytes and are involved in combating infections by releasing granular proteins or by degranulation.

Lymphocytes are B-cells or T-cells and they have receptors on their surface and are able to bind antigens and thus, help the foreign substance to get removed from the body.

Neutrophils are the most abundant type of WBCs. They are phagocytic in nature and are able to engulf foreign substances (like bacteria).

Monocytes are a type of WBCs. Monocytes mature in different types of macrophages at different locations. Monocytes and their macrophages serve three main functions as phagocytosis, antigen presentation and cytokine production.

170(3)

The principle nitrogenous excretory compound in humans is urea. Urea is produced in a series of reactions (urea cycle) which take place in the mitochondrial matrix and cytosol of liver cells. Urea cycle (ornithine cycle) is the series of biochemical

reactions that converts ammonia, which is highly toxic, and carbon dioxide to the much less toxic urea during the excretion of metabolic nitrogen derived from the deamination of excess amino acids. The urea is ultimately excreted in solution in urine.

171(3)

Proximal convoluted tubule helps in the reabsorption of most electrolytes and water from the glomerular filtrate, independent of hormones. They are reabsorbed mostly by Na^+K^+ transport and water is reabsorbed due to the presence of many aquaporins. The loop of Henle is responsible for reabsorption of Na^+ and Cl^- . Only 15% water is reabsorbed from the loop of Henle. Distal convoluted tubule regulates water and electrolyte absorption only in presence of the hormones aldosterone and vasopressin. So, only fewer amounts of electrolyte and water are reabsorbed.

172(2)

Muscular dystrophy is characterized by progressive skeletal muscle weakness, defects in muscle proteins and the death of muscle cells and tissue. Myasthenia gravis is an auto-immune neuromuscular disease in which muscle becomes weak, which is caused by circulating antibodies that block acetylcholine receptors at the postsynaptic neuromuscular junction inhibiting the excitatory effects of the acetylcholine. Gout is inflammation of joints which is caused by elevated levels of uric acid in the blood which crystallizes and the crystals are deposited in joints, tendons and surrounding tissues.

173(3)

Glial cells sometimes called as neuroglia are non-neuronal cells, that maintain homeostasis, form myelin, and provide support and protection for neurons in the brain and peripheral nervous system.

174(1)

Cortisol is a glucocorticoid, secreted by adrenal cortex. It is primarily meant for carbohydrate metabolism, which increases the rate of gluconeogenesis (conversion of proteins in liver into sugars) and decreases peripheral utilisation of glucose, thus it possess anti-insulin effect.

175(2)

Parathyroid gland secretes parathormone which regulates Ca^{2+} level in blood. Anterior lobe of pituitary secretes the following hormones growth hormone, ACTH, TSH, FSH, LH. Posterior pituitary secretes vasopressin and oxytocin. The intermediate lobe (pars intermedium) of the pituitary gland secretes MSH which causes dispersal of pigment granules in the pigment cells which give colour to the skin.

176(1)

Delta cells are somatostatin-producing cells. They can be found in the stomach, intestine and the pancreatic islets. In women, relaxin is secreted into the circulation by the corpus luteum in the ovary. when a body does not make enough insulin, blood sugar level increases causing diabetes mellitus disease. However, glucagon is secreted by an alpha cell of the pancreas.

177(1)

The appearance of hair on the head of the fetus and initial movements called Quickening takes place between the 14th to 16th month of pregnancy. So, the correct answer is 'Fourth month'.

178(2)

Infertility due to inability of the male to inseminate the female or due to very low sperm counts in the ejaculates can be corrected by artificial insemination. Ova from the wife/donor (female) and sperms from the husband/donor (male) are collected and are induced to form zygote under simulated conditions in the laboratory is called test-tube baby programme. Introduction of sperms of healthy donor directly into the ovary is called Intra Cytoplasmic Sperm Injection (ICSI).

179 (4)

Primitive atmosphere was reducing type (without free oxygen). Hydrogen atoms combined with oxygen forming water and with nitrogen, forming ammonia. Water and ammonia were probably the first compound molecules on primitive earth. The primitive atmosphere contained gases like CO_2 , CO , N , H_2 , etc. and methane (CH_4) was the first organic compound formed in primitive atmosphere. In the primitive atmosphere, electric discharge, ATP and solar energy provided the source of energy for polymerization reactions of organic synthesis

which lead to the synthesis of amino acids, that joined to form polypeptides and proteins. Simple sugar units combined to form polysaccharides; fatty acids and glycerol to form fats; sugars, nitrogenous bases and phosphates combined into nucleotides which polymerised into nucleic acids in the ancient oceans.

180(2)

Mesozoic era is the era during which reptiles were dominant. It includes three periods : Triassic (240 million years ago), Jurassic (195 million years ago) and Cretaceous (135 million years ago). Origin of dinosaurs occurred during triassic period. During Jurassic period, lizards, crocodiles and alligators originated. Dinosaurs became large and reptiles were dominant during this period. During cretaceous period, dinosaurs got extinct.

181(3)

Convergent evolution is the process whereby organisms not closely related, independently evolve similar traits as a result of having to adapt to similar environments or ecological niches. Convergent evolution creates analogous structures that have similar form or function but were not present in the last common ancestor of those groups. Hence two species of different genealogy (a line of descent traced continuously from an ancestor) show resemblance due to similar adaptation. The phenomenon is convergent evolution.

182. (3) Cellulose is the structural polysaccharide of plant cell walls. They are long chain polymers of β -glucose units. The adjacent β -glucose units are joined by linkages.

183(4) Genetic drift

184(1)

Vaccine contains dead, attenuated form or antigen of a pathogen which can be injected to provide immunity towards that pathogen. Monoclonal antibodies are homogenous immunological reagents of defined specificity, so that these can be utilized for diagnosis and screening with certainty.

185(2)

There are various factors which can affect our lungs by causing allergies which may lead to uncomfortable coughing and fever. Seasonal allergies can also trigger such problems related to lungs such as asthma, bronchitis allergies.

Pollen is one of the most common triggers of allergies. Plants release pollen each spring and during early fall. Exposure to these Pollen can cause allergic reaction which will adversely affect our lungs and can even trigger asthma.

So we can say that the increased as the asthmatic attacks in a certain season can be related to the inhalation of seasonal pollen grains through air.

SECTION : B

186(1)

Anti-snake venom is made by collecting venom from the snake and injecting small amounts of it usually into a horse. The antibodies that form in the horse blood are then collected and used to treat a snake bite case by injecting directly to the affected person.

Antibodies against smallpox are produced by B-lymphocytes.

Antibodies contain 2 light chains and 2 heavy chains.

Rejection of a kidney graft is a function of T-lymphocytes.

So, the correct answer is, 'Preformed antibodies need to be injected to treat the bite by a viper snake'.

187(2)

The clone is a population of genetically identical individuals normally produced asexually or by vegetative reproduction. A plasmid is an extrachromosomal small DNA molecule which can replicate independently.

They are mostly found in bacteria but are also present in archaea and eukaryotic organisms. An engineered DNA molecule that can serve to carry foreign genetic material into another cell to facilitate the expression of the foreign gene, for example, plasmids, cosmids, and artificial chromosomes. A probe is a radiolabeled single-stranded DNA/ RNA fragment used to search for a gene of interest or other DNA sequence. For the purpose, the base sequence of the probe is complementary to the target sequence to facilitate its base pairing with the target gene.

188(1)

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.

189(3)

At the constant birth rate in population through time and is never limited by food or disease, known as exponential growth.

The formula of exponential growth is $\frac{dN}{dt} = rN$ where $\frac{dN}{dt}$ is the rate of change in population size, r is the biotic potential and N is the population size.

190(1)

Diversification in plant life appeared due to long periods of evolutionary changes.

Initially plants were thalloid. There were no differentiation among root, stem and leaves. Vascular tissues were absent.

191(1)

Downstreaming process helps in the recovery and purification of biosynthetic product. It is mainly used during large scale production of metabolites. The steps included in down streaming process are as follows:

Removal of insoluble substances

Isolation of product

Purification of product

Product polishing

192(2)

In humans, dentition is

- Thecodont: Teeth are present in the sockets of the jaw bone called alveoli.
- Diphyodont : Teeth erupts twice, temporary milk or deciduous teeth are replaced by a set of permanent or adult teeth.
- Heterodont dentition : Dentition consists of different types of teeth namely incisors, canine, premolars and molars.

193(1)

The digestive system of most of the aves consists of the pharynx, oesophagus, crop, proventriculus, gizzard, small intestine and large intestine. Proventriculus and gizzard are parts of the stomach. From the oesophagus, food passes into the crop. It then moves into the gizzard.

194(2)

Those organisms that have the ability to maintain their internal temperature, even when the external temperature is constantly changing are called homeotherms.

Animals like mammals, amphibians, and insects are able to maintain their internal temperature.

Chelone is from class reptilia which are cold-blooded animals.

They cannot maintain their internal temperature.

195(2)

Hypothalamus in the thermoregulatory centre of our brain. It is responsible for maintaining constant body temperature.

196(1)

True segmentation is present in Annelida, Arthropoda and Chordata. They also have an organ-system level of organisation, bilateral symmetry and are true coelomates. On the other hand, molluscs have an unsegmented body.

So, the correct answer is 'Annelida, Arthropoda and Chordata'

197(2)

According to rules of binomial nomenclature, correctly written scientific name of mango is *Mangifera indica* Linn.

198(2)

Restriction enzymes cut DNA molecules at a particular point by recognising a specific sequence. Each restriction endonuclease functions by inspecting the length of a DNA sequence. Once it finds its specific recognition sequence, it will bind to the DNA and cut each of the two strands of the double helix at specific points in their sugar-phosphate backbone.

199(1)

Clotting of blood can be prevented by adding heparin, one of the most powerful anticoagulants, which acts indirectly by activating plasma antithrombin III. Heparin is effective both in vivo and in vitro. EDTA and sodium citrate are also effective anticoagulants. Calcium on the other hand, is required for the clotting cascade of blood. Without calcium, blood cannot clot. So, use of a calcium compound will most definitely induce clotting.

200 (1)

Gastrin is a peptide hormone produced in the stomach lining. It stimulates the gastric acid (HCl)

secretion by the oxyntic cells of stomach. This HCl further helps in digestion process. Inhibin is secreted by granulosa and sertoli cells in response to FSH. It inhibits secretion of follicle-stimulating hormone (FSH) by the pituitary gland. Enterokinase hormone is secreted by the duodenum. It converts the inactive trypsinogen into trypsin that helps in digestion of proteins. Atrial natriuretic factor (ANF) is secreted by atrium of heart. It inhibits release of renin by targeting juxtaglomerular apparatus.

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