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NEET MOCK TEST 2023

**Question Paper With Solution and
Explanation**

Date: 05.05.2023 FRIDAY

NEET PERSONAL BATCH BY EXPERTS

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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/markings responses on Answer Sheet.
5. Rough work is to be done in the space provided for this purpose in the Test Booklet only.

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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.

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Physics
SECTION : A

1. The dimensional formula of torque is

- (1) $[ML^2 T^{-2}]$
- (2) $[MLT^{-2}]$
- (3) $[ML^{-1} T^{-2}]$
- (4) $[ML^{-2} T^{-2}]$

2. If the error in the measurement of radius of a sphere is 2%, then the error measurement of volume will be:

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

3. A car moving with a speed of 40 km/h can be stopped by applying brakes at least after 2 m. If the same car is moving with a speed of 80 km/h, what is the minimum stopping distance?

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

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

- (1) Uniform and remains constant for both the regions.
- (2) A linearly increasing function of distance upto the boundary of the wire and then linearly decreasing for the outside region.
- (3) A linearly increasing function of distance r upto the boundary of the wire

and then decreasing one with $\frac{1}{r}$ dependence for the outside region.

(4) A linearly decreasing function of distance upto the boundary of the wire and then a linearly increasing one for the outside region.

5. A particle moves with a velocity $6\hat{i} - 4\hat{j} + 3\hat{k}$ m/s under the influence of a constant force $F = 20\hat{i} + 15\hat{j} - 5\hat{k}$ N. The instantaneous power applied to the particle is

- (1) 45 J/s
- (2) 35 J/s
- (3) 25 J/s
- (4) 195 J/s

6. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is:

- (1) $\theta = \tan^{-1}\left(\frac{1}{4}\right)$
- (2) $\theta = \tan^{-1}(4)$
- (3) $\theta = \tan^{-1}(2)$
- (4) $\theta = 45^\circ$

7. If a cricketer catches a ball of mass 150 gm moving with a velocity of 20 m/s, then he experiences a force of (Time taken to complete the catch is 0.1 sec.)

- (1) 300 N
- (2) 30 N
- (3) 3 N
- (4) 0.3 N

8. The kinetic energy acquired by a mass (m) in travelling distance (s) starting from rest under the action of a constant force is directly proportional to

- (1) $1/\sqrt{m}$

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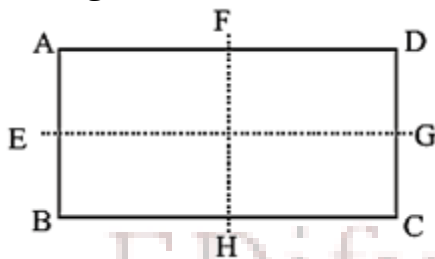
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- (2) $1/m$
- (3) \sqrt{m}
- (4) m^0

9. A body of mass 1 kg is thrown upwards with a velocity 20 m/s. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction? ($g = 10 \text{ m/s}^2$)

- (1) 30 J
- (2) 40 J
- (3) 10 J
- (4) 20 J

10. In a triangle ABCD ($BC = 2AB$). The moment of inertia is minimum along axis through.



- (1) BC
- (2) BD
- (3) HF
- (4) EG

11. A thin circular ring of mass M and radius r is rotating about its axis with a constant angular velocity ω . Four objects each of mass m , are kept gently to the opposite ends of two perpendicular diameters of the ring. The angular velocity of the ring will be

- (1) $\frac{(M+4m)\omega}{M+4m}$
- (2) $\frac{4\omega}{4m}$
- (3) $\frac{M\omega}{M+2m}$

(4) $\frac{(M-4m)\omega}{m}$

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

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

13. Assuming earth to be a sphere of a uniform density, what is the value of gravitational acceleration in a mine 100 km below the earth's surface (Given $R=6400 \text{ km}$)

- (1) 9.65 m/s^2
- (2) 7.65 m/s^2
- (3) 5.06 m/s^2
- (4) 3.10 m/s^2

14. When an elastic material with Young's modulus Y is subjected to stretching stress S , elastic energy stored per unit volume of the material is

- (1) $YS/2$
- (2) $S^2 Y/2$
- (3) $S^2 / 2Y$

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(4) S/ 2Y

15. Consider a compound slab consisting of two different materials having equal thicknesses and thermal conductivities K and $2K$, respectively. The equivalent thermal conductivity of the slab is

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

16. 110 joules of heat is added to a gaseous system, whose internal energy is 40J; then the amount of external work done is

- (1) 150 J
- (2) 70 J
- (3) 110 J
- (4) 40 J

17. A mass of diatomic gas ($\gamma = 1.4$) at a pressure of 2 atmospheres is compressed adiabatically so that its temperature rises from 27°C to 927°C . The pressure of the gas in final state is

- (1) 28 atm
- (2) 68.7 atm
- (3) 256 atm
- (4) 8 atm

18. A particle moving along the X-axis, executes simple harmonic motion then the force acting on it is given by

- (1) $- A kx$
- (2) $A \cos (kx)$
- (3) $A \exp (- kx)$
- (4) Akx

19. A series LCR circuit with inductance 10 H, capacitance $10 \mu\text{F}$, resistance 50

Ω is connected to an ac source of voltage, $V = 200\sin(100t)$ volt. If the resonant frequency of the LCR circuit is ν_1 and the frequency of the ac source is ν , then

- (1) $\nu_0 = \nu = 50 \text{ Hz}$
- (2) $\nu_0 = \nu = \frac{50}{\pi} \text{ Hz}$
- (3) $\nu_0 = \frac{50}{\pi} \text{ Hz}, \nu = 50 \text{ Hz}$
- (4) $\nu = 100 \text{ Hz}; \nu_0 = \frac{100}{\pi} \text{ Hz}$

20. The velocity of sound in any gas depends upon

- (1) wavelength of sound only
- (2) density and elasticity of gas
- (3) intensity of sound waves only
- (4) amplitude and frequency of sound

21. The equation of a travelling wave is $y = 60 \cos (180t - 6x)$ where y is in microns, t in second and x in metres.

The ratio of maximum particle velocity to velocity of wave propagation is

- (1) 3.6
- (2) 3.6×10^{-4}
- (3) 3.6×10^{-6}
- (4) 3.6×10^{-11}

22. A wave in a string has an amplitude of 2 cm. The wave travels in the +ve direction of x axis with a speed of 128 m/sec and it is noted that 5 complete waves fit in 4 m length of the string. The equation describing the wave is

- (1) $y = (0.02) \text{ m} \sin (15.7x - 2010t)$
- (2) $y = (0.02) \text{ m} \sin (15.7x + 2010t)$
- (3) $y = (0.02) \text{ m} \sin (7.85x - 1005t)$
- (4) $y = (0.02) \text{ m} \sin (7.85x + 1005t)$

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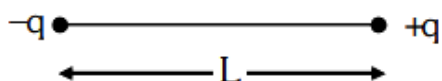
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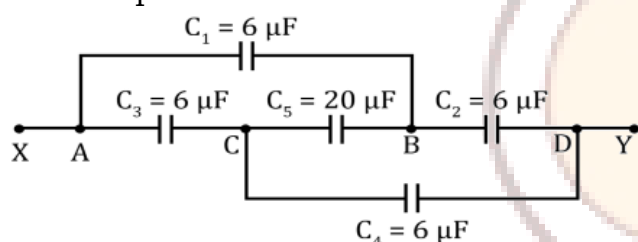
23. Two point charges $-q$ and $+q$ are placed at a distance of L , as shown in the figure.



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

- (1) $1/R^3$
- (2) $1/R^4$
- (3) $1/R^6$
- (4) $1/R^2$

24. What is the effective capacitance between points X and Y?



- (1) $04 \mu\text{F}$
- (2) $98 \mu\text{F}$
- (3) $90 \mu\text{F}$
- (4) $6 \mu\text{F}$

25. Four point charges $-Q$, $-q$, $2q$ and $2Q$ are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is:

- (1) $Q = -q$
- (2) $Q = -\frac{1}{q}$
- (3) $Q = q$
- (4) $Q = \frac{1}{q}$

26. Three equal resistors connected across a source of e.m.f. together dissipate 10 watt of power. What will be the power dissipated in watts if the same

resistors are connected in parallel across the same source of e.m.f.?

- (1) 10
- (2) $10/3$
- (3) 30
- (4) 90

27. A 6 volt battery is connected to the terminals of the three metre long wire of uniform thickness and resistance of 100 ohm. The difference of potential between two points on the wire separated by a distance of 50 cm will be

- (1) 1.5 volt
- (2) 3 volt
- (3) 3 volt
- (4) 1 volt

28. A thermocouple of negligible resistance produces an e.m.f. of $42 \mu\text{V}/^\circ\text{C}$ in the linear range of temperature. A galvanometer of resistance 10 ohm whose sensitivity is $9 \mu\text{A}/\text{div}$, is employed with the thermocouple. The smallest value of temperature difference that can be detected by the system will be

- (1) 0.5°C
- (2) 1°C
- (3) 0.1°C
- (4) 0.25°C

29. At what distance from a long straight wire carrying a current of 12 A will the magnetic field be equal to $3 \times 10^{-6} \text{ Wb}/\text{m}^2$?

- (1) $8 \times 10^{-2} \text{ m}$
- (2) $12 \times 10^{-2} \text{ m}$
- (3) $18 \times 10^{-2} \text{ m}$
- (4) $24 \times 10^{-2} \text{ m}$

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30. A short bar magnet of magnetic moment 0.4 JT^{-1} is placed in a uniform magnetic field of 0.16 T . The magnet is in stable equilibrium when the potential energy is

- (1) -0.64 J
- (2) zero
- (3) -0.082 J
- (4) 0.064 J

31. A wire loop is rotated in a magnetic field. The frequency of change of direction of the induced e.m.f. is

- (1) twice per revolution
- (2) four times per revolution
- (3) six times per revolution
- (4) once per revolution

32. A 220 volts input is supplied to a transformer. The output circuit draws a current of 2.0 ampere at 440 volts. If the efficiency of the transformer is 80%, the current drawn by the primary windings of the transformer is

- (1) 3.6 ampere
- (2) 2.8 ampere
- (3) 2.5 ampere
- (4) 5.0 ampere

33. The electric and magnetic field of an electromagnetic wave are

- (1) in opposite phase and perpendicular to each other
- (2) in opposite phase and parallel to each other
- (3) in phase and perpendicular to each other
- (4) in phase and parallel to each other.

34. Aluminium object is placed at a distance of 30 cm from the convex lens of

focal length 20 cm. On the other side of the lens, at what distance from the lens a convex mirror of radius of curvature 10 cm be placed in order to have an upright image of the object coincident with it?

- (1) 12 cm
- (2) 30 cm
- (3) 50 cm
- (4) 60 cm

35. A ray of light is incident at an angle of incidence, i , on one face of prism of angle A (assumed to be small) and emerges normally from the opposite face. If the refractive index of the prism is μ , the angle of incidence is nearly equal to:

- (1) μA
- (2) $\frac{\mu A}{2}$
- (3) $\frac{A}{\mu}$
- (4) $\frac{A}{2\mu}$

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SECTION : B

36. In Young's double slit experiment the distance between the slits and the screen is doubled. The separation between the slits is reduced to half. As a result the fringe width

- (1) is doubled
- (2) is halved
- (3) becomes four times
- (4) remains unchanged

37. Einstein work on the photoelectric effect provided support for the equation

- (1) $E = hv$
- (2) $E = mc^2$
- (3) $E = -\frac{Rhc}{n^2}$
- (4) $K.E. = \frac{1}{2}mv^2$

38. The threshold frequency for a photosensitive metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on this metal, the cut-off voltage for the photoelectric emission is nearly

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

39. J.J. Thomson's cathode-ray tube experiment demonstrated that

- (1) the e/m ratio of the cathode-ray particles changes when a different gas is placed in the discharge tube
- (2) cathode rays are streams of negatively charged ions
- (3) all the mass of an atom is essentially in the nucleus
- (4) the e/m of electrons is much greater

than the e/m of protons

40. The nuclei ${}^6\text{C}^{13}$ and ${}^7\text{N}^{14}$ can be described as

- (1) isotones
- (2) isobars
- (3) isotopes of carbon
- (4) isotopes of nitrogen

41. Which of the following is used as a moderator in nuclear reactors?

- (1) Plutonium
- (2) Cadmium
- (3) Heavy water
- (4) Uranium

42. The binding energy of deuteron is 2.2 MeV and that of ${}^2\text{H}^e$ is 28 MeV. If two deuterons are fused to form one ${}^2\text{He}^4$, then the energy released is

- (1) 23.6 MeV
- (2) 19.2 MeV
- (3) 30.2 MeV
- (4) 25.8 MeV

43. At absolute zero, Si acts as

- (1) non-metal
- (2) metal
- (3) insulator
- (4) none of these

44. A combination of logic gates has the truth table below.

P Q Z
0 0 0
0 1 1
1 0 1
1 1 0

- (1) XOR

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- (2) OR
(3) AND
(4) NAND

45. Carbon, silicon and germanium atoms have four valence electrons each. Their valence and conduction bands are separated by energy band gaps represented by $(E_g)_C$, $(E_g)_{Si}$ and $(E_g)_{Ge}$ respectively. Which one of the following relationships is true in their case?

- (1) $(E_g)_C > (E_g)_{Si}$
(2) $(E_g)_C < (E_g)_{Si}$
(3) $(E_g)_C = (E_g)_{Si}$
(4) $(E_g)_C < (E_g)_{Ge}$

46. For a plane electromagnetic wave propagating in x-direction, which one of the following combination gives the correct possible directions for electric field

(E) and magnetic field (B) respectively?

- (1) $-\hat{j} + \hat{k}$, $-\hat{j} + \hat{k}$
(2) $\hat{j} + \hat{k}$, $\hat{j} + \hat{k}$
(3) $-\hat{j} + \hat{k}$, $-\hat{j} - \hat{k}$
(4) $\hat{j} + \hat{k}$, $-\hat{j} - \hat{k}$

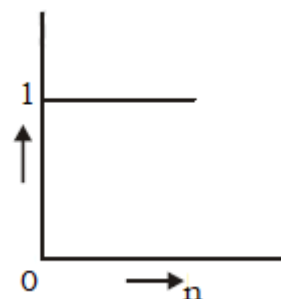
47. The resistance of a wire is 'R' ohm. If it is melted and stretched to 'n' times its original length, its new resistance will be :

- (1) $\frac{R}{n}$
(2) n^2R
(3) $\frac{R}{n^2}$
(4) nR

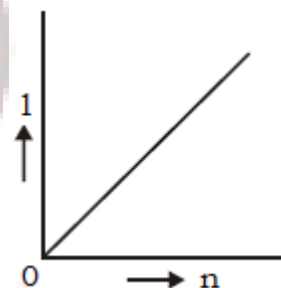
48. A battery consists of a variable number 'n' of identical cells (having internal resistance 'r' each) which are connected in series. The terminals of the

battery are short-circuited and the current I is measured. Which of the graphs shows the correct relationship between I and n?

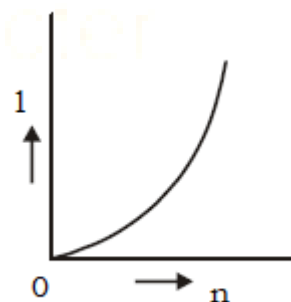
(1)



(2)



(3)



(4)

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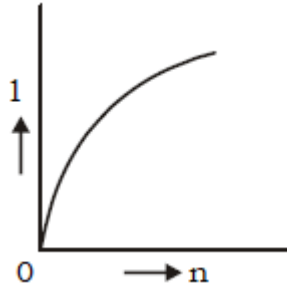
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49. Two similar thin equi-convex lenses, of focal length f each, are kept coaxially in contact with each other such that the focal length of the combination is F_1 .

When the space between the two lenses is filled with glycerin (which has the same refractive index ($\mu = 1.5$) as that of glass) then the equivalent focal length is F_2 . The ratio $F_1 : F_2$ will be :

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

50. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is :

$$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$$

- (1) $6.28 \times 10^{-5} \text{ T}$
- (2) $3.14 \times 10^{-5} \text{ T}$
- (3) $6.28 \times 10^{-4} \text{ T}$
- (4) $3.14 \times 10^{-4} \text{ T}$

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**Chemistry
SECTION : A**

51. Match List-I with List-II.

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

Choose the correct answer from the options given below:

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

52. Volume occupied by one molecule of water (density = 1 g / cm³) is:

- (1) 9.0×10^{-23} cm³
(2) 6.023×10^{-23} cm³
(3) 3.0×10^{-23} cm³
(4) 5.5×10^{-23} cm³

53. The radius of hydrogen in the ground state is 0.53 Å. The radius of Li²⁺ in ground state will be:

- (1) 0.17 Å
(2) 0.265 Å
(3) 0.53 Å
(4) 1.06 Å

54. The energies E₁ and E₂ of two radiations are 25 eV and 50 eV respectively. The relation between their wavelengths i.e. λ₁ and λ₂ will be:

- (1) λ₁ = λ₂
(2) λ₁ = 2 λ₂
(3) λ₁ = 4 λ₂

(4) λ₁ = $\frac{1}{2}$ λ₂

55. An atom has electronic configuration 1s², 2s², 2p⁶, 3s² 3p⁶, 3d³, 4s², you will place it in which group?

- (1) Fifth
(2) Fifteenth
(3) Second
(4) Third

56. Which one of the following has the shortest carbon carbon bond length?

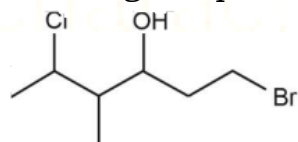
- (1) Benzene
(2) Ethene
(3) Ethyne
(4) Ethane

57. Copper crystallises in fcc unit cell with cell edge length of 3.608×10^{-8} cm. The density of copper is 8.92 g cm⁻³.

Calculate the atomic mass of copper.

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

58. The correct IUPAC name of the following compound is



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

59. Absolute zero is defined as the temperature

- (1) at which all molecular motion ceases
(2) at which liquid helium boils

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- (3) at which ether boils
(4) all of the above

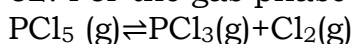
60. The pressure exerted by 6.0g of methane gas in a 0.03 m³ vessel at 129^o C is (Atomic masses : C = 12.01 H = 1.01 and R = 8.314 J K⁻¹mol⁻¹) :

- (1) 31684 Pa
(2) 215216 Pa
(3) 13409 Pa
(4) 41648 Pa

61. The entropy change in the fusion of one mole of a solid melting at 27^oC(Latent heat of fusion, 2930 Jmol⁻¹) is:

- (1) 9.77 JK⁻¹ mol⁻¹
(2) 10.73 JK⁻¹ mol⁻¹
(3) 2930 JK⁻¹ mol⁻¹
(4) 108.5 JK⁻¹ mol⁻¹

62. For the gas phase reaction



Which of the following conditions are correct ?

- (1) $\Delta H = 0$ and $\Delta S < 0$
(2) $\Delta H > 0$ and $\Delta S > 0$
(3) $\Delta H < 0$ and $\Delta S < 0$
(4) $\Delta H > 0$ and $\Delta S < 0$

63. The equilibrium constants for the reaction $\text{A}_2 \rightleftharpoons 2\text{A}$ at 500K and 700K are 1×10^{-10} and 1×10^{-5} . The given reaction is

- (1) exothermic
(2) slow
(3) endothermic
(4) fast

64. The hydrogen ion concentration of a 10^{-8} M HCl aqueous solution at 298 K is:

[Given that: $K_w = 10^{-14}$]

- (1) 11×10^{-8} M
(2) 1.0525×10^{-7} M
(3) 9.525×10^{-8} M
(4) 1.0×10^{-6} M

65. The values of K_{sp} of CaCO_3 and CaC_2O_4 are 4.7×10^{-9} and 1.3×10^{-9} respectively at 25^oC. If the mixture of these two is washed with water, what is the concentration of Ca^{2+} ions in water?

- (1) 7.746×10^{-5} M
(2) 5.831×10^{-5} M
(3) 6.856×10^{-5} M
(4) 3.606×10^{-5} M

66. When a substance A reacts with water it produces a combustible gas B and a solution of substance C in water. When another substance D reacts with this solution of C, it also produces the same gas B on warming but D can produce gas B on reaction with dilute sulphuric acid at room temperature. A imparts a deep golden yellow colour to a smokeless flame of Bunsen burner. A, B, C and D respectively are

- (1) Na, H₂, NaOH, Zn
(2) K, H₂, KOH, Al
(3) Ca, H₂, Ca(OH)₂, Sn
(4) CaC₂, C₂H₂, Ca(OH)₂, Fe

67. The compound A on heating gives a colourless gas and a residue that is dissolved in water to obtain B. Excess of CO₂ is bubbled through aqueous solution of B, C is formed which is recovered in the solid form. Solid C on gentle heating gives back A. The compound is

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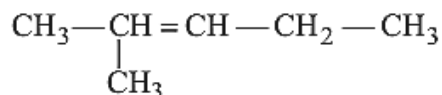
- (1) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
- (2) CaCO_3
- (3) Na_2CO_3
- (4) K_2CO_3

68. The Cl - C - Cl angle in 1,1,2,2-tetrachloroethene and tetrachloromethane respectively will be about

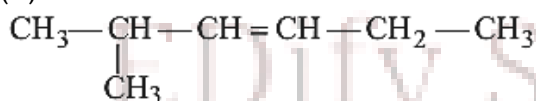
- (1) 120°
- (2) 90° and 109.5°
- (3) 109.5° and 90°
- (4) 120° and 109.5°

69. Which of the following will not show cis-trans isomerism?

- (1) $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_3$
- (2) $\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH}_3$
- (3)

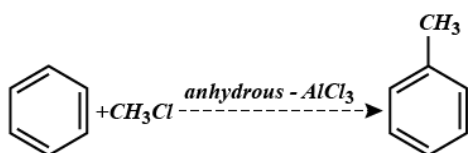


(4)

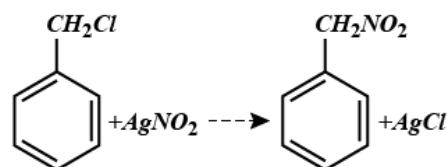


70. Which one of the following is a free radical substitution reaction ?

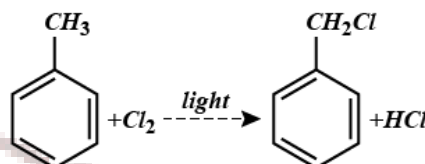
(1)



(2)



- (3) $\text{CH}_2\text{Cl} \text{ CH}_2\text{NO}_2 + \text{AgNO}_2$
- (4)



71. Which of the following compounds will exhibit cis-trans (geometrical) isomerism?

- (1) Butanol
- (2) 2-Butyne
- (3) 2-Butenol
- (4) 2-Butene

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

$$\text{Ni(s)} + 2\text{Ag}^+(0.001 \text{ M}) \rightarrow \text{Ni}^{2+}(0.001\text{M}) + 2\text{Ag(s)}$$

(Given that $E_{\text{cell}}^0 = 10.5 \text{ V}$, $\frac{2.303RT}{F} = 0.059$ at 298K)

- (1) 1.05 V
- (2) 1.0385 V
- (3) 1.385 V
- (4) None

73. Which one of the following statement is not true?

- (1) pH of drinking water should be between 5.5 - 9.5.
- (2) Concentration of DO below 6 ppm is good for the growth of fish.
- (3) Clean water would have a BOD value

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of less than 5 ppm.

(4) Oxides of sulphur, nitrogen and carbon are the most widespread air pollutant.

74. If a stands for the edge length of the cubic system : simple cubic, body-centred cubic and face-centred cubic, then the ratio of radii of the spheres in these systems will be respectively

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

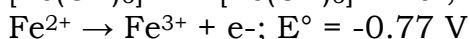
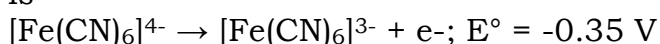
75. Which of the following statements, regarding the mole fraction of a component in solution, is incorrect?

- (1) $0 \leq x \leq 1$
- (2) $x \leq 1$
- (3) x is always non negative
- (4) $-2 \leq x \leq 2$

76. Which of the following is an insulator?

- (1) Graphite
- (2) Aluminium
- (3) Diamond
- (4) Silicon

77. On the basis of the following E° values, the strongest oxidizing agent is



- (1) $[\text{Fe}(\text{CN})_6]^{4-}$
- (2) Fe^{2+}
- (3) Fe^{3+}
- (4) $[\text{Fe}(\text{CN})_6]^{3-}$

78. If radius of second Bohr orbit of the He^+ ion is 105.8 pm, what is the radius of third Bohr orbit of Li^{2+} ion?

- (1) 158.7 Å
- (2) 158.7 pm
- (3) 15.87 pm
- (4) 1.587 pm

79. In a zero-order reaction for every 10° rise of temperature, the rate is doubled. If the temperature is increased from 10°C to 100°C , the rate of the reaction will become:

- (1) 256 times
- (2) 512 times
- (3) 64 times
- (4) 128 times

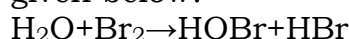
80. In the extraction of copper from its sulphide ore, the metal is finally obtained by the reduction of cuprous oxide with:

- (1) Copper sulphide (Cu_2S)
- (2) Sulphur dioxide (SO_2)
- (3) Iron sulphide (FeS)
- (4) Carbon monoxide (CO)

81. H_3PO_2 is the molecular formula of an acid of phosphorus. Its name and basicity respectively are

- (1) Phosphorus acid and two
- (2) Hypophosphorous acid and two
- (3) Hypophosphorous acid and one
- (4) Hypophosphoric acid and two

82. Which is the best description of the behaviour of bromine in the reaction given below?



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- (1) Proton acceptor only
- (2) Both oxidized and reduced
- (3) Oxidized only
- (4) Reduced only

83. The electronic configurations of four elements are given below. Which element does not belong to the same family as others?

- (1) $[\text{Xe}]4f^{14}5d^{10}6s^2$
- (2) $[\text{Kr}]4d^{10}5s^2$
- (3) $[\text{Ne}]3s^23p^5$
- (4) $[\text{Ar}]3d^{10}4s^2$

84. The basic character of the transition metal monoxides follows the order (Atomic Nos., Ti = 22, V = 23, Cr = 24, Fe = 26)

- (1) $\text{TiO} > \text{VO} > \text{CrO} > \text{FeO}$
- (2) $\text{VO} > \text{CrO} > \text{TiO} > \text{FeO}$
- (3) $\text{CrO} > \text{VO} > \text{FeO} > \text{TiO}$
- (4) $\text{TiO} > \text{FeO} > \text{VO} > \text{CrO}$

85. Sc (Z = 21) is a transition element but Zn (Z = 30) is not because

- (1) both Sc and Zn do not exhibit variable oxidation states
- (2) both Sc^{3+} and Zn^{2+} ions are colourless and form white compounds
- (3) in case of Sc, 3 orbitals are partially filled but in Zn these are completely filled
- (4) last electron is assumed to be added to 4s level in case of Zn

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SECTION : B

86. Among the following, which is not the S-bonded organometallic compound?

- (1) $(\text{CH}_3)_4\text{Sn}$
- (2) $\text{K}[\text{PtCl}_3(\eta^2 - \text{C}_2\text{H}_4)]$
- (3) $\text{Fe}(\eta^5 - \text{C}_5\text{H}_5)_2$
- (4) $\text{Cr}(\eta^6 - \text{C}_6\text{H}_6)_2$

87. Crystal field splitting energy for high spin 4 octahedral complex is:

- (1) - 1.6 Δ_0
- (2) - 1.2 Δ_0
- (3) - 0.6 Δ_0
- (4) - 0.8 Δ_0

88. Which one of the following compounds will be most readily attacked by an electrophile ?

- (1) Chlorobenzene
- (2) Benzene
- (3) Phenol
- (4) Toluene

89. Which of the following compounds can be used as antifreeze in automobile radiators?

- (1) Methyl alcohol
- (2) Glycol
- (3) Nitrophenol
- (4) Ethyl alcohol

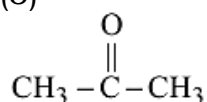
90. Aspirin is an acetylation product of

- (1) o-hydroxybenzoic acid
- (2) o-dihydroxybenzene
- (3) m-hydroxybenzoic acid
- (4) p-dihydroxybenzene

91. Which one of the following on treatment with 50% aqueous sodium

hydroxide yields the corresponding alcohol and acid?

- (1) $\text{C}_6\text{H}_5\text{CHO}$
- (2) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$
- (3)



- (4) $\text{C}_5\text{H}_5\text{CH}_2\text{CHO}$

92. The compound obtained by heating a mixture of a primary amine and chloroform with ethanolic potassium hydroxide (KOH) is

- (1) an alkyl cyanide
- (2) a nitro compound
- (3) an alkyl isocyanide
- (4) an amide

93. Enzymes take part in a reaction and

- (1) decrease the rate of a chemical reaction
- (2) increase the rate of a chemical reaction
- (3) both
- (4) and

94. A sequence of how many nucleotides in messenger RNA makes a codon for an amino acid?

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

95. Which of the following is not correctly matched?

- (1) Copper - Co
- (2) cobalt - Co
- (3) calcium - Ca
- (4) Silver - Ag

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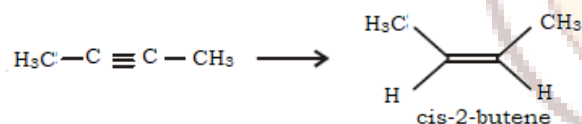
96. Ionic mobility of which of the following alkali metal ions is lowest when aqueous solution of their salts are put under an electric field ?

- (1) K
- (2) Rb
- (3) Li
- (4) Na

97. Which of the following oxides is most acidic in nature?

- (1) MgO
- (2) BeO
- (3) CaO
- (4) BaO

98. The most suitable reagent for the following conversion, is :



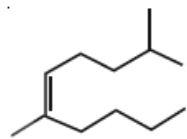
- (1) Na/liquid NH_3
- (2) H_2 , Pd/C, quinoline
- (3) Zn/HCl
- (4) Hg^{2+} / H^+ , H_2O

99. Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?

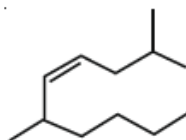
- (1) $\text{F}^- < \text{SCN}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$
- (2) $\text{CN}^- < \text{C}_2\text{O}_4^{2-} < \text{SCN}^- < \text{F}^-$
- (3) $\text{SCN}^- < \text{F}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$
- (4) $\text{SCN}^- < \text{F}^- < \text{CN}^- < \text{C}_2\text{O}_4^{2-}$

100. The correct structure of 2, 6-Dimethyl-dec-4-ene is

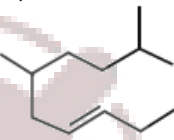
- (1)



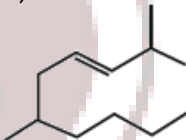
(2)



(3)



(4)



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**BOTANY
SECTION : A**

101. Classification given by Bentham and Hooker is

- (1) artificial
- (2) natural
- (3) phylogenetic
- (4) numerical

102. What is true for photolithotrops?

- (1) Obtain energy from radiations and hydrogen from organic compounds
- (2) Obtain energy from radiations and hydrogen from inorganic compounds
- (3) Obtain energy from organic compounds
- (4) Obtain energy from inorganic compounds

103. Which one belongs to monera?

- (1) Amoeba
- (2) Escherichia
- (3) Gelidium
- (4) Spirogyra

104. Entamoeba coli causes

- (1) Pyrrhoea
- (2) Diarrhoea
- (3) Dysentery
- (4) None

105. A few organisms are known to grow and multiply at temperatures of 100–105°C. They belong to

- (1) marine archaeobacteria
- (2) thermophilic sulphur bacteria
- (3) hot-spring blue-green algae (cyanobacteria)
- (4) thermophilic, subaerial fungi

106. Mannitol is the stored food in:

- (1) Porphyra
- (2) Fucus
- (3) Gracillaria
- (4) Chara

107. In gymnosperms like Pinus and Cycas, the endosperm is

- (1) triploid
- (2) haploid
- (3) diploid
- (4) tetraploid

108. Agar is commercially obtained from

- (1) red algae
- (2) green algae
- (3) brown algae
- (4) blue-green algae

109. Cycas have two cotyledons but not included in angiosperms because of

- (1) Naked ovules
- (2) Seems like monocot
- (3) Circinate ptyxis
- (4) Compound leaves

110. Which one of the following is common to multicellular fungi, filamentous algae and protonema of mosses

- (1) Diplontic life cycle
- (2) Members of kingdom plantae
- (3) Mode of Nutrition
- (4) Multiplication by fragmentation

111. Buttress roots are found in

- (1) sorghum
- (2) banyan
- (3) Terminalia
- (4) Pandanus

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112. Which of the following is a flowering plant with nodules containing filamentous nitrogen-fixing microorganism

- (1) *Crotalaria juncea*
- (2) *Cycas revoluta*
- (3) *Cicer arietinum*
- (4) *Casuarina equisetifolia*

113. Which meristem helps in increasing girth?

- (1) Lateral meristem
- (2) Intercalary meristem
- (3) Primary meristem
- (4) Apical meristem

114. What is not true about sclereids?

- (1) These are parenchyma cells with thickened lignified walls
- (2) These are elongated and flexible with tapered ends
- (3) These are commonly found in the shells of nuts and in the pulp of guava, pear, etc
- (4) These are also called the stone cells

115. Reduction in vascular tissue, mechanical tissue and cuticle is characteristic of:

- (1) mesophytes
- (2) epiphytes
- (3) hydrophytes
- (4) xerophytes

116. Fluid mosaic model of cell membrane was put forward by

- (1) Danielli and Davson
- (2) Singer and Nicolson
- (3) Garner and Allard
- (4) Watson and Crick

117. The desmosomes are concerned with

- (1) cytolysis
- (2) cell division
- (3) cell adherence
- (4) cellular excretion

118. Vacuole in a plant cell

- (1) is membrane-bound and contains storage proteins and lipids
- (2) is membrane-bound and contains water and excretory substances
- (3) lacks membrane and contains air
- (4) lacks membrane and contains water and excretory substances

119. A competitive inhibitor of succinic dehydrogenase is

- (1) Malonate
- (2) Oxaloacetate
- (3) m-ketoglutarate
- (4) Malate

120. In the somatic cell cycle

- (1) In G₁ phase DNA content is double the amount of DNA present in the original cell
- (2) DNA replication takes place in S-phase
- (3) a short interphase is followed by a long mitotic phase
- (4) G₂ phase follows mitotic phase

121. At constant temperature, the rate of transpiration will be higher at

- (1) Sea level
- (2) 1 km below sea level
- (3) 1 km above sea level
- (4) 1.5 km above sea level

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122. Which one of the following elements is not an essential micronutrient for plant growth?

- (1) Zn
- (2) Cu
- (3) Ca
- (4) Mn

123. Kranz anatomy is typical of

- (1) C₄ plants
- (2) C₃ plants
- (3) C₂ plants
- (4) CAM plants

124. Which one of the following statements about cytochrome P₄₅₀ is wrong?

- (1) It contains iron
- (2) It is an enzyme involved in oxidation reaction
- (3) It is a coloured cell
- (4) It has an important role in metabolism

125. In leaves of C₄ plants malic acid synthesis during CO₂ fixation occurs in

- (1) epidermal cells
- (2) mesophyll cells
- (3) bundle sheath
- (4) guard cells

126. Life without air would be

- (1) reductional
- (2) free from oxidative damage
- (3) impossible
- (4) anaerobic

127. In germinating seeds fatty acids are degraded exclusively in the

- (1) proplastids
- (2) glyoxysomes

- (3) peroxisomes
- (4) mitochondria

128. Flowering dependent on cold treatment is

- (1) cryotherapy
- (2) cryogenics
- (3) cryoscopy
- (4) vernalisation

129. One set of a plant was grown at 12 hours day and 12 hours night period cycles and it flowered while in the other set night phase was interrupted by flash of light and it did not produce flower.

Under which one of the following categories will you place this plant?

- (1) Long day
- (2) Darkness neutral
- (3) Day neutral
- (4) Short day

130. An example of a seed with endosperm, perisperm, and caruncle is

- (1) coffee
- (2) lily
- (3) castor
- (4) cotton

131. The estrous cycle is a characteristic of

- (1) human males only
- (2) human females only
- (3) mammalian males other than primates
- (4) mammalian females other than primates

132. An organism with two identical alleles is

- (1) dominant

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- (2) hybrid
- (3) heterozygous
- (4) homozygous

133. When two genetic loci produce identical phenotypes in cis and trans position, they are considered to be

- (1) pseudoalleles
- (2) different genes
- (3) multiple alleles
- (4) parts of same gene

134. Red-green colour blindness in humans is governed by a sex-linked recessive gene. A normal woman whose father was colour blind marries a colour blind man. What proportion of their daughters is expected to be colour blind?

- (1) $3/4$
- (2) $1/2$
- (3) $1/4$
- (4) All

135. Two crosses between the same pair of genotypes or phenotypes in which the source of the gametes are reversed in one cross, is known as

- (1) reverse cross
- (2) test cross
- (3) reciprocal cross
- (4) dihybrid cross

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SECTION : B

136. Two genes R and Y are located very close on the chromosomal linkage map of maize plant. When RRY⁺Y⁺ and rry genotypes are hybridized, the F₂ segregation will show

- (1) segregation in the expected 9: 3: 3: 1 ratio
- (2) segregation in 3: 1 ratio
- (3) higher number of the parental types
- (4) higher number of the recombinant types.

137. The incorrect statement with regard to Haemophilia is:

- (1) It is a recessive disease
- (2) It is a dominant disease
- (3) A single protein involved in the clotting of blood is affected
- (4) It is a sex-linked disease

138. In E.coli during lactose metabolism repressor binds to

- (1) regulator gene
- (2) operator gene
- (3) structural gene
- (4) promoter gene

139. The length of DNA molecule greatly exceeds the dimensions of the nucleus in eukaryotic cells. How is this DNA accommodated?

- (1) super-coiling in nucleosomes
- (2) DNase digestion
- (3) through elimination of repetitive DNA
- (4) deletion of non-essential genes.

140. In an inducible operon, the genes are

- (1) Always expressed

(2) Usually not expressed unless a signal turns them "on"

(3) Usually expressed unless a signal turns them "off"

(4) Never expressed

141. Vacuole in a plant cell

(1) is membrane-bound and contains storage proteins and lipids

(2) is membrane-bound and contains water and excretory substances

(3) lacks membrane and contains air

(4) lacks membrane and contains water and excretory substances

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

(1) Terminalization

(2) Synaptonemal complex

(3) Bivalent

(4) Sites at which crossing over occurs

143. Among flowers of Calotropis, tulip, Sesbania, Asparagus, Colchicine, Sweet pea, Petunia, Indigofera, Mustard, Soyabean, Tobacco and groundnut how many plants have corolla with valvate aestivation?

(a) Five

(b) Six

(c) Seven

(d) Eight

144. The flowers are Zygomorphic in:

(a) Mustard

(b) Gulmohar

(c) Cassia

(d) Datura

(e) Chilly

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Choose the correct answer from the options given below:

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

145. A woman has an X-linked condition on one of her X chromosomes. This chromosome can be inherited by

- (1) Only daughters
- (2) Only sons
- (3) Both sons and daughters
- (4) Only grandchildren

146. AGGTATCGCAT is a sequence from the coding strand of a gene. What will be the corresponding sequence of the transcribed mRNA?

- (1) AGGUAUCGCAU
- (2) UGGTUTCGCAT
- (3) UCCAUAGCGUA
- (4) ACCUAUGCGAU

147. Select the wrong statement :

- (1) Cell wall is present in members of Fungi and Plantae
- (2) Mushrooms belong to Basidiomycetes
- (3) Mitochondria are the powerhouse of the cell in all kingdoms except Monera
- (4) Pseudopodia are locomotory and feeding structures in Sporozoans

148. Which of the following statements is correct?

- (1) Ovules are not enclosed by ovary wall in gymnosperms
- (2) Selaginella is heterosporous, while Salvinia is homosporous
- (3) Stems are usually unbranched in both Cycas and Cedrus

(4) Horsetails are gymnosperms

150. If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is 6.6×10^9 bp, then the length of the DNA is approximately

- (1) 2.2 meters
- (2) 2.7 meters
- (3) 2.0 meters
- (4) 2.5 meters

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Zoology
SECTION : A

151. The chief advantage of encystment to an Amoeba is

- (1) the chance to get rid of accumulated waste products
- (2) the ability to survive during adverse physical conditions
- (3) the ability to live for sometime without ingesting food
- (4) protection from parasites and predators

152. A chordate character is

- (1) gills
- (2) spiracles
- (3) post anal tail
- (4) chitinous exoskeleton

153. Sound box of birds is called

- (1) pygostyle
- (2) larynx
- (3) syrinx
- (4) synsacrum

154. The organisms attached to the substratum, generally, possess

- (1) radial symmetry
- (2) one single opening of digestive canal
- (3) asymmetrical body
- (4) cilia on surface to create water current

155. In contrast to Annelids the Platyhelminths show:

- (1) Absence of body cavity
- (2) Bilateral symmetry
- (3) Radial symmetry
- (4) Presence of pseudocoel

156. Which group of animals belong to the same phylum?

- (1) Earthworm, Pinworm, Tapeworm
- (2) Prawn, Scorpion, Locusta
- (3) Sponge, Sea anemone, Starfish
- (4) Malarial parasite, Amoeba, Mosquito

157. Formation of cartilage bones involves

- (1) deposition of bony matter by osteoblasts and resorption chondroblasts
- (2) deposition of bony matter by osteoclasts and resorption by chondroblasts
- (3) deposition of bony matter by osteoclasts only
- (4) deposition of bony matter by osteoblasts only

158. If a live earthworm is pricked with a needle on its outer surface without damaging its gut, the fluid that comes out is:

- (1) coelomic fluid
- (2) haemolymph
- (3) slimy mucus
- (4) excretory fluid

159. Which is not consistent with double helical structure of DNA?

- (1) A = T, C = G
- (2) Density of DNA decreases on heating
- (3) A + T/C + G is not constant
- (4) Both A and B

160. Carbohydrates are commonly found as starch in plant storage organs. Which of the following five properties of starch (a-e) make it useful as a storage material?

- (A) Easily translocated

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- (B) Chemically nonreactive
- (C) Easily digested by animals
- (D) Osmotically inactive
- (E) Synthesized during photosynthesis

The useful properties are

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

161. Secretion of gastric juice is stopped by

- (1) Gastrin
- (2) Pancreozymin
- (3) Cholecystokinin
- (4) Enterogastrone

162. A person is eating boiled potato, which food component is found in it?

- (1) DNA which gets digested by pancreatic DNAase
- (2) Lactose which is indigestible
- (3) Starch which does not get digested
- (4) Cellulose which is digested by intestinal cellulose

163. One of the constituents of the pancreatic juice while poured into the duodenum in humans, is:

- (1) trypsinogen
- (2) chymotrypsin
- (3) trypsin
- (4) enterokinase

164. RBC do not occur in

- (1) frog
- (2) cow
- (3) camel
- (4) cockroach

165. Which one of the following statements about blood constituents and transport of respiratory gases is most accurate?

- (1) RBCs transport oxygen whereas WBCs transport CO₂
- (2) RBCs transport oxygen whereas plasma transports only CO₂
- (3) RBCs as well as WBCs transport both oxygen and CO₂
- (4) RBCs as well as plasma transport both oxygen and CO₂

166. Solenocytes are the main excretory structures in

- (1) Platyhelminthes
- (2) Annelids
- (3) Molluscs
- (4) Echinodermates

167. A fall in glomerular filtration rate (GFR) activates

- (1) adrenal cortex to release aldosterone.
- (2) adrenal medulla to release adrenaline.
- (3) juxta - glomerular cells to release renin.
- (4) posterior pituitary to release vasopressin.

168. The characteristics and an example of a synovial joint in humans is:

Characteristics Examples

- (1) Fluid filled between Skull bones two joints, provides cushion
- (2) Fluid filled synovial Joint between cavity between two atlas and axis bones
- (3) Lymph filled between gliding joint two bones, limited between movement carpals
- (4) Fluid cartilage Knee joint between two

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bones, limited movements

169. When we migrate from dark to light, we fail to see for sometime but after a time visibility becomes normal. It is an example of

- (1) accommodation
- (2) adaptation
- (3) mutation
- (4) photoperiodism

170. Insulin is

- (1) vitamin
- (2) lipid
- (3) hormone
- (4) enzyme

171. Melanin protects us from

- (1) U. V. rays
- (2) visible rays
- (3) infrared rays
- (4) X-rays

172. Match the source gland with respective hormone as well as the function correctly. Source gland – Hormone -- Function

- (1) Anterior pituitary – Oxytocin -- Contraction of uterus muscles during child birth
- (2) Posterior pituitary – Vasopressin – Stimulates reabsorption of water in the distal tubules in the nephron
- (3) Corpus luteum -- Estrogen -- Supports pregnancy
- (4) Thyroid -- Thyroxine --Regulates blood calcium level

173. Study of formation, growth and development of new individual from an egg is

- (1) Apomixis
- (2) Embryology
- (3) Embryogeny
- (4) Cytology

174. Which one of the following statements about human sperm is correct?

- (1) Acrosome has a conical pointed structure used for piercing and penetrating the egg, resulting in fertilisation
- (2) The sperm lysins in the acrosome dissolve the egg envelope facilitating fertilisation
- (3) Acrosome serves as a sensory structure leading the sperm towards the ovum
- (4) Acrosome serves no particular function

175. Which one of the following statements is correct regarding Sexually Transmitted Diseases (STD)?

- (1) The chances of a 5 year boy contacting a STD are very little
- (2) A person may contact syphilis by sharing milk with one already suffering from the disease
- (3) Haemophilia is one of the STD
- (4) Genital herpes and sickle-cell anaemia are both STD

176. Extremities, tail and ear are relatively shorter in animals living in cooler regions as compared to those inhabiting warmer zones. This is

- (1) Bergman's Rule
- (2) Jordan's Rule
- (3) Gloger's Rule

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(4) Allen's Rule

177. Which of the following is most important for speciation?

- (1) Seasonal isolation
- (2) Reproductive isolation
- (3) Behavioural isolation
- (4) Tropical isolation

178. Which one of the following statement is correct?

- (1) There is no evidence of the existence of gills during embryogenesis of mammals
- (2) All plant and animal cells are totipotent
- (3) Ontogeny repeats phylogeny
- (4) Stem cells are specialize cells.

179. Dinosaurs dominated the world in which of the following geological era?

- (1) Devonian
- (2) Coenozoic
- (3) Jurassic
- (4) Mesozoic

180. Which one of the following is the correct statement regarding the particular psychotropic drug specified?

- (1) Hashish causes after thought perceptions and hallucinations
- (2) Opium stimulates nervous system and causes hallucinations
- (3) Morphine leads to delusions and disturbed emotions
- (4) Barbiturates cause relaxation and temporary euphoria

181. The cell-mediated immunity inside the human body is carried out by:

- (1) B-lymphocytes

(2) Thrombocytes

(3) Erythrocytes

(4) T-lymphocytes

182. Which one of the following statement is correct in relation to honey bees?

- (1) Apis indica is the largest wild honey bee in India
- (2) Honey is predominantly sucrose and arabinose
- (3) Beewax is a waste product of honey bees
- (4) Communication in honey bees was discovered by Karl Von Frisch

183. Consider the following four measures (i-iv) that could be taken to successfully grow chickpea in an area where bacteri blight disease is common
(i) Spray with Bordeaux mixture
(ii) Control of the insect vector of the disease pathogen
(iii) Use of only disease-free seeds
(iv) Use of varieties resistant to the disease
Which two of the above measures can control the disease?

Which two of the above measures can control the disease?

- (1) III and IV
- (2) I and IV
- (3) II and III
- (4) I and II

184. CryI endotoxins obtained from Bacillus thuringiensis are effective against

- (1) mosquitoes
- (2) flies
- (3) nematodes

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(4) boll worms

85. There is a restriction endonuclease called EcoRI. What does .co. part in it stand for?

- (1) colon
- (2) coelom
- (3) coenzyme
- (4) coli



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SECTION : B

186. Some of the characteristics of Bt cotton are:

- (1) long fibre and resistance to aphids
- (2) medium yield, long fibre and resistance to beetle pests
- (3) high yield and production of toxic protein crystals which kill dipteran pests
- (4) high yield and resistance to bollworms

187. At which latitude, heat gain through insolation approximately equals heat loss through terrestrial radiation?

- (1) 22 1/2 ° North and South
- (2) 40° North and South
- (3) 42 1/ 2 ° North and South
- (4) 66° North and South

188. Which one of the following statements is correct regarding Sexually Transmitted Diseases (STD)?

- (1) The chances of a 5 year boy contacting a STD are very little
- (2) A person may contact syphilis by sharing milk with one already suffering from the disease
- (3) Haemophilia is one of the STD
- (4) Genital herpes and sickle-cell anaemia are both STD

189. Receptor sites for neurotransmitters are present on :

- (1) Pre-synaptic membrane
- (2) Tips of axons
- (3) Post-synaptic membrane
- (4) Membrane of synaptic vesicles

190. Adult human RBCs are enucleated. Which of the following statement(s)

is/are most appropriate explanation for this feature ?

- (a) They do not need to reproduce
 - (b) They are somatic cells
 - (c) They do not metabolize
 - (d) All their internal space is available for oxygen transport
- (1) only (a)
 - (2) (a), (c) and (d)
 - (3) (b) and (c)
 - (4) only (d)

191. According to Hugo de Vries, the mechanism of evolution is

- (1) Multiple step mutations
- (2) Saltation
- (3) Minor mutations
- (4) Phenotypic variations

192. Among the following sets of examples for divergent evolution, select the incorrect option :

- (1) Forelimbs of man, bat and cheetah
- (2) Heart of bat, man and cheetah
- (3) Eye of octopus, bat and man
- (4) Brain of bat, man and cheetah

193. Which kind of therapy was given in 1990 to a four-year-old girl with adenosine deaminase [ADA] deficiency ?

- (1) Gene therapy
- (2) chemotherapy
- (3) Immunotherapy
- (4) Radiation therapy

194.

Match the following

List - I	List - II
A.	I. Three dimensional image

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Sandwich ELISA	
B. QRS complex	II. Substrate linked antibody
C. Allograft	III. Ventricular depolarisation
D. CT Scan	IV. Transplantation between genetically non-identical individuals

C. Graafian follicle	3. Relaxin
D. Leydig cells	4. GnRH
E. Parturition	5. Testosterone

- (1) A-4, B-1, C-2, D-3, E-5
 (2) A-2, B-1, C-4, D-3, E-5
 (3) A-2, B-1, C-5, D-4, E-3
 (4) A-4, B-1, C-2, D-5, E-3

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

195. Which of the following four glands is correctly matched with the accompanying description?

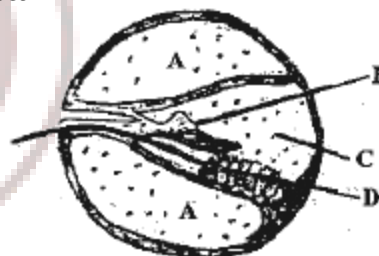
- (1) Thyroid-Hyperactivity in young children causes cretinism
 (2) Thymus-Starts undergoing atrophy after puberty.
 (3) Parathyroid-Secretes parathormone, which promotes movement of ions from blood into bones during calcification.
 (4) Pancreas- Delta cells of the islets of Langerhans secrete a hormone which stimulates glycolysis in liver.

196.

Match list I with II and choose the correct answer

List I	List II
A. Hypothalamus	1. Sperm lysins
B. Acrosome	2. Estrogen

197. Given below is a diagrammatic cross section of a single loop of human cochlea



Which one of the following options correctly represents the names of three different parts?

- (1) B: Tectorial membrane, C: Perilymph, D: Secretory cells
 (2) C: Endolymph, D: Sensory hair cells, A: Serum
 (3) D: Sensory hair cells, A: Endolymph, B: Tectorial membrane
 (4) A: Perilymph, B: Tectorial membrane, C: Endolymph

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

- | | |
|-------------------|---------------------------------------------|
| Column-I | Column-II |
| (a) Floating Ribs | (i) Located between second and seventh ribs |

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(b) Acromion
Humerus

(ii) Head of the

(c) Scapula

(iii) Clavicle

(d) Glenoid cavity
with the sternum

(iv) Do not connect

(a) (b) (c) (d)

(1) (iii) (ii) (iv) (i)

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

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

(4) (i) (iii) (ii) (iv)

199. Match the following

(a) Inhibitor of catalytic activity

(i) Ricin

(b) Possess peptide bonds

(ii) Malonate

(c) Cell wall material in fungi

(iii) Chitin

(d) Secondary metabolite

(iv) Collagen

Choose the correct option from the following

(a) (b) (c) (d)

(1) (iii) (iv) (i) (ii)

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

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

(4) (iii) (i) (iv) (ii)

200. Which one of the following pairs is not correctly matched?

(1) Streptomyces - Antibiotic

(2) Serratia - Drug addiction

(3) Spirulina - Single cell protein

(4) Rhizobium - Biofertilizer

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Answer key

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

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32	4		
33	3		
34	3		
35	1		



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chemistry			
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51	3	86	1
52	3	87	3
53	1	88	3
54	2	89	2
55	1	90	1
56	4	91	1
57	2	92	1
58	2	93	2
59	1	94	1
60	3	95	1
61	1	96	3
62	2	97	2
63	3	98	2
64	2	99	3
65	1	100	2
66	1		
67	2		
68	4		
69	3		
70	4		
71	4		
72	4		
73	2		
74	1		
75	2		
76	3		
77	3		
78	2		
79	2		
80	1		
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Botany			
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101	2	136	3
102	2	137	2
103	2	138	2
104	4	139	1
105	2	140	2
106	2	141	2
107	2	142	4
108	1	143	3
109	1	144	3
110	4	145	3
111	3	146	1
112	4	147	4
113	1	148	1
114	1	149	1
115	3	150	1
116	2		
117	3		
118	4		
119	1		
120	2		
121	4		
122	3		
123	1		
124	4		
125	2		
126	4		
127	2		
128	4		
129	4		
130	3		
131	4		
132	4		
133	1		

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zoology			
Section A		Section B	
151	2	186	4
152	3	187	1
153	3	188	1
154	1	189	3
155	3	190	4
156	2	191	2
157	4	192	3
158	1	193	1
159	3	194	4
160	2	195	2
161	4	196	4
162	1	197	4
163	1	198	2
164	4	199	3
165	4	200	2
166	1		
167	3		
168	3		
169	2		
170	3		
171	1		
172	2		
173	2		
174	2		
175	1		
176	4		
177	2		
178	3		
179	4		
180	1		
181	4		
182	4		
183	2		

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Physics solution

SECTION : A

1(1)

Torque (T) = Moment of Inertia \times Angular Acceleration (1)

Since, Moment of Inertia (M.O.I) = Radius of Gyration² \times Mass

\therefore The dimensional formula of Moment of Inertia = $M^1 L^2 T^0$. . . (2)

And, Angular Acceleration = Angular velocity \times Time⁻¹

\therefore The dimensional formula of Angular Acceleration = $M^0 L^0 T^{-2}$. . . (3)

On substituting equation (2) and (3) in equation (1) we get,

Torque = Moment of Inertia \times Angular Acceleration

Or, $I = [M^1 L^2 T^0] \times [M^0 L^0 T^{-2}] = [M L^2 T^{-2}]$.

2(2)

Percentage error in radius is given as 2%

i.e.

$$\frac{\Delta r}{r} \times 100 = 2\%$$

Volume of sphere $V = \frac{4\pi}{3} r^3$

Percentage error in volume

$$\frac{\Delta V}{V} \times 100$$

$$= 3 \times \frac{\Delta r}{r} \times 100$$

$$= 3 \times 2 = 6\%$$

3(1)

For 1st case:

$$u = 40 \text{ km/h} = \left(40 \times \frac{5}{18}\right) \text{ m/s}$$

From third equation of motion we have,

$$v^2 - u^2 = 2as$$

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

$$0 = \left(40 \times \frac{5}{18}\right)^2 + 2a(2)$$

$$a = -\frac{1}{4} \left(\frac{100}{9}\right)^2 \dots \dots (1)$$

For 2nd case:

$$u = 80 \text{ km/h} = \left(80 \times \frac{5}{18}\right) \text{ m/s}$$

From third equation of motion we have,

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

$$0 = \left(80 \times \frac{5}{18}\right)^2 + 2 \times a \times s$$

$$2 \times a \times s = -\left(\frac{200}{9}\right)^2$$

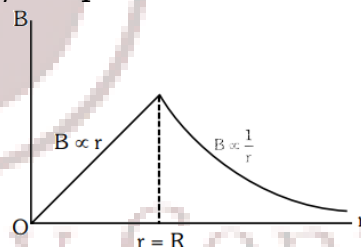
$$-2 \times \frac{1}{4} \times \left(\frac{100}{9}\right)^2 \times s = -\left(\frac{200}{9}\right)^2$$

on solving we get

$$s = 8 \text{ m}$$

4(4)

Correct answer is (4) a linearly increasing function of distance r upto the boundary of the wire and then decreasing one with $1/r$ dependence for the outside region.



5(1)

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

$$= 20 \times 6 + 15 \times (-4) + (-5) \times 3$$

$$= 120 - 60 - 15 = 120 - 75$$

$$= 45 \text{ J/s}$$

6(2)

We know,

$$H = \frac{u^2 \sin^2 \theta}{2g}$$

$$R = \frac{u^2 \sin 2\theta}{g}$$

As,

$$H = R$$

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$$\frac{u^2 \sin^2 \theta}{2g} = \frac{u^2 \sin 2\theta}{g}$$

$$\tan \theta = 4$$

$$\Rightarrow \theta = \tan^{-1}(4)$$

7(2)

$$F = \frac{\Delta P}{\Delta t}$$
$$= \frac{m(V_2 - V_1)}{\Delta t}$$
$$= \frac{0.15(0 - 20)}{0.1}$$
$$= 30 \text{ N.}$$

8(4)

Kinetic energy acquired by the body
= Force applied on it \times Distance covered
by the body

$$K.E = F \times d$$

It is given that force is constant.

We see that Kinetic energy is
independent of mass.

9(4)

$$\text{Loss of energy} = \frac{1}{2} mv^2 - mgh = 20 \text{ J}$$

10(4)

For a rectangular lamina, moment of
inertia about a line passing through
centre and parallel to longer side is
minimum.

Hence, momentum of inertia
about EG will be minimum.

11(3)

By using conservation of angular
momentum

Initial angular p = Final angular P

$$I\omega = I'\omega'$$

$$MR^2\omega = (MR^2 + mR^2 + mR^2)\omega'$$

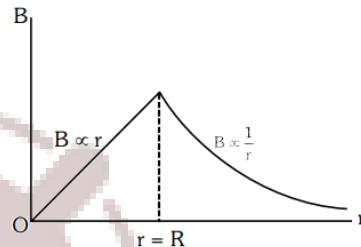
$$MR^2\omega = (MR^2 + 2mR^2)\omega'$$

$$M\omega = (M + 2m)\omega'$$

$$\omega' = \frac{M\omega}{M + 2m}$$

12(4)

a linearly increasing function of distance
r upto the boundary of the wire and then
decreasing one with $1/r$ dependence for
the outside region.



13(1)

Formula used:

$$g' = g \left(1 - \frac{d}{r} \right)$$

Given,

$$d = 100 \text{ km}$$

$$R = 6400 \text{ km}$$

Acceleration due to gravity at depth d,

$$g' = g \left[1 - \frac{d}{r} \right]$$

$$= g \left[1 - \frac{100}{6400} \right]$$

$$= 9.8 \left[1 - \frac{1}{64} \right]$$

$$= 9.8 \times 6364$$

$$= 9.66 \text{ m/s}^2$$

14(3)

Young's modulus = Y,

Stretching stress = S,

Energy stored per unit volume is,

$$= \frac{1}{2} \times \text{stress} \times \text{strain}$$

We know that, stress = strain \times Y

Therefore energy per unit volume will be

$$E = \frac{1}{2} \times S \times \frac{S}{Y} = \frac{S^2}{2Y}$$

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15(1)

The thermal resistances can be added as they are in series. But, note that the width of the combined slab is twice the width of individual slab.

So, we have:

$$\Rightarrow \frac{2L}{K_{eq}A} = \frac{L}{KA} + \frac{L}{2KA}$$
$$\Rightarrow K_{eq} = 4/3 K$$

16(2)

$$\Delta Q = \Delta U + \Delta W$$
$$\Delta W = \Delta Q - \Delta U$$
$$= 110 - 40$$
$$= 70 J.$$

17(3)

For a gas undergoing adiabatic process, equation of state in terms of P and T is given by

$$P^{1-\gamma} T^\gamma = \text{constant}$$

$$\Rightarrow PT^{\left(\frac{\gamma}{1-\gamma}\right)} = \text{constant}$$

Relation between initial and final states can be written as

$$\frac{P_2}{P_1} = \left(\frac{T_2}{T_1}\right)^{\left(\frac{\gamma}{1-\gamma}\right)}$$

From the data given in the question,

$$\frac{P_2}{2} = \left(\frac{1200}{300}\right)^{\left(\frac{1.4}{1-1.4}\right)}$$

$$\Rightarrow P_2 = 2 \times (7)^2$$

$$\Rightarrow P_2 = 2^8 = 256 \text{ atm}$$

18(1)

For SHM, we need $F \propto -x$, which means that force will act in the opposite direction to force.

Looking at the given options we see that only $F = -AKx$ will be satisfying the condition of SHM if we assume AK to be the constant of proportionality.

19(2)

$$\omega = 100$$

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

Resonance frequency

$$v_0 = \frac{1}{2\pi\sqrt{C}} = \frac{1}{2\pi} \sqrt{\frac{1}{10 \times 10 \times 10^{-6}}}$$
$$= \frac{50}{\pi} \text{ Hz}$$

20(2)

Sound propagate through a medium following the Newton-Laplace equation:

The velocity of sound is $v = (K/\rho)$

where, K = the modulus of bulk elasticity for gases and ρ = density of the medium.

So v depends on both of them.

21(2)

Maximum particle velocity $v_{max} = \omega a$ and wave velocity $v = \omega k$

$$\Rightarrow \frac{v_{max}}{v} = \frac{\omega a}{\omega k} = ka.$$

From the given equation k = Co-efficient of x = 6 m

$$a = 60 \times 10^{-6} \text{ m}$$

$$\Rightarrow \frac{v_{max}}{v} = ka$$

$$= 6 \times 10^{-6} \times 60$$

$$= 3.6 \times 10^{-4}$$

22(3)

$$\text{Amplitude} = 2 \text{ cm} = 0.02 \text{ m,}$$

$$v = 128 \text{ m/s}$$

$$\lambda = 54 = 0.8 \text{ m;}$$

$$v = \frac{128}{0.8} = 160 \text{ Hz}$$

$$\omega = 2\pi v = 2\pi \times 160 = 1005;$$

$$k = \frac{2\pi}{\lambda} = \frac{2\pi}{0.8} = 7.85$$

$$\therefore y = 0.02 \sin(7.85x - 1005t).$$

23(1)

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It is electric dipole at large distance
electric field intensity

$$E = \frac{KP}{R^3} \sqrt{1 + 3\cos^2\theta}$$

$$\therefore E \propto \frac{1}{R^3}$$

24(4)

the capacitors are behaving as passive element

Hence we can say that they are forming wheatstone bridge

Now we can say that we can eliminate 20 μF capacitor as no current will flow through that branch.

Now

$$C_{\text{eq}} = \frac{C_1 C_2}{C_1 + C_2} + \frac{C_3 C_4}{C_3 + C_4}$$
$$\Rightarrow C_{\text{eq}} = \frac{6 \times 6}{6 + 6} + \frac{6 \times 6}{6 + 6}$$
$$= 6 \mu\text{F}$$

25(1)

Let the side of the square be = a

Potential at centre

$$V_c = \frac{K \times -Q}{\frac{a}{\sqrt{2}}} + \frac{K \times -q}{\frac{a}{\sqrt{2}}} + \frac{K \times 2q}{\frac{a}{\sqrt{2}}} + \frac{K \times 2Q}{\frac{a}{\sqrt{2}}}$$

$$0 = \frac{KQ}{\frac{a}{\sqrt{2}}} + \frac{Kq}{\frac{a}{\sqrt{2}}}$$

$$\Rightarrow Q = -q$$

26(4)

In first case the resistances are in series so equivalent resistance, $R_S = R + R + R = 3R$

$$\text{Thus, power } P = \frac{V^2}{R_S}$$

$$10 = \frac{V^2}{3R}$$

$$V^2 = 30R$$

In parallel, the equivalent resistance is

$$R_P = \left(\frac{1}{R} + \frac{1}{R} + \frac{1}{R} \right)^{-1}$$
$$= R/3$$

$$\text{Power} = \frac{V^2}{R_P} = \frac{30R}{R/3} = 90W$$

27(1)

The potential drop across 3m will be 6V.

Let the potential drop across 50cm be E.

Since,

$$\frac{E_q}{L_1} = \frac{E_2}{L_2}$$

$$\frac{6}{3} = \frac{E}{0.5}$$

$$\Rightarrow 36 = 0.5E$$

$$[E = 2 \times 0.5 = 1V]$$

28(4)

1 division = $1 \mu\text{A}$

Current for 1C = $1040 \mu\text{v} = 4 \mu\text{A}$

$$1 \mu\text{A} = \frac{1}{4} C = 0.25C$$

29(1)

$$B = 3 \times 10^{-5} \text{Wb/m}^2$$

$$i = 12A$$

The magnetic field at a distance r from the long current carrying straight wire is given by,

$$B = \frac{\mu_0 i}{2\pi r}$$

$$r = \frac{\mu_0 i}{2\pi B}$$

$$r = \frac{4\pi \times 10^{-7} \times 12}{2\pi \times 3 \times 10^{-5}}$$

$$r = 8 \times 10^{-2} \text{m}$$

30(1)

Here,

$$M = 0.4 \text{JT}^{-1};$$

$$B = 0.16T$$

For stable equilibrium, the potential energy (U) of bar magnet in the magnetic field is

$$U = -MB$$

$$= -0.4 \times 0.16$$

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$$=-0.064J$$

31(2)

Let us Consider the ring starting to rotate from its initial position where it is perpendicular to the magnetic field. Thus initially maximum flux is passing through the loop. When it rotates, the flux passing through the loop starts to decrease. When it becomes parallel to the magnetic field, the flux becomes zero and then starts to increase. Here the direction of the induced emf remains the same. Then as it rotates further, it keeps on increasing, reaches maximum. Here the direction of induced emf changes. According to lenz law, the induced emf tends to oppose the flux when it was increasing and now since it is decreasing, it tends to increase it. Similarly when it reaches its initial position it changes the direction.

32(4)

Efficiency of transformer, $\eta=80\%$

Efficiency of transformer,

$$\eta = \frac{\text{Output power}}{\text{Input power}}$$

$$\eta = \frac{V_s I_s}{V_p I_p} \quad \text{Or}$$

$$IP = \frac{V_s I_s}{\eta V_p}$$

$$= \frac{(440V)(2A)(100)}{(80)(230V)}$$

$$= 5A$$

33(3)

In electromagnetic wave, electric and magnetic field are in phase and perpendicular to each other and also

perpendicular to the direction of the propagation of the wave.

34(3)

For lens $u = 30$ cm. $f = 20$ cm, hence by using

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$
$$\Rightarrow \frac{1}{+20} = \frac{1}{v} - \frac{1}{-30}$$

$$\Rightarrow v = 60\text{cm}$$

The final image will coincide the object, if light ray falls normally on convex mirror as shown. From figure it is seen clear that separation between lens and mirror is $60 - 10 = 50$ cm.

35(1)

$$\alpha = 180^\circ - 90^\circ - A$$

$$= 90^\circ - A$$

$$r = 90^\circ - \alpha = A$$

from snell's law

$$\mu_1 \sin i = \mu_2 \sin r$$

$$1 \sin i = \mu \sin A$$

for small angle

$$i = \mu A$$

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SECTION : B

36(3)

Fringe width $\beta = D\lambda/d$

where D is the distance between slits and screen

and d is the distance between the slits.

Thus, From qn $D' = 2D$ and $d' = d/2$

When D is doubled and d is reduced to half, then the fringe width becomes

$$\beta' = \lambda 2D / (d/2)$$

$$= 4\lambda D/d$$

$$= 4\beta$$

Thus, when the double slit experiment the distance between the slits and the screen is doubled and the separation between the slits is reduced to half, the fringe width becomes four times.

37(1)

Einstein's photoelectric effect & Compton effect established particle nature of light.

These effects can be explained only, when we assume that the light has particle nature (To explain, Interference & Diffraction the light must have wave nature. It means that light has both particle and wave nature, so it is called dual nature of light).

38(1)

$$v_{th} = 3.3 \times 10^{14} \text{ Hz.}$$

$$v = 8.2 \times 10^{14} \text{ Hz}$$

we know that,

$$K.E. = hv - hv_{th} = eV_0$$

Where, (V_0 = cut-off voltage)

$$\Rightarrow V_0 = \frac{h}{e} (8.2 \times 10^{14} - 3.3 \times 10^{14})$$

$$\Rightarrow V_0 = \frac{6.6 \times 10^{-34} \times 4.9 \times 10^{14}}{1.6 \times 10^{-19}} \approx 2 \text{ V}$$

39(4)

J.J. Thomson's cathode-ray tube experiment demonstrated the relation for e/m of charged particles. The relation is

$$\frac{e}{m} = \frac{E^2}{2B^2V}$$

Thus, knowing B, E and V , the value of e/m for electrons and protons can be calculated. It is found the e/m of electrons is much greater than the e/m of protons.

40(1)

As ${}^6_6\text{C}^{13}$ and ${}^7_7\text{N}^{14}$ have same no. of neutrons ($13 - 6 = 7$ for C and $14 - 7 = 7$ for N), they are isotones.

41(3)

A moderator is a material used in a nuclear reactor to slow down the neutrons produced from fission. By slowing the neutrons down the probability of a neutron interacting with Uranium-235 nuclei is greatly increased thereby maintaining the chain reaction. Heavy water (D_2O) is used as a moderator in nuclear reactor.

It contains significantly more than the natural proportions (one in 6,500) of heavy hydrogen (deuterium, D) atoms to ordinary hydrogen atoms. Heavy water is used as a moderator in some reactors because it slows down neutrons effectively and also has a low probability of absorption of neutrons.

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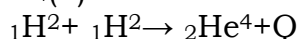
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42(1)



Where, Q is the energy released in the reaction.

By conservation of energy,

$$Q = (\text{B.E})_{\text{product}} - (\text{B.E})_{\text{reactants}}$$

$$\Rightarrow Q = (\text{B.E of } {}_2\text{He}^4) - 2(\text{B.E of } {}_1\text{H}^2)$$

$$\Rightarrow Q = 28 \text{ MeV} - 4.4 \text{ MeV}$$

$$\Rightarrow Q = 23.6 \text{ MeV}$$

43(3)

Semiconductors are insulators at room temperature.

44(1)

Here, X = 0, if A = 0 and B = 0 and X = 0,

if A = 1 and B = 1

Hence, this is the output of XOR gate.

45(1)

The energy band gap in maximum for carbon, less for silicon and least for germanium

$$(E_g)_C > (E_g)_{Si} > (E_g)_G$$

46(3)

Direction of propagation of electromagnetic waves is along $\vec{E} \times \vec{B}$.

Given that direction of propagation is along x-axis.

Checking all the options:

$$\text{Option 1: } (-\hat{j} + \hat{k}) \times (-\hat{j} + \hat{k})$$

$$= [-\hat{j} \times (-\hat{j}) - \hat{j} \times \hat{k} + \hat{k} \times (-\hat{j}) + \hat{k} \times \hat{k}]$$

$$= 0 - \hat{i} - (-\hat{i}) + 0 = 0$$

Similarly,

$$\text{Option 2: } (\hat{j} + \hat{k}) \times (\hat{j} + \hat{k}) = 0$$

$$\text{Option 3: } (-\hat{j} + \hat{k}) \times (-\hat{j} - \hat{k}) = 2\hat{i}$$

$$\text{Option 4: } (\hat{j} + \hat{k}) \times [-(\hat{j} + \hat{k})] = 0$$

47(2)

$$R_1 = \frac{p l_1}{A_1}$$

$$R_2 = \frac{p l_2}{A_2}$$

$l_1 A_1 = l_2 A_2 \rightarrow$ (Since volume remains constant)

$$l_1 A_1 = n l_1 A_2 \quad (l_2 = n l_1)$$

$$\Rightarrow A_2 = \frac{A_1}{n}$$

$$\Rightarrow R_2 = \frac{p n^2 l_1}{A_1}$$

$$\text{Hence } R_2 = n^2 R_1$$

48(1)

$$i = \frac{nE}{NR} = \frac{E}{R}$$

49(2)

$$\frac{1}{F_1} = \frac{1}{f} + \frac{1}{f}$$

$$\Rightarrow F_1 = \frac{f}{2}$$

The space between convex lenses filled with glycerin will act as concave lens of focal length -f.

$$\frac{1}{F_2} = \frac{1}{f} + \frac{1}{f} - \frac{1}{f}$$

$$\Rightarrow F_2 = f$$

$$\Rightarrow \frac{F_1}{F_2} = 1/2$$

50(3)

Magnetic field at centre of solenoid $= \mu_0 n I$
 $n = \frac{L}{N}$

$$= \frac{100}{50 \times 10^{-2}}$$

$$= 200 \text{ turns/m}$$

$$I = 2.5 \text{ A}$$

On putting the values,

$$B = 4\pi \times 10^{-7} \times 200 \times 2.5$$

$$= 6.28 \times 10^{-4} \text{ T}$$

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**Chemistry solution
SECTION : A**

51(3)

Haematite Fe₂O₃

Magnetite Fe₃O₄

Calamine ZnCO₃

Kaolinite [Al₂(OH)₄Si₂O₅]

52(3)

Density of water (ρ) = 1g/cm³

Molar mass of water (M) = 18 g/mol

V_m = 18 cm³ /mol

Therefore,

Volume of 1 molecule of water = V_m / N

Where N is Avogadro number

The volume of 1 molecule of water =

18/(6.022 × 10²³) Volume of 1 molecule

of water = 2.989 × 10⁻²³

or 3 × 10 m⁻²³

53(1)

$$r \propto \frac{n^2}{z}$$

$$r_{Li} = \frac{r_H}{3} = 0.17\text{\AA}$$

54(2)

Given the value of E₁ = 25eV and E₂

=50eV

$$E_1 = \frac{hc}{\lambda_1}, E_2 = \frac{hc}{\lambda_2}$$

By divide E₁ and E₂

$$\Rightarrow \frac{25}{50} = \frac{\lambda_2}{\lambda_1}$$

$$\lambda_1 = 2\lambda_2$$

55(1)

An atom has electronic configuration

$$1s^2, 2s^2 2p^6$$

$$, 3s^2 3p^6 3d^3, 4s^2$$

It is a member of d-block element because the last electron is filled in d-subshell as 3d³ and the following electronic configuration is possible for d-subshell as (n-1)d^{1 to 10}

Hence, it is member of fifth group.

Group number	IIIB	IVB	VB	VIB	VIIB
	(13)	(14)	(15)	(16)	(17)
$ns^2(n-1)s^2p^6$	d ¹	d ²	d ³	d ⁴	d ⁵
	VIII	VIII	VIII	IB	IIIB
	(18)	(19)	(20)	(21)	(22)
	d ⁶	d ⁷	d ⁸	d ⁹	d ¹⁰

56(4)

As the bond order increases, bond length decreases.

Thus, the ethyne has the shortest bond length.

57(2)

$$d = \frac{Z \times M}{N_A \times a^3}$$

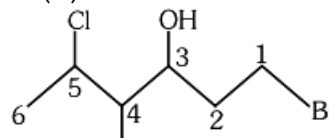
$$8.92 = \frac{4 \times M}{6.022 \times 10^{23} \times (3.608 \times 10^{-8})^3}$$

$$M = \frac{8.92 \times 6.022 \times 10^{23}}{4} \times 46.96 \times 10^{-24}$$

M = 63.1 g/mol (Molar Atomic Mass)

M = 63.1 u (Atomic Mass)

58(2)



59(1)

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Absolute zero temperature is the temperature at which particles of matter have the least possible energy.

It is also defined as the temperature at which all molecular motion ceases.

The value of absolute zero on different scales are as below :

Kelvin	0 K
Celsius	-273 °C
Fahrenheit	-459° F

60(3)

Given, mass of CH₄ , w=6g

Volume of CH₄ , V=0.03m³

T = 129°

$$C = 129 + 273 = 402 \text{ K}$$

$$R = 8.314 \text{ J K}^{-1}\text{mol}^{-1}$$

Molecular mass of CH₄ ,

$$M = 12.01 + 4 \times 0.4$$

$$= 16.05$$

$$PV = nRT = \frac{w}{M} RT$$

$$P = \frac{w}{M} \frac{R}{T} = \frac{6}{16.05} \times \frac{8.314 \times 402}{0.03}$$

$$= 41648 \text{ Pa}$$

61(1)

$$\Delta S = \frac{q}{T}$$

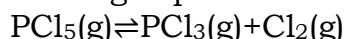
$$q = 2930$$

$$T = 273 + 37 = 300$$

$$\Delta S = \frac{2930}{300} = 9.77 \text{ JK}^{-1}\text{mol}^{-1}$$

62(2)

Given gas phase reaction is :-



we know that,

$$\Delta H = \Delta H^\circ + \Delta n_g RT$$

Here ΔH° = Enthalpy change of reaction

ΔE = internal energy change of reaction

Δn_g = difference in no. of moles of gaseous products and reactants.

Here, $\Delta n_g = 1 + 1 - 1 = 1 > 0$

so, $\Delta H > 0$

& $\Delta S = S_{\text{product}} - S_{\text{reactant}} > 0$

63(3)

Equilibrium constant 'K' of a reaction changes with temperature.

For endothermic reaction, K increases with increase in temperature. For exothermic reaction, K decreases with increase in temperature.

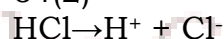
In the given reaction

at 500 K, $K = 1 \times 10^{-10}$

at 700 K, $K = 1 \times 10^{-7}$

As value of K increases with increase in temperature, so given reaction is an endothermic reaction.

64(2)



$$10^{-8} \times 10^{-8}$$

$$K_w = [\text{H}^+][\text{OH}^-]$$

$$10^{-14} = (10^{-8} + a) \times a$$

$$a = 0.95 \times 10^{-7} [\text{H}^+]$$

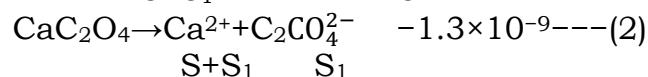
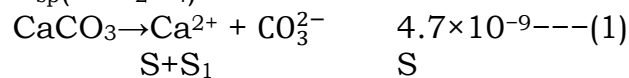
$$= 10^{-8} + (0.95 \times 10^{-7})$$

$$= 1.05 \times 10^{-7} \text{ M}$$

65(1)

$$K_{sp}(\text{CaCO}_3) = 4.7 \times 10^{-9}$$

$$K_{sp}(\text{CaC}_2\text{O}_4) = 1.3 \times 10^{-9}$$



On dividing (1) & (2),

$$\frac{(s+s_1) \times s}{(s+s_1) \times s_1} = \frac{4.7 \times 10^{-9}}{1.3 \times 10^{-9}}$$

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$$S = 3.61 S_1 \text{-----(3)}$$

From(1),

$$(S+S_1) \times S = 4.7 \times 10^{-9}$$

From(2),

$$(S+S_1) \times S_1 = 1.3 \times 10^{-9}$$

$$(3.61S_1+S_1) \times S_1 = 1.3 \times 10^{-9}$$

$$4.61S_1^2 = 1.3 \times 10^{-9}$$

$$S_1^2 = 0.281 \times 10^{-9}$$

$$S_1 = \sqrt{0.281 \times 10^{-9}}$$

$$= 1.67 \times 10^{-5}$$

From(3),

$$S = 3.61 S_1$$

$$= 3.61 \times 1.67 \times 10^{-5}$$

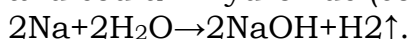
$$= 6.02 \times 10^{-5}$$

$$[Ca^{2+}] = S + S_1 = (6.02 + 1.67) \times 10^{-5}$$

$$= 7.69 \times 10^{-5}$$

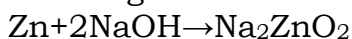
66 (1)

Substance A is sodium metal. It reacts with water to produce hydrogen (gas B) and sodium hydroxide (compound C).

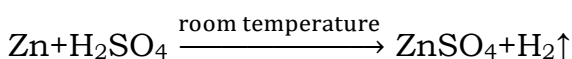


Another substance D is zinc.

It reacts with solution of sodium hydroxide, it produces hydrogen gas on warming.



Zinc also reacts with sulphuric acid at room temperature to produce hydrogen gas.



Thus, substance A, B, C and D, respectively are Na, H₂, NaOH, Zn.

67(2)

CaCO₃ on heating gives a colourless gas CO₂ and CaO as the residue. CaO with water will form Ca(OH)₂ and when treated with

excess CO₂ will give Ca(HCO₃)₂ which on heating gives back CaCO₃.

68(4)

In 1,1,2,2-tetrachloroethene, each carbon is sp²-hybridised, thus having bond angle 120° and in tetrachloromethane carbon is sp³-hybridised, hence bond angle is 109.5°.

69(3)

In (CH₃)₂C=CHCH₂CH₃, two methyl groups are attached to the C having a double bond. Hence, cis-trans isomerism is not possible for this structure.

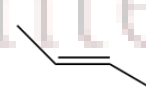
70(4)

Chlorination of toluene in presence of sunlight follows free radical mechanism. Benzyl radical (C₆H₅CH₂[•]) is most stable so benzyl chloride is major product formed.

71(4)



Cis-2-butene



trans-2-butene

1-butanol does not have any of the double bond so it cannot form geometrical isomerism.



2-butanol also does not have any double bond so cannot form geometrical isomerism.

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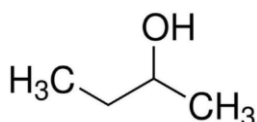
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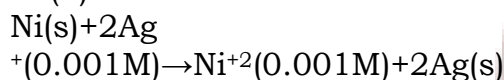
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2-butyne has a triple bond in it and a triple bond does not show geometrical isomerism.



72(4)



$$E_{\text{cell}} = E_{\text{cell}}^0 - \frac{0.059}{2} \log \frac{[\text{Ni}^{2+}]^1}{[\text{Ag}^+]^2}$$

$$E_{\text{cell}} = 10.5 - \frac{0.059}{2} \log 10^{+3}$$

$$= 10.5 - \frac{0.059}{2} \log 10^{+3}$$

$$= 10.5 - \frac{0.059}{2} \times 3$$

$$= 10.4115\text{V}$$

73(2)

The growth of fishes get hindered if the concentration of DO is below 6ppm.

74(1)

Simple cubic unit cell, $r = a/2$

Body-centred cubic unit cell, $r = \frac{a\sqrt{3}}{4}$

Face-centred cubic unit cell, $r = \frac{a}{2\sqrt{2}}$

Where a = edge length, r = radius.

∴ Ratio of radii of the three will be:

$$\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a$$

75(2)

The mole fraction is the number of moles of a component in the solution divided by

the total number of moles in the given solution.

Mole fraction =

$$\frac{\text{No. of moles component A}}{\text{no of moles of component A} + \text{no of moles of component B}}$$

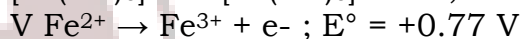
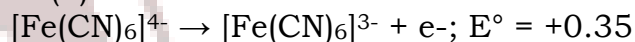
Mole fraction is always non - negative.

Sum of mole fractions of all components in the solution is equal to 1.

76(3)

Diamond is an insulator .

77(3)



Higher the +ve reduction potential, stronger will be the oxidising agent.

Oxidising agent oxidises other compounds and gets itself reduced easily.

78(2)

Acc. to Bohar's atomic model

$$r \propto \frac{n^2}{z}$$

$$3^{\text{rd}} \text{ orbit of Li}^{+2} \quad n_1 = 3$$

$$Z_1 = 3$$

$$2^{\text{nd}} \text{ orbit of He}^+ \quad n_1 = 2$$

$$Z_1 = 2$$

$$\frac{(r_3)_{\text{Li}^{+2}}}{(r_2)_{\text{He}^+}} = \frac{n_1^2}{n_2^2} \times \frac{Z_2}{Z_1}$$

$$\frac{(r_3)_{\text{Li}^{+2}}}{105.8\text{pm}} = \frac{3 \times 3}{2 \times 2} \times \frac{2}{3}$$

$$(r_3)_{\text{Li}^{+2}} = 158.7 \text{ pm}$$

79(2)

or rise in temperature, $n=1$

$$\text{Therefore rate} = 2^n = 2^1 = 2$$

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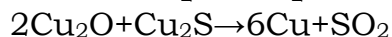
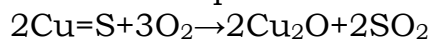
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When temperature is increased from 10°C to 100°C change in temperature = 100-10 = 90°C therefore n=9 therefore, rate = 2⁹=512 times.

80(1)

It is an example of auto reduction

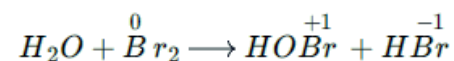


81(3)

H₃PO₂ is named as hypophosphorous acid. As it contains only one P-OH group, its basicity is one.

82(2)

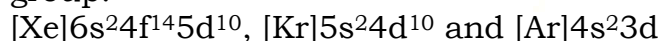
In reaction,



The oxidation number of bromine increases from 0 to +1 and decreases from 0 to -1, so due to this reason bromine is both oxidised as well as reduced in the above reaction.

83(3)

Elements having the same number of valence electrons belong to the same group.



belong to the same group since each one of them have two electrons in the outermost shell. In contrast, [Ne]3s²3p⁵ has 7 electrons in the outermost shell. Hence, it belongs to a different group.

84(1)

Basic character of oxides decreases with increase in atomic number. So the correct basic order will be TiO > VO > CrO > FeO

85(3)

Sc (Z = 21) has incompletely filled 3d-orbitals in its ground state (3d¹), it is considered as a transition element but Zn (Z = 30) has completely filled d-orbitals (3d¹⁰) in its ground state and its common oxidation state of (+2), it is not considered as a transition element.

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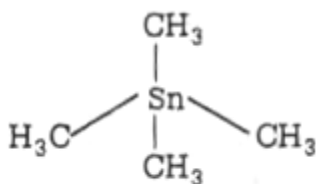
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SECTION : B

86(1)

In $(\text{CH}_3)_4\text{Sn}$ (organometallic compounds of tin) single bonds are present in form of sigma bond, pi-bonded organometallic compound includes organometallic compounds of alkenes, alkynes and some other carbon containing compounds having pi-electrons in their molecular orbitals.



87(3)

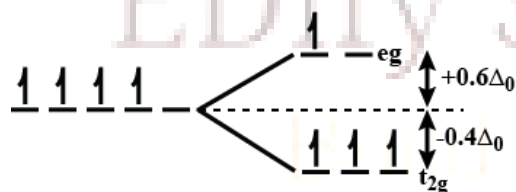
For high spin d^4 Octahedral complex the splitting is given by

(Refer to Image)

$$\text{CFSE} = [-0.4 \times 3 + 0.6 \times 1] \Delta_0$$

$$= [-1.2 + 0.6] \Delta_0$$

$$= -0.6 \Delta_0$$



88(3)

- OH group being electron donor increases the electron density in phenol. Thus, the electron density in phenol is higher than that of toluene, benzene and chlorobenzene.

89(2)

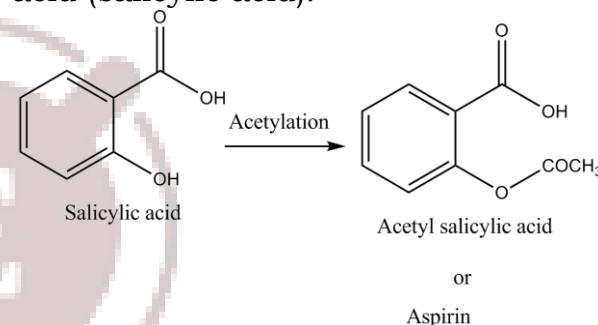
Glycol can be used as antifreeze in automobile radiators. It lowers the freezing point of water and

prevents the automobile engine from bursting due to expansion when water freezes.

It provides a wide temperature range in which the mixture remains in the liquid phase.

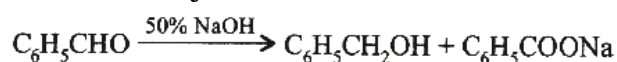
90(1)

Aspirin (acetyl salicylic acid) is an acetylation product of o-hydroxybenzoic acid (salicylic acid).



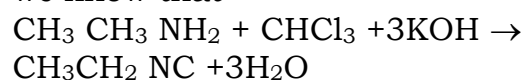
91(1)

Aldehydes which do not have α -H atom, in presence of 50% NaOH or 50% KOH undergoes disproportionation reaction to produce alcohol and sodium salt of acid. This reaction is known as Cannizzaro reaction. $\text{C}_6\text{H}_5\text{CHO}$ containing no α -H atom undergoes Cannizzaro reaction to produce benzyl alcohol and sodium



92(1)

we know that



In this reaction, bad smelling compound ethyl isocyanide ($\text{CH}_3\text{CH}_2\text{NC}$) is produced

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This equation is known as carbylamine reaction.

93(2)

The enzymes are biological catalysts produced by living cells which increase the rate of biochemical reactions in living organisms.

94(1)

A sequence of three nucleotides in messenger RNA makes a codon for an amino acid. A codon is a sequence of three adjacent nucleotides constituting the genetic code that determines the insertion of a specific amino acid in a polypeptide chain during protein synthesis or the signal to stop protein synthesis. A codon is defined by the initial nucleotide from which translation starts.

95(1) In the periodic table, each and every element is denoted by symbols.

The symbol for

1. copper - Cu,
2. cobalt - Co,
3. Calcium - Ca
4. Silver - Ag.

96(3)

Li^+ being smallest, has maximum charge density

$\therefore \text{Li}^+$ is most heavily hydrated among all alkali metal ions. Effective size of Li^+ in aq solution is therefore, largest.

\therefore Moves slowest under electric field.

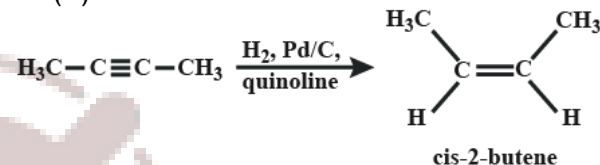
97(2)

In metals moving down the group metallic character increases, so basic

nature increases hence most acidic will be BeO as Be is least metallic in group 2 elements.

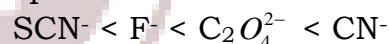
BeO is most acidic in nature as the acidity of oxides decreases with increases in the electropositive character of the central atom.

98(2)

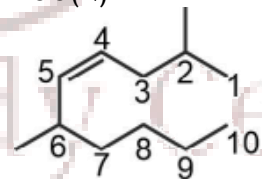


99(3)

Arrangement of different ligands in increasing order of field strength called spectrochemical series is as follows:



100(2)



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Biology solution

BOTANY

SECTION : A

101(2)

Classification given by Bentham and Hooker is Natural System. Monocots were placed after dicots; closely related families were separated; gymnosperms were placed between dicots and monocots.

102(2)

Photolithotrophs are those plants that obtain energy from radiation and hydrogen from inorganic compounds.

103(2)

Escherichia coli is the bacteria belongs to the kingdom of Monera.

- Escherichia coli is the unicellular, prokaryotic bacteria. Most of the bacteria under the kingdom Monera are single-celled prokaryotes.
- E.coli has a rod-shaped structure. It is a gram-negative bacterium.
- E.coli is a good bacteria found in the Intestine of humans and animals.
- It is harmless bacteria but some times this is pathogenic it causes illness.
- Harmful E.coli bacteria cause diarrhea, urinary tract infections, etc.

104(4)

Entamoeba coli is a non-pathogenic species of Entamoeba that frequently exists as a commensal parasite in the human gastrointestinal tract.

105(2)

Thermophilic sulphur bacteria use Sulphur for metabolism. The rotten egg odour of the hot springs is because of Sulphur compounds that naturally occur in the hot springs. Sulphur bacteria thrive and multiply in the hot springs at temperatures 100-105°C

106(2)

Fucus belongs to class-Phaeophyceae, in which reserve food is found in form of laminarin, mannitol and oil. Chara belongs to class-Chlorophyceae, in which reserve food is found in form of starch and oil. Porphyra and Gracillaria belongs to class-Thodophyceae, in which reserve food is found in form of floridean starch and Galactan So _ (2) polymers.

107(2) haploid

108(1)

Agar is a jelly-like material that is derived from Red Algae. The jelly material in algae is due to the presence of unbranched polysaccharides obtained from the cell walls of the red algae. Agar-agar is used as a thickening agent in jellies, cakes, etc.

109(1)

In Cycas, though the ovules are dicotyledonous, these are not covered by an ovary, are naked and do not bear fruits. Hence, they are grouped with other seed bearing vascular plants which bear naked seeds.

110(4)

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Multicellular fungi, filamentous algae and protonema of mosses all show multiplication by fragmentation.

111(3)

Battess roots refer to regular, broad-like the wood plants that arise from basal parts of main stem of older plants, and spread in different directions in the soil, e.g. Ficus religiosa (peepal), Terminalia, Bombax etc. These roots aids in providing mechanical support to the trees.

112(4)

Casuarina and Alnus are some of the angiosperms, which have root nodules formed due to filamentous species of Actinomycetes. Legume crops show root nodules due to rod shaped Rhizobium bacteria.

Cycas is a gymnosperm having cyanobacteria in coralloid roots, which fix atmospheric nitrogen.

Crotalaria is a legume and is used as green manure. It does not contain filamentous symbiotic nitrogen fixer.

113(1)

The secondary growth in plants occurs due to the cell division of the lateral meristems or secondary meristems that helps to increase the thickness or the girth of the plants.

In vascular plants, the secondary growth occurs due to the activity of the two lateral meristems- the cork cambium and the vascular cambium.

In woody plants, the secondary growth produces wood and gives shapes to the plant with a thickened trunk.

114(1)

Sclereids are small bundles of sclerenchyma tissue in plants that form durable layers, such as the cores of apples and the gritty texture of pears. Sclereids are variable in shape. The cells can be isodiametric, prosenchymatic, forked or fantastically branched. The cell walls fill nearly all the cell's volume. The shell of many seeds like those of nuts as well as the stones of drupes like cherries or plums are made up from sclereid.

115(3)

Hydrophytes are aquatic plants that live in aquatic environments either completely or partially submerged in water. As an adaptation, their vascular tissue and mechanical tissue are reduced. The cuticle is either completely absent or it is reduced, thin and poorly developed.

On contrary, xerophytes have heavy cuticle, vascular tissue and mechanical tissue. Mesophytes have moderate vascular tissue, mechanical tissue and cuticle and epiphytes are lower plants or mosses that live in marine environment, they are non-vascular.

116(2)

The fluid mosaic model of the biomembrane or cell membrane was proposed by SJ Singer and GL Nicolson in the year 1972.

According to this model, the protein molecules are embedded in the lipid bilayer.

Thus, the proteins are seen as icebergs in the sea of lipids.

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It is the most acceptable model of the plasma membrane and its main function is to provide shape to the cell.

117(3)

Desmosomes (macula adherens) consists of intercellular thickening material, disc-shaped intracellular thickening adjacent to each membrane with tonofibrils. These act as intercellular cementing material, adhere cells together at places like spot welding.

118(4)

A large central vacuole is a characteristic of a plant cell.

It is a membrane-bound organelle.

The plant cell vacuole is filled with water and excretory substances.

119(1)

Competitive inhibition is a form of enzyme inhibition where binding of the inhibitor to the active site on the enzyme prevents binding of the substrate and vice versa. Malonate is a competitive inhibitor of the enzyme succinate dehydrogenase: malonate binds to the active site of the enzyme without reacting, and so competes with succinate, the usual substrate of the enzyme.

120(2)

The interphase of a typical cell cycle comprises of G₁ phase, S phase and G₂ phase. The S phase stands for synthesis phase in which DNA replication occurs followed by synthesis of histones.

121(4)

At constant temperature, the rate of transpiration will be higher at 1.5 km above the sea level. At lower atmospheric pressure there is increase in the rate of evaporation.

122(3)

Essential micronutrients for plant growth are:

1)Manganese

2)Zinc

3)Copper

4)Boron

5)Molybdenum

6)Chlorine

-Calcium is a macronutrient.

123(1)

Leaves of C₄ -plants (e.g. sugarcane, maize) are characterised by Kranz anatomy in which the mesophyll is undifferentiated and its cells occur in concentric layers around vascular bundles. Vascular bundles are surrounded by large sized bundle sheath cells which are arranged in a wreath-like manner (Kranz- wreath).

124(4)

Cytochromes are iron-containing hemeproteins central to which are heme groups that are primarily responsible for the generation of ATP via electron transport. Cytochrome P₄₅₀ is not a colored cell is wrong.

125(2)

Mesophyll is the site in plant leaves, where chlorophyll pigment is present. Thus carbon dioxide fixation occurs there, which produces malic acid. It is

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then transferred to agranal chloroplast in bundle sheath.

126(4)

Anaerobic means in the absence of molecular oxygen, so life without air would be anaerobic. The atmosphere of earth at the time of origin of life was without free oxygen atoms so the primitive atmosphere was reducing.

127(2)

Glyoxysomes are small, spherical vesicles enclosed by a single unit membrane. Glyoxysomes are generally found in cells of yeast, Neurospora and in germinating fatty seeds where fat is being converted into carbohydrates, i.e., glyoxylate cycle (gluconeogenesis).

128(4)

In several plants, particularly bienniales and perennials, light does not seem to be the only factor controlling the process of flowering. Temperature, particularly the low temperature treatment induce flowering. Vernalization means ability of low temperature | to convert winter cereal into spring cereal as a result of satisfaction of their low temperature requirement.

129(4)

When the dark period is interrupted by the flash of light, the plant could not produce flowers because the dark period could not reach the critical requirement. It shows that the plant needs a long dark period than the light period. So, it is a short day plant.

130(3)

The seeds of castor (*Ricinus communis*, family- Euphorbiaceae) are endospermic dicot seeds. They possess, endosperm which acts as the food storage tissue for the seed. They also possess perisperm and caruncle.

131(4) mammalian females other than primates

132(4)

An organism with two identical alleles is said to be Homozygous.

133(1)

Pseudoalleles are closely placed genes producing related phenotypic effect which is distinguishable only through a rare crossing over, e.g. dominant star and recessive asteroid eye traits in *Drosophila*.

134(2) $\frac{1}{2}$

135(3)

A cross, with the phenotype of each sex reversed as compared with the original cross, to test the role of parental sex on inheritance pattern is called Reciprocal crosses.

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SECTION : B

136(3)

Higher number of the parental types formed when RRYy and rryy genotypes are hybridised giving the condition that R and Y genes are closely linked. Law of independent assortment does not apply when the gene of different character occupy the same homologous chromosome i.e. are linked gene.

137(2)

Haemophilia is a sex-linked recessive disorder.

The gene for it is present on the X chromosome.

An unaffected carrier female passes it onto some of her male offspring.

Hence, it is not a dominant disorder.

138(2) operator gene

139(1)

Histones are highly alkaline proteins found in eukaryotic cell nuclei that package and order the DNA into structural units called nucleosomes.

They are the chief protein components of chromatin, acting as spools around which DNA winds and play a role in gene regulation. Without histones, the unwound DNA in chromosomes would be very long (a length to width ratio of more than 10 million to 1 in human DNA). For example, each human cell has about 1.8 meters of DNA, (approx. 6 ft) but wound on the histones it has about 90 micrometers (0.09 mm) of chromatin, which, when duplicated and condensed during mitosis, result in about 120

micrometers of chromosomes. So, DNA is accommodated by super-coiling in nucleosomes.

140(2)

Inducible operon is an operon which remains switched off normally but becomes operational in the presence of an inducer (lactose in case of lac operon). The inducible operon generally functions in catabolic pathways. In the presence of an inducer, i.e., lactose (actually allolactose or metabolite of lactose), the repressor has a higher affinity for the inducer than for the operator gene. When lactose is added, a few lactose molecules are carried into the cell by the enzyme lactose permease as small amount of this enzyme is present in the cell even when the operon is not working. These few lactose molecules are converted into allolactose molecules which act as an inducer and bind to the repressor (a product of regulator gene). The repressor-inducer complex fails to join with the operator gene, thus it is turned on.

141(2)

The cytoplasm of many plant and some animal cells contains numerous small or large sized, hollow, liquid filled structures, the vacuoles. The vacuoles of plant cells are bounded by a single semi permeable membrane known as tonoplast. These vacuoles contain water, phenol, flavonols, anthocyanins, alkaloids and storage products such as sugars and proteins. The vacuoles of animal cells are bounded by a lipoproteinaceous membrane and their

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function is storage, transmission of materials and maintenance of internal pressure of cell.

142 (4)

Prophase I in meiosis-I is divided into 5 subphases:

In Pachytene there is recombination of chromosomes. This is accomplished by the formation of recombination nodule.

There is chiasmata formation in Diplotene which depicts the past recombination event.

Terminalisation takes place of chiasmata.

143. (3)

Calotropis, tulip, Asparagus, colchicine, Petunia, mustard, tobacco having valvate aestivation while sweet pea, groundnut, soyabean, Indigofera, Sesbania having vexillary aestivation.

144 (3)

The zygomorphic flower is those which are only divided into two half from one plane. It includes pea, Gulmohar, cassia, and beans.

Mustard, datura, and chili are the actinomorphic flowers as they are divided into two half from any plane.

145(3)

Woman is a carrier. · · Both son & daughter inherit X-chromosome · · Although only son be the diseased.

146(1)

The sequence of the coding strand and the mRNA is the same, exception is the T

is replaced with U. AGGUAUCGCAU is the sequence of the transcribed mRNA.

147(4)

Pseudopodia are locomotory structures in sarcodines (Amoeboid).

148(1)

- Horsetails are seedless vascular plants that reproduce with spores and are found in moist environments. They are Pteridophytes.
- In gymnosperms, ovules are not enclosed by an ovary wall.
- In cycas, the stem is erect, stout and unbranched. However, in Pinus and Cedrus, the stem is branched.
- Selaginella and Salvinia are heterosporous. They have spores of two different sizes, microspores and megaspores.

149(1)

Ovules are not enclosed by ovary wall in gymnosperms.

Gymnosperms are seed-bearing vascular plants in which the ovules or seeds are not enclosed in an ovary.

Horsetails are pteridophytes.

Selaginella and Salvinia are both heterosporous.

Stems are unbranched in Cycas and branched in Cedrus.

150(1)

Length of DNA = Number of base pairs $\times 0.34\text{nm} \times 0.34\text{nm}$

$= 6.6 \times 10^9 \times 0.34\text{nm}$

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$$=6.6 \times 10^9 \times 0.34 \text{ nm}$$

$$=6.6 \times 10^9 \times 0.34 \times 10^{-9} \text{ m}$$

$$=6.6 \times 10^9 \times 0.34 \times 10^{-9} \text{ m}$$

$$=2.2 \text{ m}$$



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Build your character

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Zoology solution

SECTION : A

151(2)

Encystment of Amoeba is occurred regularly to tide over unfavourable - conditions like drought and extreme temperature etc. During these conditions, the Amoeba forms a covering or cyst wall around itself.

152(3)

Presence of post-anal tail is one of the characters of chordate.

153(3)

At the point where the windpipe divides is situated the bird's sound producing organ, a voice box called the syrinx. syrinx produces sounds without the vocal folds of mammals. the sound is produced by the vibrations of some or all of the membrana tympaniformis (the walls of the syrinx) and the pessulus, caused by air flowing through the syrinx.

154(1)

The organisms attached to the substratum possess radial symmetry in all vertical planes. All the animals belonging to cnidaria (e.g. jellyfish) and echinodermata (e.g. starfish) are radially symmetrical and typically sessile in their adult form. In radial symmetry the parts in an organ or organism when cut through the centre in any direction produces two halves that are mirror images of each other.

155(3)

In contrast to annelids, the Platyhelminthes show the absence of

body cavity. Flatworms belong to the phylum Platyhelminthes and flatworms are the largest phylum of acoelomates.

156(2)

Earthworm is an annelid while pinworm is nematode and tapeworm is platyhelminth.

Sponges belong to the phylum Porifera, sea anemone belongs to phylum Cnidaria while starfish to Echinodermata.

Plasmodium falciparum is a malarial parasite belonging to the Apicomplexa, Amoeba is protozoa while the mosquito is an arthropod.

Prawn, Scorpion, Locusta all belong to the phylum Arthropoda.

157(4)

Osteoblasts are bone forming cells while osteoclasts are bone-destroying cells.

Ossification or osteogenesis is the process of bone formation.

Chondroblasts are cartilage forming cells.

158(1)

The coelomic fluid, which is made up of a watery matrix, plasma, and numerous coelomocytes with a variety of roles, is crucial for the development of innate immunity.

Earthworms typically exude coelomic fluid to keep their bodies moist and support their physiological functions. Without hurting its gut, the earthworm's outer surface is pierced by a needle, and coelomic fluid leaks out.

159(3)

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The density of DNA decreases on heating as hydrogen bonds breakdown.

According to Chargaff's rules, the amount of adenine is always equal to that of thymine, and the amount of guanine is always equal to that of cytosine i.e $A = T$ and $G = C$. The base ratio $A + T / G + C$ may vary from species to species, but is constant for a given species.

160(2)

The compound used as storage compound should be chemically unreactive then only it can store and hold energy. Further storage compound should be osmotically inactive otherwise the cell storing it would swell and burst. Both of these requirements are fulfilled by starch. Hence, starch is the most commonly stored form of carbohydrate in plants. In plants carbohydrates are synthesized as glucose or fructose, transported as sucrose and stored as starch.

161(4)

Gastrin is secreted in stomach by the parietal cells and stimulates the secretion of gastric juices from the gastric glands.

Secretin is secreted in duodenum and stimulates the secretion of pancreatic juice but inhibits the secretion of gastric juices.

Enterogastrone is secreted from the duodenal mucosa and decreases the secretion of gastric juices.

Cholecystokinin is secreted from the duodenum and causes contraction of gall

bladder and secretion of pancreatic juice into duodenum.

So, the correct answer is 'Enterogastrone'.

162(1)

Anything which cannot be digested cannot serve as 'food'. Therefore, starch and lactose in the present case have been automatically deleted. Cellulose cannot be digested by human beings thus option 4 is also stands rejected. Pancreatic juice can digest DNA which is the component of every cell.

163(1)

The pancreas secretes pancreatic juice. Trypsinogen, chymotrypsinogen, procarboxypeptidase, and the enzyme elastase are all proenzymes that are present.

All of them have to do with protein digestion.

The substance that is injected into the human duodenum is trypsinogen.

Trypsinogen is transformed into trypsin, which is its active form, with the aid of the enterokinase enzyme found in the intestinal juice.

Large peptides are formed when trypsin digests protein molecules.

164(4)

RBCs or red blood corpuscles are meant for the transportation of respiratory gases in the blood and these are present in all vertebrates. In cockroach haemolymph is present which serves for the transportation of nutrients, maintains hydrostatic pressure and acts as a reservoir of water.

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165(4)

RBCs and plasma both transport O₂ and CO₂ either in chemically bonded state or in dissolved state.

166(1)

Solenocytes are elongated, flagellated cells that aid in the removal of nitrogenous wastes in most lower invertebrates.

Flame cells are another name for Solenocytes.

Solenocytes/flame cells are responsible for excretion and osmoregulation in Platyhelminthes.

167(3)

The juxtaglomerular apparatus is a specialized structure formed by the distal convoluted tubule and the glomerular afferent arteriole.

One of the effects of the sympathetic nervous system is to stimulate renin secretion by the juxtaglomerular cells, activating the renin-angiotensin-aldosterone system (RAAS).

The RAAS increases extracellular fluid volume by increasing sodium reabsorption which is the fall in the glomerular filtration rate.

168(3)

All articulations between bones that help in a certain kind of movement, are placed at a distance from each other to prevent friction between them during movement. This space between the two bones is filled with synovial fluid that also helps reduce friction. For example the ball and

socket joint of the pelvic girdle, the pivotal joint between the atlas and the axis

So, the correct answer is 'Characteristics - Fluid filled synovial cavity between two bones, Examples - Joint between atlas and axis'

169(2)

The rod cells of eye contain a purplish pigment called visual purple, or rhodopsin. They function in dim light and at night. Bright light splits rhodopsin into a lipoprotein scotopsin and a carotenoid pigment retinene. The splitting of rhodopsin depolarizes the rod cell. In the dark, rhodopsin is resynthesized from "scotopsin and retinene. This process is called "dark" adaptation. It makes the rods functional. It takes some time for rhodopsin to be reformed. This is why on entering a dark room at daytime or on coming out of a well lighted room at night, we feel blind for a while. When we go from darkness into bright light, we feel difficulty in seeing properly for a moment till rhodopsin is bleached and cones become functional. Accommodation is the reflex mechanism by which the focus of the eye changes to make the images of distant and near objects sharp on the retina. Mutation is a change in the genetic material (DNA) of a cell, or the change in a characteristic of an individual, which is not caused by normal genetic processes. Photoperiodism is the response of an organism to the day length.

170(3)

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Insulin is earliest known hormone. It is also called hypoglycemic or antidiabetic factor, as it decreases glucose level in blood and prevents occurrence of diabetes. It is secreted by β -cells of the islets of Langerhans.

171(1)

Melanin is produced by specialized epidermal cells called melanophores (or melanocytes). Their dispersion in these cells is controlled by melanocyte - stimulating hormone and melatonin. Melanin, a pigment present in skin, protects it from harmful effects of UV rays. People living in tropics have more melanin in their skin which is an adaptation to protect themselves from harmful UV rays. Melanin cannot protect from infrared rays and X-rays.

172 (2)

The posterior pituitary contains two hormones, oxytocin and vasopressin, which are produced by the hypothalamus. Vasopressin is known as an antidiuretic hormone, which induces water reabsorption from the distal convoluted tubule and prevents water loss.

173(2)

Study of formation, growth and development of new individual from an egg is embryology. Study of an individual's life cycle after the fertilization takes place till it develops into a new organism.

174(2)

Penetration of human sperm is a chemical mechanism. In this, acrosome of sperm undergoes acrosomal reaction and releases certain sperm lysins, which dissolve the egg envelope locally and make the path for the penetration of sperm. Sperm lysins are acidic proteins. These sperm lysins contain a lytic enzyme hyaluronidase (that dissolves the hyaluronic acid polymers in the intercellular spaces, which holds the granulosa cells of corona radiata together) corona penetrating enzyme and acrosin.

175(1)

Syphilis is caused by bacterium *Treponema pallidum*. It is a sexually transmitted disease (STD) which is transmitted through sexual intercourse with infected person. Haemophilia is an X-linked genetic disorder of blood, It is not transmitted via any sexual practice. Genital herpes is an STD while sickle-cell anaemia is an autosomal hereditary disorder. The chances of a 5 years old boy contracting an STD are very rare since he is unlikely to have sex at this age. So, the correct answer is 'The chances of a 5-years boy contracting a STD are very rare'.

176(4)

According to Ailen's rule, extremities, tail and ear are relatively shorter in animals living in cooler regions as compared to those inhabiting warmer zones.

177(2)

Reproductive isolation is the prevention of interbreeding between the populations

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of a species present in the different environments. It maintains the characters of the species but also leads to origin of new species (speciation).

178(3)

Ontogeny recapitulates phylogeny, that means the development of an embryo (ontogeny) repeats the evolutionary changes its species took over the millennia to appear in its modern form (phylogeny).

Therefore mammals have also evolved from fishes and amphibians and will go through similar stages of development. All plant and animal cells are not totipotent and stem cells are unspecialized cells as they cannot perform specific function.

179(4)

Dinosaurs dominated in Jurassic period of mesozoic era and were extinct by cretaceous period.

180(1)

Hashish also called charas is extracted from cannabis sativa, it is a hallucinogen, which alters a persons thought.

181(4)

The cell-mediated immunity inside the human body is carried out by T-lymphocytes.

182(4)

Karl Von Frisch, carried out many experiments and determined that when a foraging bee returns to the hive, it performs a waggle dance. Honey is

predominantly glucose and fructose. Dorsata is a bigger bee than Apis indica (a medium sized bee). Bees wax is secreted by special wax glands to make compartments.

183(2)

Bacterial blight of chickpea is caused by bacterium Xanthomonas campestris. The stems and the leaves of infected plant give blighted or burnt up appearance. Control measures includes roguing, 3-year crop rotation, disease-free seeds, spray of copper fungicides (Bordeaux mixture) and antibiotics besides sowing disease resistant varieties.

184(4)

A bollworm is a common term for any larva of a moth that attacks the fruiting bodies of certain crops, especially cotton. B. thuringiensis (commonly known as Bt) is an insecticidal bacterium, marketed worldwide for control of many important plant pests - mainly caterpillars of the Lepidoptera (butterflies and moths) but also mosquito larvae. During sporulation, many Bt strains produce crystal proteins (proteinaceous inclusions), called as endotoxins or cry proteins, that have insecticidal action. This has led to their use as insecticides, and more recently to genetically modified crops using Bt genes

185(4)

The enzyme restriction endonuclease EcoRI is found in the colon bacteria E. coli. So, here 'co' stands for coli. According to nomenclature of restriction enzyme, the first letter used for the

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enzyme is the first letter of the genus name (in italics) of the bacterium, then comes the first two letters of its species (also in italics), next is the strain of the organism. At last is a Roman numeral signifying the order of discovery. Here, the enzyme EcoRI was isolated from the bacterium *Escherichia coli* (co), strain RY13(R) and it was first endonuclease (I) isolated from *E.coli*.

SECTION : B

186(4)

Some characteristics of Bt cotton are high yield and resistance to boll worms. The high yield can be attributed to the resistance against pests.

187(1)

Terrestrial radiation refers to the long-wave electromagnetic radiation originating from Earth and its atmosphere. this radiation is emitted by naturally radioactive materials on Earth including uranium, thorium, and radon. Most of the terrestrial radiation is absorbed by the water vapor in the atmosphere and some by other gases (about 8 percent is radiated directly to outer space). The latitude is responsible for the temperature around the earth and in the earth. Areas that are close to the equator receive more heat than areas that are close to the poles, so it depends on the latitude between these. Insolation is concentrated near the equator but dispersed near the poles, where the distance is responsible. Second reason is that insolation near the poles has to pass through a greater amount of atmosphere

and there is more chance of it being reflected back out to space.

188. (1)

STDs are more common in 15-24 years age group. Gonorrhoea, syphilis, genital herpes, chlamydiasis, genital warts, trichomoniasis, hepatitis-B and AIDS are some of the common STDs. Haemophilia is sex-linked recessive disease, which show its transmission from unaffected carrier female to some of male progeny. Sickle cell anaemia is an autoimmune linked recessive trait in which both the partners are carrier for the gene.

189(3)

Neurotransmitters refer to the chemical messengers that transfer necessary signals from a neuron to a target cell. The specific receptor sites are found in the postsynaptic membrane.

190(4) In Human RBCs, nucleus degenerates during maturation which provide more space for oxygen carrying pigment (Haemoglobin). It lacks most of the cell organelles including mitochondria so respire anaerobically.

191(2)

The development of newer types of organisms from pre-existing ones is called 'evolution.'
Based on his work on evening primrose, Hugo de Vries proposed the idea of mutations.

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According to him, mutations are random and directionless.

He also stated that mutation creates speciation.

Hugo de Vries believed that mutation caused evolution and called it saltation (single-step large mutation).

192(3)

The examples of convergent evolution overlap with those of analogous organs. Analogous organs are the organs of different animals which have different basic structure but perform the same function.

Eye of octopus, bat, and man have the same different structures but serve the same function.

193(1)

Gene therapy was given in 1990 to a four year old girl child with ADA deficiency.

194(4)

ELISA stands for enzyme-linked immuno assay. It is a commonly used laboratory test to detect antibodies in the blood. The QRS represents the simultaneous activation of the right and left ventricles. Allograft is the transplant of an organ or tissue from one individual to another of the same species with a different genotype. Computerized tomography is an X-ray procedure that combines many X-ray images with the aid of a computer to generate three-dimensional images of the internal organs and structures of the body.

195(2)

1. Thymus is located behind the sternum in the front part of the chest.
2. The function of thymus is to boost the immunity of the body by producing T-lymphocytes.
3. Thymus is prone to atrophy and starts to shrink after puberty.

196 (4)

Hypothalamus = GnRH

Acrosome = Sperm lysins

Graafian follicle = Estrogen

Leydig cells = Testosterone

parturition = Relaxin

197. (4)

The diagrammatic cross section of a single loop of human cochlea represents the three

different parts A- Perilymph B- Tectorial membrane C- Endolymph Cochlea arises from sacculus. It is spirally coiled duct.

It is also known as Lagena. It is connected with

sacculus by duct of Reunies.

198 (2)

- Floating Ribs — Do not connect with the sternum
- Acromion—Clavicle
- Scapula — Located between second and seventh ribs
- Glenoid cavity — Head of the Humerus

199(3)

- Inhibitor of catalytic activity — Malonate
- Possess peptide bonds — Collagen

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- Cell wall material in fungi —Chitin
- Secondary metabolite — Ricin

200. (2) Rhizobium is a symbiotic nitrogen fixing bacteria. Streptomyces is

source for streptomycin. Spirulina is a rich source of vitamin B1 and proteins.



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