NEET (UG) 2024

SAMPLE PAPER - 3

Time Allowed: 3 hours and 20 minutes   **Maximum Marks: 720**

General Instructions:

- The test is of 3 hours and 20 minutes and it contains 200 questions. Internal choice is given within the sections.
- 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.

PHYSICS (Section-A)

1. A physical quantity depends upon five factors, all of which have dimensions; then the method of dimensional analysis: **[4]**

    i. can be applied

    ii. cannot be applied

    iii. depends upon factors involved

    iv. both can be applied and depends upon factors involved

    a) iv and i   b) only ii

    c) iii and iv   d) i and ii

2. A hypothetical experiment is conducted to determine Young's formula $Y = \dfrac{\cos \theta T^x \cdot \tau}{l^3}$, **[4]**

    If Y = Young's modulus, T = time period, τ = torque and l = length, then find the value of x:

    a) 3   b) 2

    c) 1   d) 0

3. A police car is travelling in a straight line with a constant speed v. A truck travelling in the same direction with constant velocity 3v/2 passes the police car at t = 0. The police car starts accelerating 10 s after passing the truck, at a constant rate of 3 m/s^2, while the truck continues to move at constant speed. If the police car takes 10 s further to catch the truck, find the value of v. **[4]**

    a) 15 m/s   b) 20 m/s

c) 10 m/s   d) 30 m/s

4. Three vectors A, B, and C add up to zero. Find which is false.   **[4]**

a) $(\vec{A} \times \vec{B}) \times \vec{C}$ is not zero unless $\vec{B}, \vec{C}$ b) $(\vec{A} \times \vec{B}) \cdot \vec{C}$ is not zero unless $\vec{B}, \vec{C}$

are parallel.   are parallel

c) $(\vec{A} \times \vec{B}) \cdot \vec{C} = |\vec{A}||\vec{B}||\vec{C}| \Rightarrow C^2$ d) if $\vec{A}, \vec{B}, \vec{C}$ define a plane,

$= A^2 + B^2$ $(\vec{A} \times \vec{B}) \times \vec{C}$ is in that plane

5. Let $\left|\vec{A_1}\right| = 3$, $\left|\vec{A_2}\right| = 5$ and $\left|\vec{A_1} + \vec{A_2}\right| = 5$. The value of $\left(2\vec{A_1} + 3\vec{A_2}\right) \cdot \left(3\vec{A_1} - 2\vec{A_2}\right)$ **[4]**

is:

a) -106.5   b) -112.5

c) -118.5   d) -99.5

6. A toy car with charge q moves on a frictionless horizontal plane surface under the   **[4]**
    influence of a uniform electric field $\vec{E}$. Due to the force $q\vec{E}$, its velocity increases from 0
    to 6m/s in one-second duration. At that instant, the direction of the field is reversed. The
    car continues to move for two more seconds under the influence of this field. The
    average velocity and the average speed of the toy car between 0 to 3 seconds are
    respectively:

a) 1 m/s, 3 m/s   b) 1.5 m/s, 3 m/s

c) 2 m/s, 4 m/s   d) 1 m/s, 3.5 m/s

7. The potential energy of a long spring when stretched by 2 cm is U. If the same spring is   **[4]**
    stretched by 8 cm the potential energy stored in it is

a) 16 U   b) 8 U

c) $U \over 4$ d) 4 U
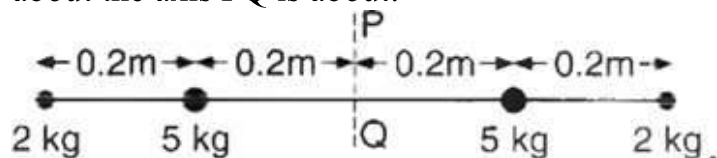
8. A billiard ball moving with a speed of 5 m/s collides with an identical ball, originally at rest. If the first ball stops dead after the collision, then the second ball will move forward with a speed of: **[4]**

   a) 2.5 ms^{-1}

   b) 10 ms^{-1}

   c) 5 ms^{-1}

   d) 1.0 ms^{-1}

9. Four masses are fixed on a massless rod as shown in the figure. The moment of inertia about the axis PQ is about: **[4]**

   a) 0.5 kg-m^2

   b) 0.3 kg-m^2

   c) 2 kg-m^2

   d) 1.04 kg-m^2

10. A particle with position vector $\vec{r}$ has a linear momentum p. Which of the following statements is true in respect of its angular momentum L about the origin? **[4]**

    a) L acts along r

    b) L is maximum when p and r are parallel

    c) L acts along p

    d) L is maximum when p is perpendicular to r

11. A satellite of mass m is orbiting the earth (of radius R) at a height h from its surface. The total energy of the satellite in terms of g_0? the value of acceleration due to gravity at the earth's surface is: **[4]**

    a) $\dfrac{2mg_0R^2}{R, + h}$

    b) $-\dfrac{2mg_0R^2}{R + h}$

    c) $\dfrac{mg_0R^2}{2(R + h)}$

    d) $-\dfrac{mg_0R^2}{2(R + h)}$

12. Which of the following statements is incorrect? **[4]**

   a) Rubber is more elastic than steel.

   b) The stretching of a coil is determined by its shear modulus.

   c) When a material is under tensile stress, the restoring forces are caused by interatomic attraction while under compressional stress; the restoring force is due to interatomic repulsion.

   d) Shearing stress plays an important role in the buckling of shafts.

13. Under steady-state the temperature of a body: **[4]**

   a) Increases with time

   b) Decreases with time

   c) Does not change with time but is different at different cross-sections of the body

   d) Does not change with time and is same at all points of the body

14. A heat source at $T = 10^3$ K is connected to another heat reservoir at $T = 10^2$ K by a copper slab which is 1 m thick. Given that the thermal conductivity of copper is 0.1 $WK^{-1} m^{-1}$, the energy flux through it in the steady state is: **[4]**

   a) $200 \ Wm^{-2}$

   b) $90 \ Wm^{-2}$

   c) $65 \ Wm^{-2}$

   d) $120 \ Wm^{-2}$

15. Which of the following relations is correct between pressure and temperature? **[4]**

   a) $P^\gamma T^{\gamma - 1}$

   b) $P^\gamma T^{1 - \gamma}$

   c) $P^{1 - \gamma} T^\gamma$

   d) $P^\gamma T^\gamma$

16. A vessel is filled with a gas at a pressure of 76 cm of Hg at a certain temperature. The mass of the gas is increased by 50% by introducing more gas in the vessel at the same temperature. The resultant pressure of the gas is: **[4]**

   a) 112 cm of Hg

   b) 114 cm of Hg

   c) 76 cm of Hg

   d) 108 cm of Hg

17. A block of mass 0.1 kg is connected to an elastic spring of spring constant 640 Nm^{-1} and oscillates in a medium of constant 10^{-2} kg s^{-1}. The system dissipates its energy **[4]**

gradually. The time taken for its mechanical energy of vibration to drop to half of its initial value is closest to:

a) 2 s

b) 7 s

c) 5 s

d) 7 s

18. A source of sound is in the shape of a long narrow cylinder radiating sound waves normal to the axis of the cylinder. Two points P and Q are at perpendicular distances of 9 m and 25 m from the axis. The ratio of the amplitudes of the waves at P and Q is: **[4]**

a) 3:5

b) $\sqrt{5}:\sqrt{3}$

c) 25:d

d) 5:3

19. An observer moves towards a stationary source of sound, with a velocity one-fifth of the velocity of sound. What is the percentage increase in the apparent frequency? **[4]**

a) 0

b) 5%

c) 0.5%

d) 20%

20. Three point charges, each +q, are placed at the corners of an equilateral triangle. The electric field at the centre will be: $\left(K = \dfrac{1}{4\pi\varepsilon_0}\right)$ **[4]**

a) $\dfrac{3Kq}{r^2}$

b) zero

c) $\dfrac{3Kq}{2r^2}$

d) $\dfrac{Kq}{r^2}$

21. Assume that an electric field $\vec{E} = 30x^2\,\hat{i}$ exists in space. Then, the potential difference $V_A - V_0$, where V_0 is the potential at the origin and V_A the potential at $x = 2$ m is **[4]**

a) 120 J/C

b) -120 J/C

c) 80 J/C

d) -80 J/C

22. A 40 μF capacitor in a defibrillator is charged to 3000 V. The energy stored in the capacitor is sent through the patient during a pulse of duration 2 ms. The power delivered to the patient is **[4]**

a) 360 kW

b) 90 kW

c) 45 kW

d) 180 kW

23. A copper wire of resistance 10 Ω is in the form of a perfect circle. Two points A and B on it are connected to a battery of emf 5 V and internal resistance 0.5 Ω. The two segments of the circle have lengths in the ratio 2:3. The net magnetic induction at the centre of the circle is: **[4]**

a) 2π

b) Zero

c) π

d) $\dfrac{\mu_0}{4\ \pi}$

24. The mid points of two small magnetic dipoles of length d in end-on positions, are separated by a distance x, (x >> d). The force between them is proportional to x^{-n} where n is: **[4]**
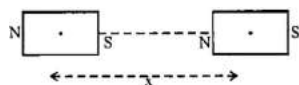
a) 2

b) 4

c) 3

d) 1

25. If a solution of ferromagnetic material is poured into a U-tube and one arm of this tube is placed between the poles of a strong magnet with the meniscus in line with the field, then the level of the solution will: **[4]**

a) remain unchanged

b) rise

c) oscillate slowly

d) fall

26. A wire loop is rotated in a magnetic field. The frequency of change of direction of the induced emf is: **[4]**

i. twice per revolution

ii. four times per revolution

iii. six times per revolution

iv. once per revolution

a) only i

b) ii and i

c) iii and iv

d) iv and i

27. The magnetic flux through a circuit of resistance R changes by an amount $\Delta\phi$ in a time Δt. Then the total quantity of electric charges Q that passes through any point in the circuit during the time Δt is represented by: **[4]**

a) $Q = \dfrac{\Delta\phi}{R}$

b) $Q = \dfrac{\Delta\phi}{\Delta t}$

c) $Q = R\dfrac{\Delta\phi}{\Delta t}$

d) $Q = \dfrac{1}{R} \cdot \dfrac{\Delta\phi}{\Delta t}$

28. A voltage source $V = V_0 \sin(\omega t + \phi)$ is applied to a circuit containing a resistance R capacitance C and inductance in series. The current will be maximum when: **[4]**

a) $\omega^2 = RLC$

b) $\omega^2 = LC$

c) $R = L = C$

d) $\omega L = \dfrac{1}{\omega C}$

29. A point source of electromagnetic radiation has an average power output of 1500 W. The maximum value of electric field at a distance of 3 m from this source (in Vm^{-1}) is: **[4]**

a) 500

b) $\dfrac{500}{3}$

c) 250

$\overline{3}$

d) 100

30. Two glass prisms P_1 and P_2 are to be combined together to produce dispersion without deviation. The angles of the prisms P_1 and P_2 are selected as 4° and 3° respectively. If the refractive index of prism P_1 is 1.54, then refractive index of P_2 will be: **[4]**

   a) 1.72

   b) 1.58

   c) 1.62

   d) 1.48

31. Monochromatic light of wavelength 589 nm is incident from air on a water surface. The refractive index of water is 1.33. The wavelength of the refracted light is: **[4]**

   a) 589 nm

   b) 333 nm

   c) 443 nm

   d) 221 nm

   o **[4]**

32. De-Broglie wavelength of an electron is 10 A then velocity will be:

   a) 7.2×10^6 m/s

   b) 7.2×10^7 m/s

   c) 7.2×10^5 m/s

   d) 7.2×10^4 m/s

33. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled? **[4]**

   a) Four times

   b) Zero

   c) Doubled

   d) One -fourth

34. In the hydrogen atom, an electron is moving in the nth orbit. The circumference S of the orbit and the de Broglie wavelength λ of the moving electron are related by the equation: **[4]**

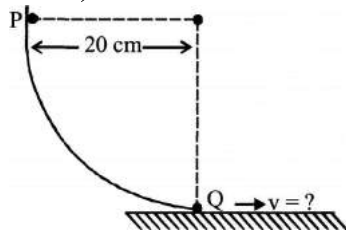   (Where n is a whole number)

   a) S = nh

   b) S = nλ

   c) Snh = 1

d)
$$S = \frac{h}{n}$$

35. For radioactive material, the half-life is 10 minutes. If initially there are 600 number of **[4]** nuclei, the time taken (in minutes) for the disintegration of 450 nuclei is:

    a) 30   b) 20

    c) 10   d) 15

PHYSICS (Section-B)
Attempt any 10 questions

36. As per the given figure, a small ball P slides down the quadrant of a circle and hits the **[4]** other ball Q of equal mass which is initially at rest. Neglecting the effect of friction and assume the collision to be elastic, the velocity of ball Q after collision will be: (g = 10 m/s^2)

    a) 0.25 m/s   b) 4 m/s

    c) 0   d) 2 m/s

37. A circular disc of radius b has a hole of radius a at its centre (see figure). If the mass per **[4]** unit area of the disc varies as $\left(\dfrac{\sigma_0}{r}\right)$, then the radius of gyration of the disc about its axis passing through the centre is
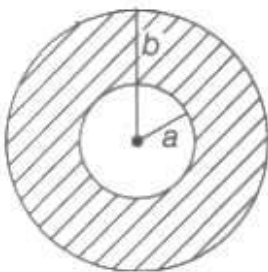
a) $a + b \over 3$

b) $\sqrt{a^2 + b^2 + ab \over 2}$

c) $\sqrt{a^2 + b^2 + ab \over 3}$

d) $a + b \over 2$

38. The height at which the acceleration due to gravity decreases by 36 % of its value on the surface of the earth is: (Assume the radius of the earth is R)   **[4]**

a) $R \over 2$

b) 4 R

c) $R \over 6$

d) $R \over 4$

39. The study of physical phenomenon at low temperatures (below liquid nitrogen temperature) is called: **[4]**

a) radiation

b) refrigeration

c) pyrometry

d) cryogenics

40. What is the effect of humidity on sound waves when humidity increases?   **[4]**

a) Speed of sound waves is more

b) Speed of sound waves is less

c) Speed of sound waves becomes zero

d) Speed of sound waves remains same

41. Speed of sound wave is v. If a reflector moves towards a stationary source emitting waves of frequency f with speed u, the wavelength of reflected wave will be: **[4]**

a) $\left(\dfrac{v + u}{v - u}\right)f$

b) $\left(\dfrac{v - u}{v + u}\right)f$

c) $\left(\dfrac{v + u}{v}\right)f$

d) $\left(\dfrac{v - u}{v}\right)f$

42. Symmetric star-shaped conducting wire loop is carrying a steady-state current I as shown in the figure. The distance between the diametrically opposite vertices of the star is 4a. The magnitude of the magnetic field at the centre of the loop is: **[4]**
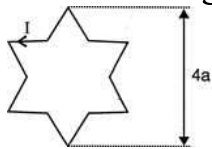
a) $\dfrac{\mu_0 I}{4\pi a}6[\sqrt{3} + 1]$

b) $\dfrac{\mu_0 I}{4\pi a}6[\sqrt{3} - 1]$

c) $\dfrac{\mu_0 I}{4\pi a}3[2 - \sqrt{3}]$

d) $\dfrac{\mu_0 I}{4\pi a}3[\sqrt{3} - 1]$

43. A paramagnetic sample shows a net magnetisation of 8 Am^{-1} when placed in an external magnetic field of 0.6 Tesla at a temperature of 4K. When the same sample is placed in an external magnetic field of 0.2 Tesla at a temperature of 16K, the magnetisation will be: **[4]**

a) 6 Am^{-1}

b) $\dfrac{2}{3}$ Am^{-1}

c) 2.4 Am^{-1}

d) $\dfrac{32}{3}$ Am^{-1}

44. Which of the following is not an application of eddy currents? **[4]**

i. Induction furnace

ii. Galvanometer damping

iii. Crystallography

iv. Speedometer of automobiles

a) iv and i   b) ii and ii

c) i and ii   d) only iii

45.   In a series L-C-R circuit R = 200Ω and the voltage and the frequency of the main   **[4]**
supply is 220 V and 50 Hz respectively. On taking out the capacitance from the circuit
the current lags behind the voltage by 30°. On taking out the inductor from the circuit
the current leads the voltage by 30°. The power dissipated in the L-C-R circuit is:

a) 305 W   b) zero

c) 242 W   d) 210 W

46.   A transparent solid cylinder rod has a refractive index of $\dfrac{2}{\sqrt{3}}$. It is surrounded by air. A   **[4]**

light ray is incident at the mid-point of one end of the rod as shown in the figure. The
incident angel θ for which the light ray grazes along the wall of the rod is:
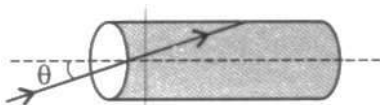
a) $\sin^{-1}\left(\dfrac{\sqrt{3}}{2}\right)$ b) $\sin^{-1}\left(\dfrac{1}{\sqrt{3}}\right)$

c) $\sin^{-1}\left(\dfrac{1}{2}\right)$ d) $\sin^{-1}\left(\dfrac{2}{\sqrt{3}}\right)$

47.   In a laboratory four convex lenses L_1, L_2, L_3 and L_4 of focal lengths 2, 4, 6 and 8 cm,   **[4]**
respectively are available. Two of these lenses form a telescope of length 10 cm and
magnifying power 4. The objective and eye-lenses are respectively:

a) L_1, L_4 b) L_1, L_2

c) L_2, L_3 d) L_4, L_1

48. A proton and an α-particle are accelerated through the same potential differences. The ratio of their de Broglie wavelengths $\dfrac{\lambda_p}{\lambda_\alpha}$ is: **[4]**

a) 1 b) $\dfrac{1}{\sqrt{8}}$

c) $\sqrt{8}$ d) 2

49. For an explanation of Bohr's theory, Bohr used which of the following principles? **[4]**

a) Conservation of linear momentum b) Conservation of energy

c) Conservation of moment of inertia d) Conservation of angular momentum

50. Tritium with a half-life of 12.5 years undergoing beta decay. What fraction of a sample of pure tritium will remain undecayed after 25 years? **[4]**

a) Two third b) one half

c) one fourth d) one third

CHEMISTRY (Section-A)

51. Which equation represents charge balance equation for a solution of H_2S in water? **[4]**

a) $[H^+] = [S^{2-}] + [HS^-] + [OH^-]$ b) $[H^+] = [S^{2-}] + [HS^-] + [H^+]$

c) $[H^+] = 2[S^{2-}] + [HS^-] + [OH^-]$ d) $[H^+] = [OH^-]$

52. If uncertainty in the position of a particle (Δx) is _____, the uncertainty in momentum (Δp) would be _____. **[4]**

a) large, large b) small, large

c) small, small d) large, infinite

53. The right order of ionization potential of Li, Be, B and C is: **[4]**

a) $C > B > Li > Be$ b) $C > Be > B > Li$

c) $C > B > Be > Li$ d) $B > C > Be > Li$

54. The compounds C_3H_8, CH_3CH_2OH and CH_3OCH_3 have very similar molar masses. **[4]** When they are arranged in order of increasing strength of their intermolecular forces, what is the **correct** order?
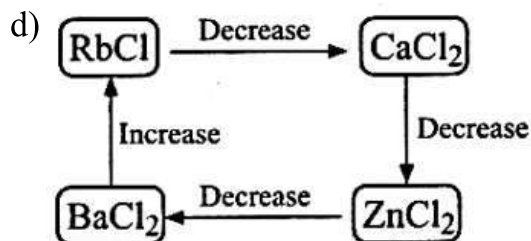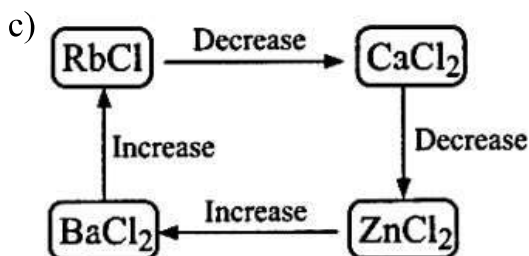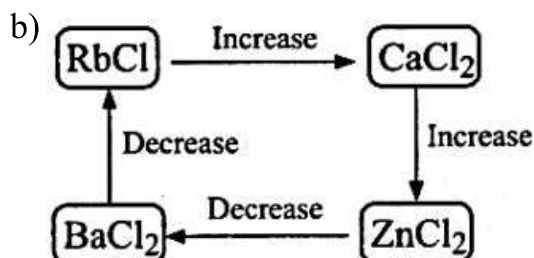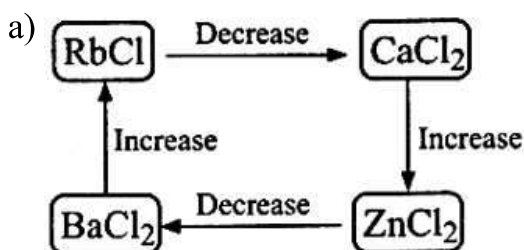
a) C_3H_8, CH_3OCH_3, CH_3CH_2OH b) CH_3CH_2OH, CH_3OCH_3, C_3H_8

c) CH_3OCH_3, C_3H_8, CH_3CH_9OH d) CH_3CH_2OH, C_3H_8, CH_3OCH_3

55. Which of the following diagram show **CORRECT** change in the ionic character of **[4]** given compounds according to Fajans rule?

56. Strongest hydrogen bond is shown by: **[4]**

a) hydrogen sulphide b) ammonia

c) water d) hydrogen fluoride

57. One mole of a non-ideal gas undergoes a change of state (2.0 atm, 3.0 L, 95 K) $\rightarrow$ **[4]** (4.0 atm, 5.0 L, 245 K) with a change in internal energy, $\Delta E = 30.0$ L-atm The change in enthalpy (ΔH) of the process in L-atm is

a) 44.0

b) 42.0

c) 40.0

d) not defined, because pressure is not constant

58. Which of the following conditions is correct for the $[OH^-]$ of either weak or strong monoacidic base? **[4]**

a) $[OH^-] = c_b$, if $(pK_b + 1) < pc_b$

b) $[OH^-] = \frac{1}{2} \left[-K_b + \sqrt{K_b^2 + 4K_b \cdot c_b} \right]$, if $(pK_b - 2) < pK_b < (pK_b + 1)$

c) $[OH^-] = \sqrt{K_b \cdot c_b}$, if $pc_b < (pK_b - 2)$

d) $[OH^-] = c_b$, if $pK_b + 1 > pc_b$

59. Hydrogen peroxide in its reaction with KIO_4 and NH_2OH respectively is acting as a: **[4]**

    i. reducing agent, oxidising agent

    ii. reducing agent, reducing agent

    iii. oxidising agent, oxidising agent

    iv. oxidising agent, reducing agent

a) iv and i

b) only i

c) iii and iv

d) ii and iii

60. Given, that $E^{\ominus}_{O_2/H_2O} = +1.23V$; **[4]**

$E^{\ominus}_{S_2O_8^{2-}/SO_4^{2-}} = 2.05V$;

$E^{\ominus}_{Br_2/Br^-} = +1.09V$;

$E^{\ominus}_{Au^{3+}/Au} = +1.4V$

The strongest oxidising agent is

a) O_2

b) Au^{3+}

c) $S_2O_8^{2-}$

d) Br_2
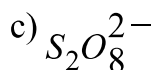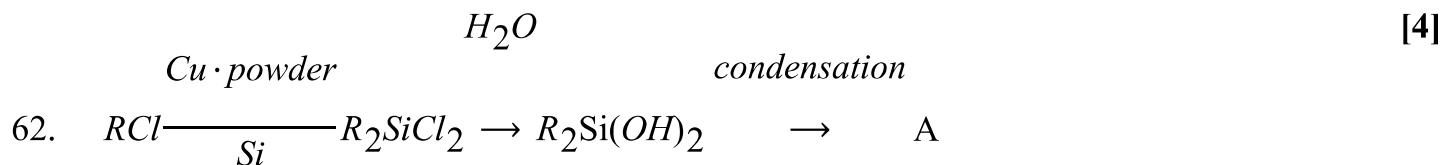
61. Select the name of mineral which is used for the production of boric acid. **[4]**

    a) Calamine

    b) Chromite

    c) Colemanite

    d) Chalcopyrite

[4]

62. $RCl \xrightarrow[Si]{Cu \cdot powder} R_2SiCl_2 \xrightarrow{H_2O} R_2Si(OH)_2 \xrightarrow{condensation} A$
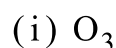
Compound (A) is:

    a) a linear silane

    b) a chlorosilane

    c) a linear silicone

    d) a network silane

63. The correct stability order of the following resonance structures is: **[4]**

$$\overset{\oplus}{H_2C}=N=\overset{\ominus}{N} \quad \overset{\oplus}{H_2C}-N\equiv\overset{\ominus}{N} \quad \overset{\ominus}{H_2C}-N\equiv\overset{\oplus}{N} \quad \overset{\ominus}{H_2C}-N=\overset{\oplus}{N}$$
$$\text{(I)} \qquad\qquad \text{(II)} \qquad\qquad \text{(III)} \qquad\qquad \text{(IV)}$$

    a) II > I > III > IV

    b) I > III > II > IV

    c) III > I > IV > II

    d) I > II > IV > III

64. 2 − hexene $\xrightarrow[\text{(ii) } H_2O]{\text{(i) } O_3}$ Products **[4]**
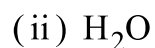
The two products formed in above reaction are-
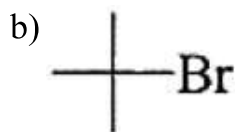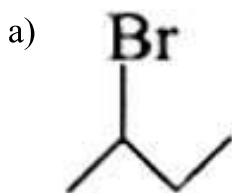
    a) Butanal and acetic acid

    b) Butanal and acetaldehyde

    c) Butanoic acid and acetic acid

    d) Butanoic acid and acetaldehyde

65. Formation of free radical takes place with absorption of minimum energy in the formation of **[4]**

a) Br

b) Br

c) Br

d) Br

66. If liquids A and B form an ideal solution: **[4]**

    a) the enthalpy of mixing is zero

    b) the free energy as well as the entropy of mixing are each zero

    c) the entropy of mixing is zero

    d) the free energy of mixing is zero

67. The amount of ice that will separate out on cooling a solution containing 50 g of ethylene glycol in 200 g water to -9.3°C is: $(K_f'=1.86$ K molality$^{-1})$ **[4]**

    a) 42 g

    b) 38.71 mg

    c) 38.71 g

    d) 42 mg

68. For the cell reaction, **[4]**

$$2Fe^{3+}(aq) + 2I^-(aq) \rightarrow 2Fe^{2+}_{(aq)} + I_2(aq)$$
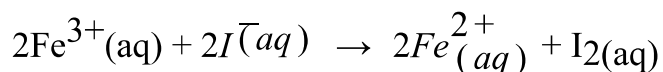
$E^o_{cell} = 0.24$ V at 298 K. The standard Gibbs energy $(\Delta_r G^o)$ of the cell reaction is

_____.

[Given that Faraday constant F = 96500 C mol^{-1}]

    a) 23.16 kJ mol^{-1}

    b) -23.16 kJ mol^{-1}

    c) 46.32 kJ mol^{-1}

    d) -46.32 kJ mol^{-1}

69. The value of rate constant of a pseudo first-order reaction: **[4]**

    a) is independent of the concentration of reactants

    b) depends on the concentration of reactants present in excess

    c) depends on the concentration of reactants present in small amount

    d) depends only on temperature

70. The half-life for a zero order reaction having 0.02 M initial concentration of reactant is **[4]** 100 s. The rate constant (in $mol\ L^{-1}\ s^{-1}$) for the reaction is:
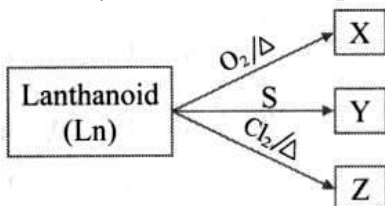
   a) 1.0×10^{-4}

   b) 2.0×10^{-4}

   c) 1.0×10^{-2}

   d) 2.0×10^{-3}

71. Identify X, Y and Z respectively. **[4]**

   a) Ln_2O_3, LnS, $LnCl_3$

   b) Ln_2O_3, Ln_2S_3, $LnCl_3$

   c) LnO_2, Ln_2S_3, $LnCl_2$

   d) $Ln(OH)_3$, LnS, $LnCl_3$

72. Which of the following has property of phosphorescence? **[4]**

   a) Black phosphorus

   b) Red phosphorus

   c) Bone ash

   d) White phosphorus

73. In zinc, find the number of electrons with spin quantum number $= \dfrac{1}{2}$. **[4]**

   a) 15

   b) 30

   c) 10

   d) 20

74. Which one of the following is expected to exhibit optical isomerism? (en = **[4]** ethylenediamine)

   a) cis-[Pt(NH$_3$)$_2$Cl$_2$]

   b) trans-[Pt(NH$_3$)$_2$Cl$_2$]

   c) trans-[Co(en)$_2$Cl$_2$]$^+$

   d) cis-[Co(en)$_2$Cl$_2$]$^+$

75. The Crystal Field Stabilization Energy (CFSE) for $[CoCl_6]^{4-}$ is 18000 cm^{-1}. The CFSE **[4]** for $[CoCl_4]^{2-}$ will be _____.

a) 16000 cm^{-1} b) 6000 cm^{-1}

c) 18000 cm^{-1} d) 8000 cm^{-1}

76. Benzene reacts with n-propyl chloride in the presence of anhydrous $AlCl_3$ to give: **[4]**
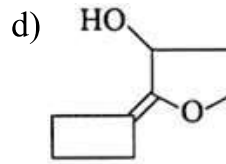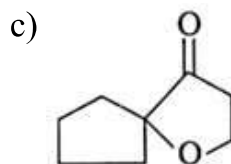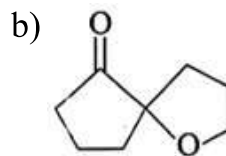
   a) 3-propyl-I-chlorobenzene b) isopropyl benzene

   c) n-propyl benzene d) no reaction

[4]

77.

$\xrightarrow{H^{\oplus}}$ Product

a)

b)

c)

d)
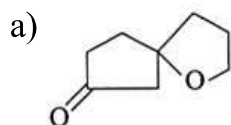
78. Arrange the following compounds in decreasing order of nucleophilic addition reaction: **[4]**
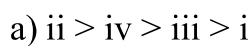
i. $H - \overset{\overset{\displaystyle O}{\|}}{C} - H$

ii. $H_3C - \overset{\overset{\displaystyle O}{\|}}{C} - H$

iii. $H_3C - \overset{\overset{\displaystyle O}{\overset{\displaystyle ||}{}}}{C} - CH_3$

iv.

   a) ii > iv > iii > i   b) iv > iii > ii > i

   c) i > ii > iii > iv   d) ii > iii > iv > i
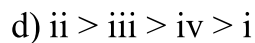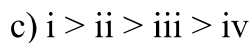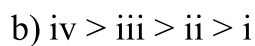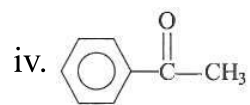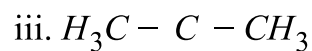
79.   The final product in the following reaction sequence is _____.   **[4]**

$$\underset{\Delta}{\overset{NaN_3 + conc.\ H_2SO_4}{\longrightarrow}} \quad A \quad \underset{0-5\,°C}{\overset{NaNO_2 + dil.HCl}{\longrightarrow}} \quad B \overset{H_2O}{\longrightarrow} C$$

   a)   b)

   c)   d)
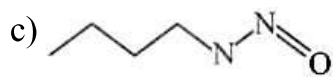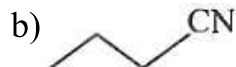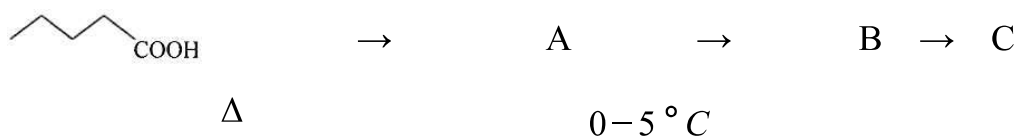
80.   The number of glycosidic linkages in linear decasaccharide is _____.   **[4]**

   a) 8   b) 10

   c) 9   d) 20

81.   Given the amino acids, identify essential amino acids.   **[4]**
   i. Isoleucine
   ii. Tryptophan
   iii. Serine
   iv. Lysine
   v. Glutamine
   vi. Methionine

   a) i, ii, iv, v and vi   b) i, ii, iv and vi

   c) i, iii, v and vi   d) i, ii and v

82. Which of the following statements is not correct? [4]

A. Primary amines show intermolecular hydrogen bonding.

B. Secondary amines show intermolecular hydrogen bonding.

C. Tertiary amines show intermolecular hydrogen bonding.

D. Amines have lower boiling points as compared to those of alcohols and carboxylic acids of comparable molar masses.

a) Only C
b) Only D

c) Only A
d) Only B

83. The standard reduction potential for the following half-cell reaction is 0.82 V: [4]

$$NO_3^-(aq) + 2H^+(aq) + e^- \rightarrow NO_{2(g)} + H_2O_{(l)}$$

What will be the reduction potential of the half cell in a neutral solution? Assume all the other species have unit concentration and temperature is 298 K.

a) -0.0272 V
b) -0.421 V

c) 0.826 V
d) -0.0474 V

84. The technique of gas chromatography is suitable for compounds which [4]

a) are soluble in water
b) vapourize without decomposition

c) are liquids
d) have very low boiling points

85. Compound (A) Cl_2H_2O, discharges the colour of Br_2-H_2O and cold $KMnO_4$. On reduction with H_2/Pt it gives compound (B) $C_{12}H_{22}$. A on ozonolysis give cyclohexanone. Find structure of A: [4]

a) None of these
b)

c)

d)

CHEMISTRY (Section-B)
Attempt any 10 questions

86. Decreasing order of the hydrogen bonding in following forms of water is correctly represented by [4]

A. Liquid water

B. Ice

C. Impure water

    a) A > B > C   b) B > A > C

    c) A = B > C   d) C > B > A

87.   Oxidation number of oxygen in KO_3, KO_2 and K_2O is: **[4]**
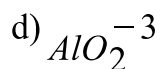
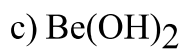   a) $-\dfrac{1}{3}, -\dfrac{1}{2}, -\dfrac{1}{2}$ b) -2, -2, -2

    c) -1, - 1, -1   d) $-\dfrac{1}{3}, -\dfrac{1}{2}, -1$

88.   Aluminium hydroxide is soluble in excess of sodium hydroxide forming the ion: **[4]**

    a) AlO_2^- b) AlO_3^-

    c) $Be(OH)_2$ d) AlO_2^{-3}

89.   The order of basic strength of given oxide: **[4]**
A. $Na_2O > MgO > Al_2O_3 > CuO$

B. $MgO > Al_2O_3 > CuO > Na_2O$

C. $Al_2O_3 > MgO > CuO > Na_2O$

D. $CuO > Na_2O > MgO > Al_2O_3$
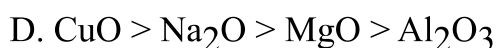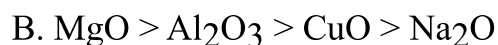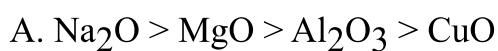
    a) D only   b) C only

    c) B only   d) A only

90.   Given is a table of work function (ϕ) of some metals. How many metals will show photoelectric effect when 300 nm light is incident on the metal?   **[4]**

Metal	ϕ (ev)
Li	2.4
Na	2.3
K	2.2

Mg	3.7
Cu	4.8
Ag	4.3
Fe	4.7
Pt	6.3
W	4.75

a) 3

b) 2

c) 4

d) 1

91. Which of the following oxide is amphoteric in nature? **[4]**

a) SiO_2

b) SnO_2

c) CO_2

d) GeO_2

92. For a hypothetical reaction, $aA + bB \rightarrow$ product, the rate law is $r = k[A]^x [B]^y$ then: **[4]**

a) $\{a + b) < (x + y)$

b) $(a + b) = (x + y)$

c) $(a + b) > (x + y)$

d) $(a + b)$ may or may not be equal to $(x + y)$

93. Given: $A^+(aq.) + e \rightleftharpoons A(s)$ $E^O = E\mathring{A}_1$ ...(1) **[4]**

$A^{2+}(aq.) + 2e \rightleftharpoons A(s)$ $E^O = E\mathring{A}_2$ ...(2)

If K_1 and K_2 are equilibrium constant for reaction (1) and (2) respectively, then $\log_{10} \dfrac{K_2}{K_1}$ can be given by:

a) $\dfrac{2E\mathring{A}_2 - E\mathring{A}_1}{0.059}$

b) $0.059\left[E\mathring{A}_2 - E\mathring{A}_1\right]$

c) $$\frac{\left(E\mathring{A}_2 - E^0_{A_1}\right)}{0.059}$$

d) $$\frac{2\left(E^0_{A_2} - E\mathring{A}_1\right)}{0.059}$$

94. The most convenient method to protect the bottom of the ship made of iron is   **[4]**

    a) connecting it with Pb block   b) coating it with red lead oxide

    c) connecting it with Mg block   d) white tin plating

95. Which one of the given statement for order of the reaction is not correct?   **[4]**

    a) Order of reaction is equal to sum of the powers of concentration terms in differential rate law   b) Order cannot be fractional

    c) Order can be determined experimentally   d) It is not affected with the stoichiometric coefficient of reactant

96. The species having pyramidal shape is: **[4]**

    a) BrF_5 b) OSF_2

    c) SrO_3^{2-} d) SO_3

97. Match the oxide given in column A with its property given in column B.   **[4]**

Column-A	Column-B
i. Na_2O	a. Neutral
ii. Al_2O_3	b. Basic
iii. N_2O	c. Acidic
iv. Cl_2O_7	d. Amphoteric

Which of the following options has all correct pairs?

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

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

98. Identify the INCORRECT statement regarding 3d transition series.   **[4]**

a) The strength of metallic bonds increases from Sc to Cr and then it decreases.

b) The number of oxidation states increases from Sc to Mn and then decreases from Fe to Zn.

c) The second ionization enthalpy of Cr is high because of the stable d^5 configuration.

d) The first ionization enthalpy decreases from Sc to Zn as the atomic number increases.
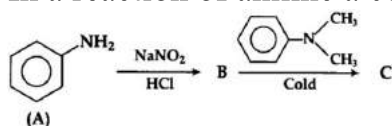
99. Which of the following will show geometrical isomerism? **[4]**

a) Square planar complexes having unsymmetrical bidentate ligands

b) Tetrahedral complexes having general formula Ma_4

c) Square planar complexes having general formula Ma_3b

d) Octahedral complexes having general formula Ma_5b

100. In a reaction of aniline a coloured product C was obtained. **[4]**

The structure of C would be:

a)

b)

c)

d)

BOTANY (Section-A)

101. The suffix - inae signifies the rank : **[4]**

a) Subfamily

b) Subtribe

c) Suborder

d) Tribe

102. Which statement is wrong for growth? **[4]**

a) Growth exhibited by living organisms from inside

b) Increase in body mass is considered as growth

c) Non-living objects also grow if we take increase in body mass as a criterion for growth

d) Non-living objects is also grow by accumulation of material from inside

103. Which of the following are the characters of dinoflagellates? **[4]**

   i. They are planktonic golden yellow algae with soap box like structure.
   ii. They are marine red biflagellated protista.
   iii. They appear yellow, green, brown, blue and red in colour.
   iv. They are uniflagellate organisms with pellicle.
   v. They are saprophytic (or) parasitic unicellular forms.

   a) (ii), (iv) and (v)   b) (i), (ii) and (iii)

   c) (ii) and (iii)   d) (ii) and (v)

104. Which of the following is correct for kingdom fungi? **[4]**

   a) Eukaryotic cell type   b) Nuclear membrane present

   c) Non-cellulosic cell wall present   d) All of these

105. Self-pollination can be prevented by **[4]**

   a) Both micropyle and dioecy   b) dioecy

   c) cleistogamy   d) production of bisexual flowers.

106. The system of classification based on the floral structure, root modification and leaf venation etc., is called as: **[4]**

   a) Artificial system   b) Both Artificial system and Arbitary system

   c) Natural system   d) Arbitary system

107. Match the entities in column I with their character in column II: **[4]**

Column I	Column II
(a) Ulothrix	(i) Unicellular
(b) Kelps	(ii) Colonial
(c) Chlamydomonas	(iii) Filamentous
(d) Volvox	(iv) Massive plant bodies

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

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

108. The pollen grain is related to the embryo sac as **[4]**

| a) male gametophyte is to female gametophyte. | b) sperm is to egg. |
| c) male gametophyte is to egg. | d) sperm is to the female gametophyte. |

109. Parthenocarpic tomato fruits can be produced by **[4]**

| a) treating the plants with low concentrations of gibberellic acid and auxins. | b) removing androecium of flowers before pollen grains are released. |
| c) raising the plants from vernalised seeds. | d) treating the plants with phenylmercuric acetate. |

110. False septum found in: **[4]**

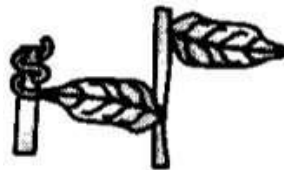| a) Mustard | b) Argemone |
| c) Primrose | d) Both Mustard and Argemone |

111. Different parts of a leaf are modified into tendrils which help the plant in climbing up. Identify the type of tendril that is seen in Clematis. **[4]**

a) tendril in smilax

b)

c)

d)

112. As compared to a dicot root, a monocot root has: **[4]**
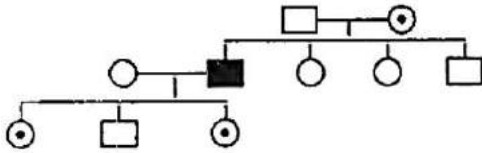
| a) More abundant secondary xylem | b) Relatively thicker periderm |
| c) Many xylem bundles | d) Inconspicuous annual rings |

113. Predict from the following chart: **[4]**

A. Sickle-cell anaemia
B. Phenyl ketonuria
C. Colour blindness
D. Polydactyle

a) (C)   b) (D)

c) (A)   d) (B)

114. In sickle-cell anaemia glutamic acid is replaced by valine. Which one of the following **[4]** triplets codes for valine?

a) AAG   b) GUG

c) GAA   d) GGG

115. What effect would you expect if gene expression of the lac operon was completely **[4]** repressed?

a) Both (Allolactose would accumulate within the cell and become toxic) and (Lactose would not be converted into the inducer and the operon could not be induced.)

b) Allolactose would accumulate within the cell and become toxic.

c) Lactose would not be converted into the inducer and the operon could not be induced.

d) The cell would be more efficient without 'wasting' the energy required for the low level of lac z, lac y, and lac a gene expression.

116. Choose the correct option for 1,2,3, and 4: **[4]**
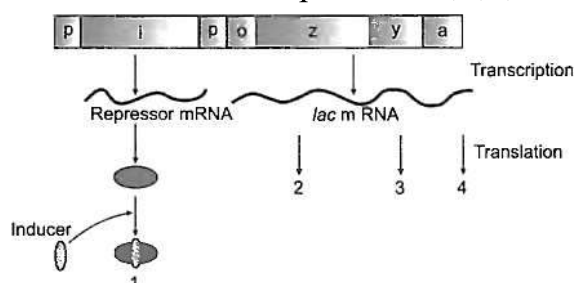
a) 1-Inactive repressor, 2-Transacetylase, 3-Permease, 4-β-Galactosidase,

b) 1-Inactive repressor, 2-β-Galactosidase, 3-Permease, 4-Transacetylase

c) 1-β-Galactosidase, 2-Inactive repressor, 3-Permease, 4-Transacetylase

d) 1-Inactive repressor, 2-Permease, 3-Transacetylase, 4-β-Galactosidase,

117. Which of the following statements about endoplasmic reticulum is true? **[4]**

   i. ER divides the intracellular space into two distinct compartments, i.e., luminal (inside ER) and extraluminal (cytoplasm) compartments.

   ii. The endoplasmic reticulum bearing ribosomes on their surface is called rough endoplasmic reticulum (RER).

   iii. The smooth endoplasmic reticulum (SER) is frequently observed in the cells actively involved in protein synthesis and secretion.

   iv. ER is extensive and continuous with the outer membrane of the nucleus.

   v. Rough endoplasmic reticulum (RER) is the major site for synthesis of lipid.

   vi. In animal cells lipid-like steroidal hormones are synthesised in SER.

   a) (i), (iii), (iv) and (v)

   b) (i), (ii), (iv) and (vi)

   c) (iii) and (v)

   d) (iii), (iv) and (v)

118. How many statements are correct for cell wall? **[4]**

   i. Cell wall of algae made of cellulose, galactans, mannans and minerals like calcium carbonate.

   ii. In other plants cell wall consists of cebulose, hemicellulose, pectins and proteins.

   iii. The primary wall gradually diminishes as the cell matures and the secondary wall is formed.

   iv. The middle lamella is a layer mainly of sodium pectate which holds or glues the different neighbouring cells together.

   v. The cell wall and middle lamellae may be traversed by plasmodesmata which connect the cytoplasm of neighbouring cells.

   a) Four

   b) One

   c) Two

   d) Three

119. Asthma may be attributed to: **[4]**

   a) Allergic reaction of the mast cells in the lungs

   b) Accumulation of fluid in lungs

c) Inflammation of trachea   d) Bacterial infection of the lungs

120. Which of the following is a carrier of dengue fever? **[4]**

     a) Aedes   b) Culex

     c) Musca   d) Anopheles

121. Match the following columns and select the correct option: **[4]**

Column-I	Column-II
(A) Smooth endoplasmic reticulum	(i) Protein synthesis
(B) Rough endoplasmic reticulum	(ii) Lipid synthesis
(C) Golgi complex	(iii) Glycosylation
(D) Centriole	(iv) Spindle formation

     a) (A) - (iv), (B) - (ii), (C) - (i), (D) - (iii)
     b) (A) - (ii), (B) - (i), (C) - (iii), (D) - (iv)

     c) (A) - (i), (B) - (ii), (C) - (iii), (D) - (iv)
     d) (A) - (iii), (B) - (i), (C) - (ii), (D) - (iv)

122. Maximum trees are present in: **[4]**

     a) Tropical rain forest   b) Savannah

     c) Evergreen forest   d) Deciduous forest

123. Primary productivity is **[4]**

     a) the rate of formation of new organic matter by consumers.
     b) total biomass of the photosynthetic organisms in the ecosystem.

     c) the rate of conversion of light into chemical energy in an ecosystem.
     d) the rate of energy production per unit area over a time period by consumers.

124. The most common substrate used in distilleries for the production of ethanol is: **[4]**

     a) Soya meal   b) Com meal

     c) Ground gram   d) Molasses

125. Nandan Kanan zoo is famous for: **[4]**

a) Hippo   b) White Tiger

c) Whale   d) Nilgiri Tahr

126. Which of the following is not a step in understanding biodiversity?   **[4]**

    a) Naming the species   b) Quantifying the species genome

    c) Looking at other related species   d) Assessing the species geographic range

127. Which of the following boxes show maximum, greater and minimum diversity?   **[4]**

Animals	Species	Members
Bird	I	1
Bird	II	1
Bird	III	4

A

Animals	Species	Members
Bird	I	2
Bird	II	2
Mammal	III	2

B

Animals	Species	Members
Bird	I	2
Mammal	II	2
Insect	III	2

C

    a) A - Maximum diversity, B - Minimum diversity, C - Greater diversity

    b) A - Minimum diversity, B - Maximum diversity, C - Greater diversity.

    c) A - Maximum diversity, B - Greater diversity, C - Minimum diversity

    d) A - Minimum diversity, B - Greater diversity, C - Maximum diversity

128. Select the correct option with respect to mitosis   **[4]**

    a. Chromosomes move to the spindle equator and get aligned along the equatorial plate in metaphase

    b. Chromatids separate but remain in the centre of the cell in anaphase

    c. Chromatids start moving towards opposite poles in telophase.

    d. Golgi complex and endoplasmic reticulum are still visible at the end of prophase.

    a) Statement (d) is correct.   b) Statement (b) is correct.

    c) Statement (a) is correct.   d) Statement (c) is correct.

129. Which stage begins with the simultaneous splitting of the centromere of each chromosome, allowing them to move toward opposite poles of the cell?   **[4]**

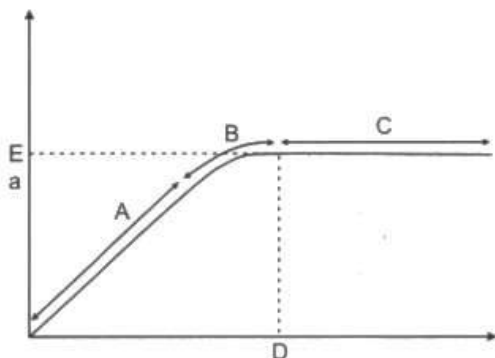   a) Anaphase - II   b) Telophase - I

    c) Telophase - II   d) Anaphase - I

130. Which pair is wrong? **[4]**

    a) Hatch and Slack cycle $\rightarrow$ OAA   b) Calvin cycle $\rightarrow$ PGA

    c) C_4-Kranz anatomy   d) C_3-Maize

131. This graph represents _____ and 'a' represents: **[4]**

    a) Effect of light intensity on photosynthesis-rate of photosynthesis   b) Effect of light intensity on respiration-rate of photosynthesis

    c) All are correct   d) Effect of O_2 on rate of photosynthesis-rate of photosynthesis

132. Which one of the following is not a limiting factor for photosynthesis? **[4]**

    a) Carbon dioxide   b) Oxygen

    c) Chlorophyll   d) Light

133. The oxygen-evolving complex has **[4]**

    a) Mn, Mg, Ca, and CI ions.   b) Mn, Cl, and Ca ions.

    c) Mg, Ca, and Cl ions.   d) Mn, Mg, and Ca ions

134. Choose the correct combination of respiratory substrates and their respective RQs. **[4]**

	Carbohydrate	Fat	Protein
(a)	2	1	1
(b)	0	1	1
(c)	1	0.7	0.9
(d)	1	0.9	0.7

a) Only D   b) Only A

c) Only C   d) Only B

135. Which of the following conditions will restrict the growth of lateral buds in the presence **[4]** of apical bud in the process of apical dominance?

a) More amount of cytokinins in lateral buds.

b) Less amount of cytokinins in lateral buds.

c) Less amount of auxin in apical bud.

d) More amount of auxin in apical bud.

BOTANY (Section-B)
Attempt any 10 questions

136. Which one is the exclusive characteristic of a living organism? **[4]**

a) Increase in mass from inside

b) Isolated metabolic reaction occuring in vitro.

c) Increase in mass both from outside and inside

d) Perception of events happening in the environment and their memory

137. Animal viruses usually have: **[4]**

a) DNA

b) DNA and RNA

c) DNA or RNA

d) RNA

138. Which of the following algae contains mannitol as reserve food material? **[4]**

a) Volvox

b) Gracilaria

c) Ulothrix

d) Ectocarpus

139. An ovule which becomes curved so that the nucellus and embryo sac lie at right angles **[4]** to the funicle is:

a) Orthotropous

b) Campylotropous

c) Anatropous

d) Hemitropous

140. Seeds are adaptively important because **[4]**

i. they maintain dormancy.

ii. they protect young plants during vulnerable stages.

iii. they store food for young plants and facilitate dispersal.

a) (i) and (ii)   b) All of these

c) (i) and (iii)   d) (ii) and (iii)

141. If an albino man marries with a normal woman and 50% offsprings are albino and 50% are normal the woman is: **[4]**

a) Hemizygous normal   b) Homozygous

c) Homozygous normal   d) Heterozygous carrier

142. Initiation codon in eukaryotes is: **[4]**

a) GUG   b) AGU

c) UAG   d) AUG

143. What is the main function of cytoplasm in a cell? **[4]**

a) Regulating the transport of molecules into and out of cell.   b) Protein synthesis in the cell.

c) Packaging and sending out proteins and lipids.   d) Suspending cellular structures and providing a place for cellular functions to take place.

144. The full potential of penicillin as an antibiotic was established by: **[4]**

a) Alexander Fleming   b) Chain and Florey

c) Louis Pasteur   d) F. Sanger

145. Disruption of which process will have the greatest impact on the number of electron carriers used by the electron transport chain? **[4]**

a) The citric acid cycle   b) Glycolysis

c) Formation of $FADH_2$ d) Anaerobic pathways

146. Maximum number of antibiotics got from: **[4]**

a) Actinomycetes   b) Viruses
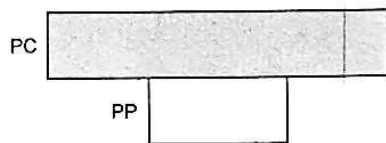
c) Mycoplasma   d) Eubacteria

147. The given pyramid represents :   **[4]**

     a) Pyramid of numbers in an aquatic ecosystem

     b) Pyramid of biomass in a tree ecosystem.

     c) Pyramid of numbers in a grassland ecosystem.

     d) Pyramid of biomass in an aquatic ecosystem.

148. The affect of apical dominance can be overcome by which of the following hormone: **[4]**

     a) IAA

     b) Gibberellin

     c) Ethylene

     d) Cytokinin

149. The growth pattern of a plant is different from the growth pattern of an animal in having: **[4]**

     a) Localized growth centres and Indefinite life span

     b) Diffused growth

     c) Indefinite life span

     d) Localized growth centres

150. The productivity of a crop declines under water stress condition because   **[4]**

     a) surface area of leaf decreases.

     b) the chlorophyll of leaves destructs.

     c) Both surface area of leaf decreases and stomata close and CO_2 cannot enter inside the leaf

     d) stomata close and CO_2 cannot enter inside the leaf.

ZOOLOGY (Section-A)

151. Animals belonging to chordata are fundamentally characterised by the presence of structures marked as A, B, C, and D in the given figure. Identify them and select the correct option.   **[4]**
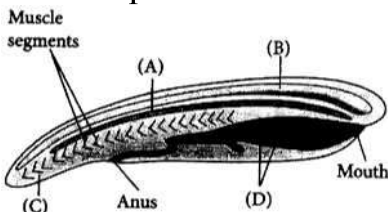
     a) A-Nerve cord, B-Notochord, C-Post-anal part, D-Gill slits.

     b) A-Notochord, B-Nerve cord, C-Gill slits, D-Post-anal part.

c) A-Nerve cord, B-Gill slits, C-Notochord, D-Post-anal part.

d) A-Nerve cord, B-Notochord, C-Post-anal tail, D-Gill slits.

152. Which of the following is correct about nematocyst? **[4]**

a) It is an organ of only defence

b) It is ejected on contact and pierce the prey

c) Its ejection is conditioned reflex

d) It can be re-used

153. Which one of the following in birds, indicates their reptilian ancestry? **[4]**

a) Scales on their hind limbs

b) Presence of mammary gland.

c) Eggs with a calcareous shell.

d) Presence of crop and gizzard in their digestive tract.

154. The horns of Rhinoceros are composed of **[4]**

a) Chitin

b) Keratin

c) Bone

d) Cartilage

155. The intercellular material of the given figure is solid and resists compression. Identify the figure and the label marked as 1 and 2. **[4]**
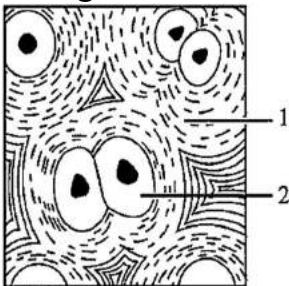
a)

Figure	1	2
Muscular tissue	Reticular fibers	Ligament

b)

Figure	1	2
Cartilage	Collagen	Chondrocytes

c)

Figure	1	2
Bone	Collagen	Chondrocytes

d)

Figure	1	2
Epithelial tissue	Microtubule	Osteoblasts

156. Maximum amount 70-75% of carbon dioxide transport occurs as: **[4]**

a) Dissolved in plasma

b) Carbamino-haemoglobin complex

c) Bicarbonate

d) Tricarbonate

157. Haemoglobin has least affinity for: **[4]**

    a) Same affinity for all of these   b) Carbon monoxide

    c) Carbon dioxide   d) Oxygen

158. Oxygen-myoglobin dissociation curve has following shape: **[4]**

    a) Straight line   b) Sigmoid

    c) Rectangular hyperbola   d) Parabola

159. Ascent of high mountains may cause altitude sickness in men. Prime cause of this is: **[4]**

    a) Decreased proportion of oxygen in air   b) Excess of CO_2 in blood

    c) Decreased partial pressure of oxygen   d) Decreased efficiency of haemoglobin

160. Mark the correct statement. **[4]**

a. Human lungs are negative pressure type

b. Avian lungs are non-elastic

c. The right lung in human is 3-lobes

d. All are correct

    a) Only B   b) Only C

    c) Only D   d) Only A

161. Identify the correct statement from the following. **[4]**

a. High levels of oestrogen trigger the ovulatory surge.

b. Oogonial cells start to proliferate and give rise to functional ova in regular cycles from puberty onwards.

c. Sperms released from seminiferous tubules are highly motile.

d. Progesterone level is high during the post-ovulatory phase of menstrual cycle.

    a) Statement (b) is correct.   b) Statement (d) is correct.

    c) Statement (a) is correct.   d) Statement (c) is correct.

162. The degeneration of follicles is called as: **[4]**

    a) Atresia   b) All of these

c) Metagenesis   d) Regression

163. The main tissue present in breast is **[4]**

    a) squamous   b) Both squamous and ciliated

    c) glandular   d) ciliated

164. Diaphragms are contraceptive devices used by females. Choose the correct option from the statements given below: **[4]**

  i. They are introduced into the uterus

  ii. They are placed to cover the cervical region

  iii. They act as physical barriers for sperm entry

  iv. They act as spermicidal agents

    a) (i) and (iii)   b) (ii) and (iii)

    c) (i) and (ii)   d) (iii) and (iv)

165. Veneral diseases can spread through **[4]**

  a. Using sterile needles

  b. Transfusion of blood from infected person

  c. Infected mother to foetus

  d. Kissing

  e. Inheritance

    a) (a), (b) and (c) only   b) (a) and (c) only

    c) (b), (c) and (d) only   d) (b) and (c) only

166. Which one of the following is the direct ancestor of modern man? **[4]**

    a) Australopithecus   b) Homo habilis

    c) Ramapithecus   d) Homo erectus

167. Evolution for Darwin was gradual while de Vries believed mutation caused speciation and hence called _____. **[4]**

    a) Saltation   b) Variation

    c) Genetic drift   d) Gene pool

168. The two kidneys in human lie: **[4]**

a) Left kidney at a higher level than the right one	b) Right kidney at a higher level than the left one
c) At the level of ovaries	d) At the same level

169. Ascending limb of loop of Henle is permeable for: **[4]**

   a) Na^+

   b) Glucose

   c) Water

   d) NH_3

170. The end-product of Ornithine cycle is **[4]**

   a) Urea

   b) Uric acid

   c) Carbon dioxide

   d) Ammonia

171. The humerus bone is situated in: **[4]**

   a) Upper arm

   b) Thigh

   c) Lower arm

   d) Shank

172. Action potential in sarcolemma of muscles causes the release of which ions from sarcoplasmic reticulum? **[4]**

   a) Na^+

   b) Cl^-

   c) HCO_3^-

   d) Ca^{2+}

173. The characteristics and an example of a synovial joint in humans is: **[4]**

Characteristics	Examples
(A) Fluid cartilage between two bones, limited movements	Knee joints
(B) Fluid-filled between two joints, provides cushion	Skull bones
(C) Fluid-filled synovial cavity between two bones	Joint between atlas and axis
(D) Lymph filled between two bones, limited movement	Gliding joint between carpals

   a) Only D

   b) Only A

   c) Only C

   d) Only B

174. From which part of spinal cord, motor root originates? **[4]**

a) Dorsal root   b) Ventral root

c) Gray matter   d) White matter

175. ANS is not involved in: **[4]**

    a) Learning and memory   b) Micturition

    c) Control of viscera   d) Heart beat

176. Which part of the brain is directly concerned with the control of heart? **[4]**

    a) Medulla oblongata   b) Cerebrum

    c) Hypothalamus   d) Pons

177. This is a diagrammatic representation of the pituitary and its relationship with the hypothalamus. Select the incorrect statement with reference to this diagram: **[4]**
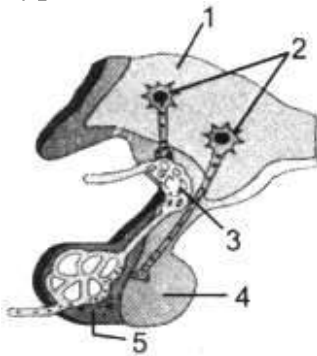
    a) Posterior pituitary receives axons of hypothalamic neurons   b) 5-is the anterior lobe of pituitary

    c) 3-carries oxytocin and vasopressin to pituitary gland   d) 4 and 5 together release at least 9 hormones

178. Endocrine glands have, to the specific organ, to carry their secretions **[4]**

    a) capillaries.   b) no ducts.

    c) tubules.   d) ducts.

179. State true or false: **[4]**

    Select incorrect statements regarding the given diagrammatic representation of formed elements in the blood.
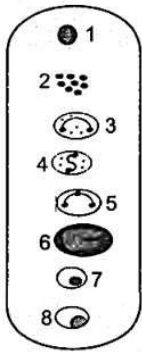
a) 7-maintains CMI

b) 5-perfoms phagocytosi

c) 6-maintains AMI

d) 4-releases histamine, serotonin, heparin

180. In which of the following options the types of heart is correctly matched to their respective group of animals? **[4]**

a) Three-chambered heart- Amphibians and birds

b) Four-chambered heart- Birds and mammals

c) Three-chambered heart- Reptiles and mammals

d) Two-chambered heart- Fishes and amphibians

181. The nerve like modified muscle responsible for initiating and maintaining the rhythmic contractile activity of the heart is: **[4]**

a) Bulbus arteriosus

b) Lymph node

c) Atrio-ventricular node

d) Pacemaker

182. Which of the following statement is incorrect? **[4]**

i. Making multiple identical copies of any template DNA is called cloning.

ii. EcoRI cuts the DNA between bases G and A.

iii. EcoRI restriction endonuclease recognises a specific palindromic nucleotide sequences in DNA.

iv. When cut by same restriction enzyme, the resultant DNA fragments do not have the same kind of sticky ends.

a) Statement (iv) is incorrect.

b) Statement (i) is incorrect.

c) Statement (iii) is incorrect.

d) Statement (ii) is incorrect.

183. Which statement is correct? **[4]**

a) Foreign DNA piece is not needs to be linked with OR (origin of

b) When a piece of foreign DNA gets integrated into the genome of the

replication) of the recipient for multiplication.

recipient, it may multiply.

c) Piece of foreign DNA multiply itself in an alien organism.

d) All are correct

184. The diagram below shows **[4]**
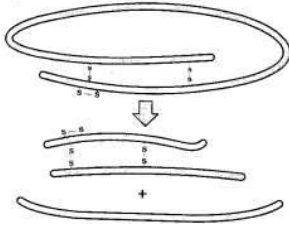
a) method of proinsulin formation.

b) enzyme replacement therapy.

c) gene therapy.

d) maturation of proinsulin into insulin.

185. Agro-chemical based agriculture includes: **[4]**

a) Both genetically modified crops and RNA interference

b) genetically modified crops

c) fertilisers and pesticides

d) RNA interference

ZOOLOGY (Section-B)
Attempt any 10 questions

186. A marine cartilaginous fish that can produce electric current is: **[4]**

a) Pristis

b) Scoliodon

c) Trygon

d) Torpedo

187. Following is the most abundant tissue in animals: **[4]**

a) Connective tissue

b) Muscular tissue

c) Epithelial tissue

d) Neural tissue

188. An artificial pacemaker is implanted subcutaneously and connected to the heart in patients **[4]**

a) With irregularity in the heart rhythm

b) Having 90% blockage of the three main coronary arteries

c) Having a very high blood pressure

d) Suffering from arteriosclerosis

189. Breathing with the help of ribs is more pronounced in: **[4]**

    a) Female   b) Fatty male

    c) Male   d) Pregnant females

190. Match the structures of male reproductive system given in column I with their features given in column II and select the correct match from **[4]**

Column I (Structures)	Column II (Features)
(A) Rete testis	(i) Facilitates insemination
(B) Leydig cells	(ii) Meiosisand sperm formation
(C) Seminiferous tubules	(iii) Connects seminiferous tubules to vasa efferentia
(D) Penis	(iv) Secrete androgens

    a) A - (ii), B - (iv), C - (iii), D - (i)   b) A - (iii), B - (i), C - (ii), D - (iv)

    c) A - (ii), B - (i), C - (iii), D - (iv)   d) A - (iii), B - (iv), C - (ii), D - (i)

191. Select the contraceptive which is implanted under the skin **[4]**

    a)

    b)

    c)

    d)
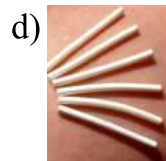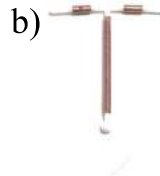
192. The most acceptable theory of origin of life was proposed by: **[4]**

    a) Schleiden and Schwann   b) Oparin and Haldane

    c) Miller and Urey   d) Darwin and Huxley

193. Figure shows human urinary system with structures labelled A to D. Select option which correctly identifies them and gives their characteristics and/or functions: **[4]**
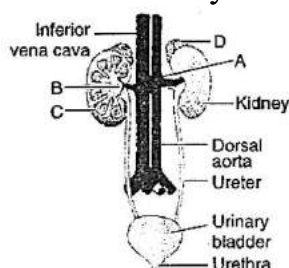
a) D-Adrenal gland-Secrete catecholamines which stimulate glycogen breakdown.

b) A-Renal artery-contain least amount of urea.

c) B-Medulla-inner zone of kidney and contains complete nephrons.

d) C-Cortex-outer part of kidney and do not contain any part of nephrons.

194. The cranium of man is made up of: **[4]**

a) 8 bones

b) 12 bones

c) 16 bones

d) 10 bones

195. If Broca's area is injured then firstly: **[4]**

a) Speech stattered & not clear

b) Only able to speak written word

c) Concerning speech muscle are paralysed

d) Unable to speak

196. Which of the following is part of pituitary gland? **[4]**

a) Pars intermedia

b) Pars distalis, pars intermedia and pars nervosa

c) Pars intermedia and pars distalis

d) Pars distalis and pars nervosa

197. Select the correct statement: **[4]**
A. Pituitary is the master of the endocrine gland.
B. LH and oxytocin are secreted by pars distalis.
C. Pars nervosa secretes MSH and FSH.
D. Neurosecretory cells are found in adenohypophysis.

a) B

b) C

c) D

d) A

198. Which of the following statements is correct? **[4]**
a. The T-wave in an ECG represents excitation of ventricles.
b. The sum of P and T waves in a given time period can determine the heart beat rate of an individual.
c. The end of the P-wave marks the end of the systole.
d. Ina standard ECG, a person is connected to the machine with three electrical leads.

a) Statement (a) is correct.

b) Statement (b) is correct.

c) Statement (d) is correct.

d) Statement (c) is correct.

199. In bacterial cells, the membrane is broken with the help of enzyme. **[4]**

    a) chitinase

    b) lysozyme

    c) lipase

    d) cellulose

200. A probe which is a molecule used to locate specific sequences in a mixture of DNA or RNA molecules could be: **[4]**

    a) Either RNA or DNA

    b) A ssDNA

    c) A ssRNA

    d) Can be ssDNA but not ssRNA

SAMPLE PAPER - 3

PHYSICS (Section-A)

1.
    (b) only ii
    Explanation: If a quantity depends upon more than three factors, each having dimensions, then method of dimensional analysis cannot be applied. It is because applying the principle of homogeneity will give only three equations.

2.
    (b) 2
    Explanation: 2

3. **(a)** 15 m/s
    Explanation: 15 m/s

4.
    (d) if $\vec{A}, \vec{B}, \vec{C}$ define a plane, $(\vec{A} \times \vec{B}) \times \vec{C}$ is in that plane
    Explanation: According to the given condition,
    If $\vec{A}, \vec{B}$ and $\bar{C}$ define a plane, $(\vec{A} \times \vec{B}) \times \vec{C}$ is in that plane.

5.
    (c) -118.5
    Explanation: Using,

    $R^2 = A_1^2 + A_2^2 + 2A_1A_2 \cos \theta$

    $5^2 = 3^2 + 5^2 + 2 \times 3 \times 5 \cos \theta$

    or $\cos \theta = -0.3$

    $\left(2\vec{A_1} + 3\vec{A_2}\right) \cdot \left(3\vec{A_1} - 2\vec{A_2}\right) = 2A_1 \times 3A_1 + (3A_2)(3A_1) \cos \theta - (2A_1)(2A_2) \cos \theta -$

    $3A_2 \times 2A_2$

    $= 6A_1^2 + 9A_1A_2 \cos \theta - 4A_1A_2 \cos \theta - 6A_2^2$

    $= 6A_1^2 \, 6A_2^2 + 5A_1A_2 \cos \theta$

    $= 6 \times 3^2 - 6 \times 5^2 + 5 \times 3 \times 5(-0.3) = -118.5$

6. **(a)** 1 m/s, 3 m/s
    Explanation: $0 < t < 1$s : Velocity increases from 0 to 6 m/s
    $1 < t < 2$s : Velocity increases from 6 to 0 m/s but car continues to move forward
    $2 < t < 3$s : Since field strength is Same
    $\therefore$ Car's velocity increases from 0 to -6 m/s
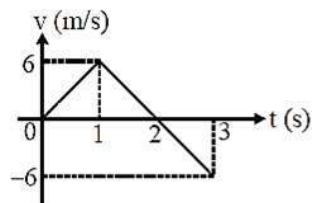   Distance traveled in 1st second

    $S = \left(\frac{u+v}{2}\right)t = \left(\frac{0+6}{2}\right)(1) = 3m$

Distance = 9m

So, Average speed $= \dfrac{9m}{3s} = 3$ m/s

Displacement = 3m

So, Average velocity $= \dfrac{3m}{3s} = 1$ m/s

7. **(a)** 16 U

Explanation: Let the initial extension = x

In stretched condition P.E of the string $= \dfrac{1}{2}kx^2$

where k = spring constant or force constant

$$\dfrac{U_1}{U_2} = \dfrac{x_1^2}{x_2^2} \quad ......(i)$$

By given conditions,
$U_1 = U$, $x_1 = 2$ cm, $x_2 = 8$ cm
After putting these values in eq (i), we get
$U_2 = 16$ U

8.

(c) 5 ms^{-1}

Explanation: It is a case of elastic collision. As masses of two balls are equal and 2nd ball is at rest before the collision, hence after the collision the speeds are just exchanged, i.e., 1st ball will now come to rest while the second ball will move forward with the same speed as that of the first, i.e., 5 ms^{-1}.

9.

(d) 1.04 kg-m^2

Explanation: Moment of inertia $= m \times r^2$
Here origin is chosen at the point through which the axis passes the rod. Using the formula total moment of inertia about the axis is $= 2 \times 5 \times (0.2)^2 + 2 \times 2 \times (0.4)^2 = 1.04 kgm^2$

10.

(d) L is maximum when p is perpendicular to r
Explanation: Angular momentum L is given as:
$L = \vec{r} \times \vec{p} = rp\sin\theta$
$\vec{r} =$ position vector of the particle w.r.t. origin
$\vec{p} =$ its linear momentum

$\vec{r} \times \vec{p}$ = is maximum when p is perpendicular to r,

i.e., $\theta = 90^\circ$

11.

(d) $-\dfrac{mg_0R^2}{2(R+h)}$

Explanation: Total energy of satellite at a height h above the earth's surface,

$$TE = -\dfrac{GMm}{2(R+h)} = -\dfrac{GMmR^2}{2(R+h)R^2} = -\dfrac{g_0mR^2}{2(R+h)}$$

12. **(a)** Rubber is more elastic than steel.

**Explanation:** Steel is more elastic than rubber. All other statements are correct.

13.

(c) Does not change with time but is different at different cross-sections of the body

Explanation: Under steady-state, the temperature of a body becomes constant at its every point but it is different at different cross-sections. The temperature is maximum at the hot end and goes on decreasing as we move away from the hot end

14.

(b) 90 Wm^{-2}

Explanation:
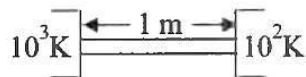
$$\left(\dfrac{dQ}{dt}\right) = \dfrac{kA\Delta T}{l}$$

Energy flux, $\dfrac{1}{A}\left(\dfrac{dQ}{dt}\right) = \dfrac{k\Delta T}{l}$

$$= \dfrac{(0.1)(900)}{1} = 90 \text{ Wm}^{-2}$$

15.

(c) $P^{1-\gamma}T^\gamma$

Explanation: $P^{1-\gamma}T^\gamma$

16.

(b) 114 cm of Hg

Explanation: Pressure exerted by a gas,

$P = \dfrac{1}{2}\dfrac{M}{V}v_{ms}^2$

Since temperature T is kept constant,

v_{rms}^2 and V are also constant.

$\therefore P \propto M$

or $\dfrac{P_2}{P_1} = \dfrac{M_2}{M_1}$

According to the question,

$\therefore \dfrac{P_2}{76} = \dfrac{\left[M_1 + \left(\dfrac{50}{100} \right) M_1 \right]}{M_1} = \dfrac{3}{2}$

$\Rightarrow \quad P_2 = \dfrac{3}{2} \times 76$

= 114 cm of mercury

17.

(b) 7 s

Explanation: Since the system dissipates its energy gradually, and hence amplitude will also decrease with time according to

$a = a_0 e^{-bt/m}$ ...(i)

$\because$ Energy of vibration drop to half of its initial value (E_0), as

$E \propto a^2 \Rightarrow a \propto \sqrt{E}$

$a = \dfrac{a_0}{\sqrt{2}} \Rightarrow \dfrac{bt}{2m} = \dfrac{10^{-2}t}{2 \times 0.1} = \dfrac{t}{20}$

From eq^n (i),

$\dfrac{a_0}{\sqrt{2}} = a_0 e^{-t/20}$

$\dfrac{1}{\sqrt{2}} = e^{-t/20}$ or $\sqrt{2} = e^{t/20}$

$\ln\sqrt{2} = \dfrac{t}{20}$

$\therefore \ t = 6.93$ seconds

18.

(d) 5:3

Explanation: For a cylindrical source,

Intensity $\propto \dfrac{1}{\text{distance}} \propto (\text{amplitude})^2$

19.

(d) 20%

Explanation: When observer moves towards stationary source then apparent frequency,

$$n' = \left[\frac{v + v_n}{v}\right]n$$

where, v_0 = frequency of the source

v_0 = velocity of the observer

v = velocity of the sound

$$\therefore \ v' = v_0\left(\frac{v + \dfrac{v}{5}}{v}\right) = \frac{6v_0}{5}$$
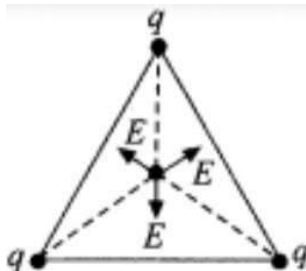
Percentage change in apparent frequency

$$\frac{v' - v_0}{v_0} \times 100 = \frac{\left(\dfrac{6v_0}{5} - v_0\right)}{v_0} \times 100 = \frac{1}{5} \times 100$$

$= 20\%$

20.

(b) zero

Explanation: Each charge will produce the same magnitude of intensity, say E, at the centroid. These are directed at angles of 120° with each other. So, their vector sum will be zero.

21.

(d) -80 J/C

Explanation: As we know, potential difference V_A - V_O is

dV = -Edx

$$\Rightarrow \int_{V_0}^{V_A} dV = -\int_{0}^{2} 30x^2 dx$$

$$V_A - V_O = -30 \times \left[\frac{x^3}{3}\right]_{0}^{2}$$

$= -10 \times [2^3 - (0)^3]$

$= -10 \times 8 = -80$ J

22.

(b) 90 kW

Explanation: Given that the capacitance is $C = 40\ \mu F$ and the potential is $V = 3000$ V. Therefore the energy

$E = \dfrac{1}{2}CV^2 = \dfrac{1}{2} \times 40 \times 10^{-6} \times (3000)^2$

$\Rightarrow E = 20 \times 9$

$\Rightarrow E = 180$ J

If this energy is transferred in a time $t = 2$ ms. Then the power delivered is,

$P = \dfrac{E}{t} = \dfrac{180}{2 \times 10^{-3}} = 90$ kW

23.

(b) Zero

Explanation: Zero

24.

(b) 4

Explanation: In magnetic dipole

Force $\propto \dfrac{1}{r^4}$

In the given question,

Force $\propto x^{-n}$

Hence, n = 4

25.

(b) rise

Explanation: rise

26. **(a)** only i

Explanation: twice per revolution

27. **(a)** $Q = \dfrac{\Delta\phi}{R}$

Explanation: Since,

$\dfrac{\Delta\phi}{\Delta t} = \varepsilon$

$= IR$

$\Rightarrow \Delta\phi = (I\Delta t)R$

$= QR$

$\Rightarrow Q = \dfrac{\Delta\phi}{R}$

28.

(d) $\omega L = \dfrac{1}{\omega C}$

Explanation: The current will be maximum when Impedance is minimum, i.e., when,

$X_L = X_C$ or $\omega L = \dfrac{1}{\omega C}$

29.

(d) 100

Explanation: Average intensity em wave is

$= \dfrac{P}{4\pi r^2} = \dfrac{1}{2} \in_0 E_0^2 \times c$

Or $E_0 = \left[\dfrac{P}{2\pi v r^2 \in_0 c} \right]^{1/2}$

$= \left[\dfrac{500}{2\pi (3)^2 \times \left[1 / \left(4\pi \times 9 \times 10^9 \right) \right] \times 3 \times 10^8} \right]^{1/2}$

$= 100$ V/m

30. (a) 1.72

Explanation: For dispersion without deviation,
deviation from first prism = deviation from second prism
$\delta_1 = \delta_2$

or $A_1 \left(\mu_1 - 1 \right) = A_2 \left(\mu_2 - 1 \right)$

Given that $A_1 = 4°$, $A_2 = 3°$ and $\mu_1 = 1.54$

$\therefore\ 4(154 - 1) = 3(\mu_2 - 1)$

or $\mu_2 = 1.72$

31.

(c) 443 nm

Explanation: The refractive index of water with respect to air,

$\mu = \dfrac{C_{air}}{C_{water}} = \dfrac{v\lambda_{air}}{v\lambda_{water}}, \mu = 1.33$

$\therefore\ \lambda$ in water $= \dfrac{\lambda_{air}}{\mu}$ or λ in water $= \dfrac{589}{1.33}$ nm

or λ in water $= 443$ nm

32.

(c) 7.2×10^5 m/s

Explanation: As we know that,

$$\lambda = \frac{h}{mv}$$

$$v = \frac{h}{m\lambda}$$

$$v = \frac{6.6 \times 10^{-34}}{9.1 \times 10^{-31} \times 10 \times 10^{-10}}$$

$$= 7.2 \times 10^5 \text{ m/s}$$

33.

(b) Zero

Explanation: $V = \frac{3}{2}v^0$

and $v' = \frac{v}{2} = \frac{3}{4}v_0$

Here, we see $v' < v < v_0$

Below threshold frequency, no photoelectric emission takes place.

34.

(b) $S = n\lambda$

Explanation: It is a postulate by Bohr, written as $2\pi r = n\lambda$

circumference $S = n \times$ wavelength

35.

(b) 20

Explanation: $N_0 = 600$, $N' = 450$

$\therefore$ $N = N_0 - N' = 600 - 450 = 150$

$$\therefore \frac{N}{N_0} = \left(\frac{1}{2}\right)^{t/T_H} \text{ or } \frac{150}{600} = \left(\frac{1}{2}\right)^{t/10}$$

$$\text{or } \frac{1}{4} = \left(\frac{1}{2}\right)^{t/10} \text{ or } \left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^{t/10}$$

$$\therefore 2 = \frac{t}{10}$$

$$\therefore t = 20 \text{ min}$$

PHYSICS (Section-B)

36.

(d) 2 m/s

Explanation: The velocities will be interchanged after collision.

$0 = v^2 - 2gh$

$v = \sqrt{2gh}$

Speed of P just before collision $= \sqrt{2gh}$

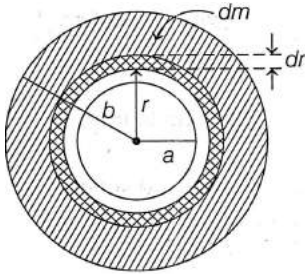$= \sqrt{2 \times 10 \times 0.2} = 2$ m/s ($\because$ h = 20 cm = 0.2 m)

37.

(c) $\sqrt{\dfrac{a^2+b^2+ab}{3}}$

Explanation:

Given, variation in mass per unit area (surface mass density),

$\sigma = \dfrac{\sigma_0}{r}$ ...(i)

Calculation of Mass of Disc

Let us divide whole disc in small area elements, one of them shown at r distance from the centre of the disc with its width as dr.

Mass of this element is

$dm = \sigma \cdot dA$

$\Rightarrow dm = \dfrac{\sigma_0}{r} \times 2\pi r\,dr$ [from Eq. (i)] .. .(ii)

Mass of the disc can be calculated by integrating it over the given limits of r,

$\int_0^M dm = \int_a^b \sigma_0 \times 2\pi \times dr$

$\Rightarrow M = \sigma_0 2\pi(b - a)$ ...(iii)

Calculation of Moment of Inertia

$I = \int_0^M r^2 dm = \int_a^b r^2 \cdot \dfrac{\sigma_0}{r} \times 2\pi r\,dr = \sigma_0 2\pi \int_a^b r^2 dr = \sigma_0 2\pi \left[\dfrac{r^3}{3}\right]_a^b$

$\Rightarrow I = \dfrac{1}{3}\sigma_0 2\pi \left[b^3 - a^3\right]$ ...(iv)

Now, radius of gyration,

$K = \sqrt{\dfrac{I}{M}} = \sqrt{\dfrac{\dfrac{2\pi\sigma_0}{3}(b^3 - a^3)}{2\pi\sigma_0(b-a)}}$

$$\Rightarrow K = \sqrt{\frac{1}{3}\frac{\left(b^3 - a^3\right)}{b - a}}$$

As we know, $b^3 - a^3 = (b - a)(b^2 + a^2 + ab)$

$$\therefore \; K = \sqrt{\frac{1}{3}\left(b^2 + a^2 + ab\right)}$$

or $K = \sqrt{\dfrac{\left(a^2 + b^2 + ab\right)}{3}}$

38.

   (d) $\dfrac{R}{4}$

   Explanation: The acceleration due to gravity at height h is given by $g' = \dfrac{gR^2}{(R+h)^2}$ ...(i)

   The acceleration due to gravity decreases at height h decreases by 36%

   $g' = g - \dfrac{36g}{100} = \dfrac{64}{100} = 0.64\,g$ ...(ii)

   From equation (i) and equation (ii), we get

   $$\frac{gR^2}{(R+h)^2} = \frac{64}{100}g$$

   $$\left(\frac{R}{R+h}\right)^2 = \left(\frac{8}{10}\right)^2$$

   $$\frac{R}{R+h} = \frac{8}{10}$$

   10R = 8R + 8h

   2R = 8R

   h = $\dfrac{R}{4}$

39.

   (d) cryogenics
   Explanation: The study of a definite branch of physics related to phenomena at very low temperatures is called." **cryogenics**".

40. **(a)** Speed of sound waves is more
   Explanation: As we know that,

   The velocity of sound = $\sqrt{\dfrac{\gamma RT}{M}}$

When water vapor is present in the air, the average molecular weight of air decreases, and hence velocity increases.

41. (a) $\left(\dfrac{v + u}{v - u}\right)f$

Explanation: Apparent frequency for reflector (which will act here as an observer) would be,

$$f_1 = \left(\dfrac{v + u}{u}\right)f$$

where f = actual frequency of source

After being reflected the apparent frequency will further change and the reflector will now behave as a source. The apparent frequency will now become:

$$f_2 = \left(\dfrac{u}{v - u}\right)f_1$$

Substituting the value of f_1, we get;

$$f_2 = \left(\dfrac{v + u}{v - u}\right)f$$

42.

(b) $\dfrac{\mu_0 I}{4\pi a}6[\sqrt{3} - 1]$

Explanation:
The given points (1, 2, 3, 4, 5, 6) makes 360° angle at O. Hence, angle made by vertices 1 and 2 with O is 60°.
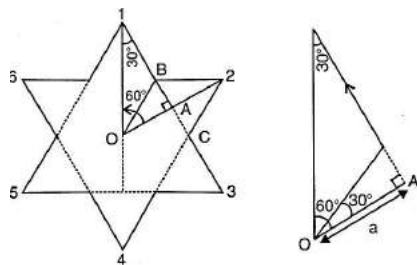
Direction of magnetic field at O due to each segment is same.
Since it is symmetric star shape, magnitude will also be same.
Magnetic field due to section BC

$$B_1 = \dfrac{KI}{a}\left[\sin\left(+60^{\circ}\right) - \sin\left(30^{\circ}\right)\right] = \dfrac{KI}{2a}(\sqrt{3} - 1)$$

$$\therefore \quad B_{\text{net}} = 12 \times B_1 = \dfrac{6KI}{a}(\sqrt{3} - 1) \quad \left[K = \dfrac{\mu_0}{4\pi}\right]$$

43.

(b) $\frac{2}{3}$ Am^{-1}

Explanation: On increasing the temperature magnetic susceptibility of paramagnetic material decreases or vice versa. According to Curie law, we can deduce a formula for the relation between magnetic field induction, temperature and magnetisation.

i.e., I (magnetization) $\propto \dfrac{B(\text{ magnetic field induction })}{t(\text{ temperature in kelvin })} \Rightarrow \dfrac{I_2}{I_1} = \dfrac{B_2}{B_1} \times \dfrac{t_1}{t_2}$

Let us suppose, here $I_1 = 8$ Am^{-1}

$B_1 = 0.6$ T, $t_1 = 4$ K

$B_2 = 0.2$ T, $t_2 = 16$ K

$\Rightarrow \dfrac{0.2}{0.6} \times \dfrac{4}{16} = \dfrac{I_2}{8}$

$\Rightarrow I_2 = 8 \times \dfrac{1}{12} = \dfrac{2}{3}$ Am^{-1}

44.

(d) only iii
Explanation: Crystallography

45.

(c) 242 W
Explanation: The given circuit is under resonance as $X_L = X_C$
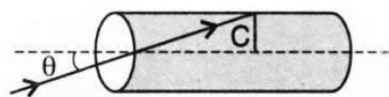
Hence, power dissipated in the circuit is

$P = \dfrac{V^2}{R} = 242$ W

46.

(b) $\sin^{-1}\left(\dfrac{1}{\sqrt{3}}\right)$

Explanation:

$\sin C = \dfrac{\sqrt{3}}{2}$ ...(i)

$\sin r = \sin(90^{\text{O}} - C) = \cos C = \dfrac{1}{2}$

$\dfrac{\sin \theta}{\sin r} = \dfrac{\mu_2}{\mu_1}$

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

$$\theta = \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$$

47.

(c) L_2, L_3

Explanation: L_2, L_3

48.

(c) $\sqrt{8}$

Explanation: add explanation here

49.

(d) Conservation of angular momentum

Explanation: For an explanation of Bohr's theory, Bohr used the principle of Conservation of angular momentum. As he postulated that the angular momentum of the electron remains conserved.

50.

(c) one fourth

Explanation: According to the concept of half-life, half of the initial sample will remain undecayed after 12.5 y. In the next 12.5 y, one-half of these nuclei would decay. Hence one-fourth of the initial sample of pure tritium will remain undecayed.

CHEMISTRY (Section-A)

51.

(c) $[H^+] = 2[S^{2-}] + [HS^-] + [OH^-]$

Explanation: In solution, $H_2O \rightarrow H^+ + OH^-$

$H_2S \rightarrow H^+ + HS^- + S^{-2}$

In solution, total positive charge from all species is equal to total negative charge from all species.

$[H^+] = 2[S^{2-}] + [HS^-] + [OH^-]$

52.

(b) small, large

Explanation: If the position of a particle is measured accurately, there will be more error in the measurement of its momentum.

53.

(b) C > Be > B > Li

Explanation:

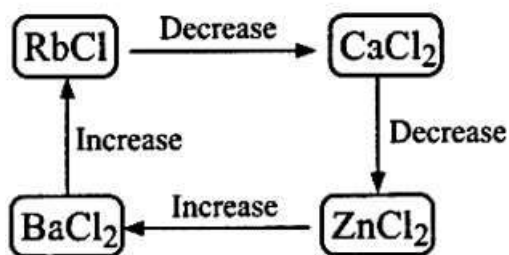| Li	Be	B	C
$2s^1$	$2s^2$	$2p^1$	$2p^2$

I.E.$_1$ = C > Be > B > Li

54. **(a)** C_3H_8, CH_3OCH_3, CH_3CH_2OH

   Explanation: Ethers are highly volatile. CH_3CH_2OH has H-bonding.

55.

   (c)

   Explanation: Ionic character = $RbCl > BaCl_2 > CaCl_2 > ZnCl_2$

56.

   (d) hydrogen fluoride

   Explanation: H-F shows strongest H-bonds because fluorine is most electronegative.

57. **(a)** 44.0

   Explanation: $\triangle H = \triangle U + P_2V_2 - P_1V_1$ Given, $\triangle U = 30.0 L$ atm.

   $P_1 = 2.0$ atm, $V_1 = 3.0$ L, $T_1 = 95$ K

   $P_2 = 40.$ atm, $V_2 = 5.0$ L, $T_2 = 245$ K

   $\triangle H = \triangle U + P_2V_2 - P_1V_1$

   $30 + (4 \times 5) - (2 \times 3) = 30 + 20 - 6 = 44 L$ atm.

58. **(a)** $[OH^-] = c_b$, if $(pK_b + 1) < pc_b$

   Explanation: $[OH^-] = c_b$, if $(pK_b + 1) < pc_b$

59.

   (b) only i

   Explanation: $KIO_4 + H_2O_2 \rightarrow KIO_3 + H_2O + O_2$

   $I^{2+} + 2e \rightarrow I^{5+}$

   $(O^{-1})_2 Reductant \rightarrow (O)_2 + 2e$

   $NH_2OH + 3H_2O_2 \rightarrow HNO_3 + 4H_2O$

   $N^- \rightarrow N^{5+} + 6e$

   $(O^{-1})_2 oxidant + 2e \rightarrow 2O^{-2}$

60.

   (c) $S_2O_8^{2-}$

   Explanation: Higher the standard reduction potential $\left(E^{\circ}_{M^{n+}/M}\right)$, better is oxidising

   agent. Among the given, $E^{\circ}_{S_2O_1^{2-}/SO_4^{2-}}$ is highest, hence $S_2O_8^{2-}$ is the strongest

   oxidising agent.

The decreasing order of oxidising agent among the given option is as follows: $S_2O_8^{2-} >$ $Au^{3+} > O_2 > Br_2$

61.

(c) Colemanite

Explanation: $Ca_2B_6O_{11} \cdot 5H_2O$ is called colemanite and it is used to prepare H_3BO_3 and borax.

62.

(c) a linear silicone

Explanation: a linear silicone

63.

(b) I > III > II > IV

Explanation: (I) is most stabilise as all atoms have a complete octet. (IV) is highly destabilize as N is +vely charged and has incomplete octet.

64.

(c) Butanoic acid and acetic acid

Explanation:

(i) O_3

$\rightarrow \quad CH_3COOH$ Acetic Acid $+ CH_3CH_2CH_2COOH$ Butanoic acid

(ii) H_2O

it is oxidative ozonolysis.

65.

(b) ⊢—Br

Explanation: The compound can give 3° radical which is highly stable.

66. (a) the enthalpy of mixing is zero

Explanation: For ideal solution $\Delta V_{mixing} = 0$, $\Delta H_{mixing} = 0$

67.

(c) 38.71 g

Explanation: 38.71 g

68.

(d) -46.32 kJ mol^{-1}

Explanation: $\Delta_r G^O = -nFE^O_{cell}$

$= -2 \times 96500 \times 0.24$

$= -46320$ J mol^{-1}

$= -46.32$ kJ mol^{-1}

69.

(d) depends only on temperature

Explanation: depends only on temperature

70. **(a)** 1.0×10^{-4}

Explanation: $k = \dfrac{[R_0]}{2t_{\frac{1}{2}}}$

$k = \dfrac{0.02}{2 \times 100}$

$k = 10^{-4}$ mol L^{-1} s^{-1}

71.

(b) Ln_2O_3, Ln_2S_3, $LnCl_3$

Explanation: Ln reacts with O_2, S and Cl_2 respectively to form Ln_2C_3, Ln_2S_3 and $LnCl_3$.
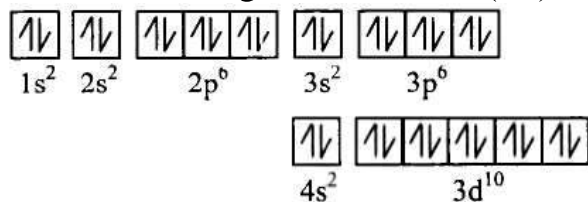
72.

(d) White phosphorus

Explanation: White phosphorus glow in dark.

73. **(a)** 15

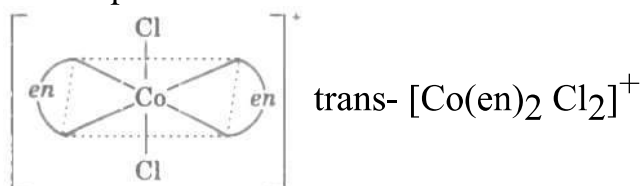**Explanation:**

Electronic configuration of zinc (Zn) is

There are 15 electrons having $+\dfrac{1}{2}$ value of a spin quantum number.

74.

(d) cis-$[Co(en)_2Cl_2]^+$

Explanation:

Optical isomerism is not planar complexes. Octahedral complexes of general formulae,

$[Ma_2b_2c_2]^{n\pm}$, $\{Mabcdef\}$, $[M(AA)_3]^{n\pm}$, $[M(AA)_2a_2]^{n\pm}$ (where AA = symmetrical

bidentate ligand), $[M(AA)_2ab]^{n\pm}$ and $[M(AB)_3]^{n\pm}$ (where AB = unsymmetrical ligands)

show optical isomerism.

 trans- $[Co(en)_2 Cl_2]^+$

does not show optical isomerism (superimposable mirror image). But cis-form shows optical isomerism.
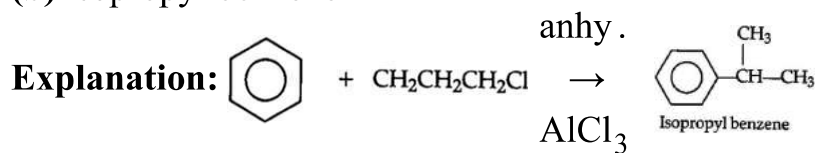
cis-[Co(en)$_2$Cl$_2$]$^+$
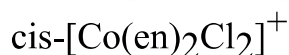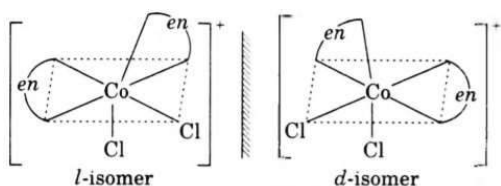
75.

(d) 8000 cm^{-1}

Explanation: $\Delta_t = \dfrac{4}{9}\Delta_o$

$= \dfrac{4}{9} \times 18000$

$= 8000$ cm^{-1}

76.

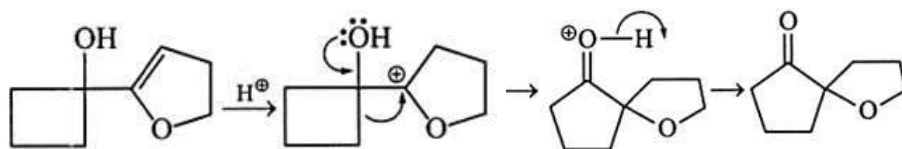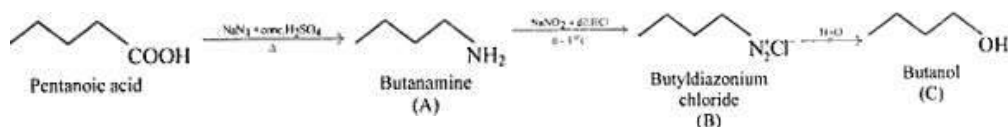**(b)** isopropyl benzene

Explanation:

77.

(b)
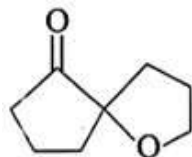
Explanation:

78.

(c) i > ii > iii > iv

Explanation: i > ii > iii > iv

79. **(a)**

Explanation:

80.

(c) 9

Explanation: Decasaccharide contains 10 monosaccharides linked to each other by 9 glycosidic bonds.

81.

(b) i, ii, iv and vi

Explanation: Essential amino acids are the amino acids which body cannot synthesize and must be supplied from diet.

Essential amino acids: PVT TIM HALL

PTV: Phenylalanine, Threonine, Valine,

TIM: Tryptophan, Isoleucine, Methionine,

HALL: Histidine, Arginine, Lysine, Leucine

Isoleucine, tryptophan, lysine and methionine are essential amino acids.

82. **(a)** Only C

Explanation: Tertiary amines show intermolecular hydrogen bonding.

83.

(c) 0.826 V

Explanation: pH is 7 for a neutral solution.

As $pH = -\log_{10}[H^+]$

$[H^+] = 10^{-7}M$

$$E^O = \frac{0.059}{n}\log\frac{[NO_2][H_2O]}{[NO_3^-][H^+]^2}$$

$$= \frac{0.059}{1}\log\frac{1}{(10^{-7})^2}$$
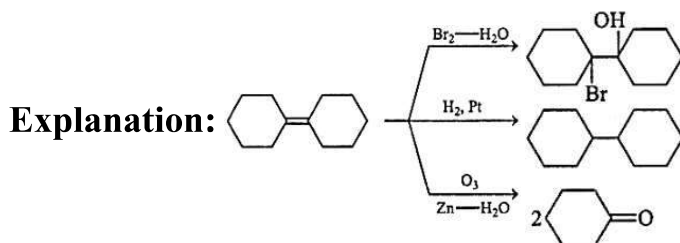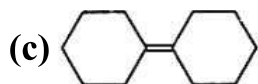
$$= 0.059 \times (\log 1 - \log 10^{-14})$$

$$= 0.059 \times (14) = 0.826 \text{ V}$$

84.

(b) vapourize without decomposition

Explanation: vapourize without decomposition

85.

(c)

Explanation:

CHEMISTRY (Section-B)

86.

(b) B > A > C

Explanation: Ice > Liquid water > Impure water
Due to impurity extent of H-Bonding decreases.

87.

(d) $-\dfrac{1}{3}, -\dfrac{1}{2}, -1$

Explanation: $-\dfrac{1}{3}, -\dfrac{1}{2}, -1$

88. (a) AlO_2^-

Explanation: AlO_2^-

89.

(d) A only

Explanation: $Na_2O > MgO > Al_2O_3 > CuO$

90.

(c) 4

Explanation: The energy of photon $= \dfrac{hc}{\lambda} = \dfrac{hc}{e\lambda}$

$= \dfrac{6.626 \times 10^{-34} \times 3 \times 10^8}{300 \times 10^{-9} \times 1.602 \times 10^{-19}}$

$= 4.14$ eV

For the photoelectric effect to occur, the energy of incident photons must be greater than the work function of the metal.

$\therefore$ Only Li, Na, K and Mg have $\phi < 4.14$ eV

91.

(b) SnO_2

Explanation:

- SnO_2 reacts with acid as well as a base. So SnO_2 is amphoteric.
- $SnO_2 + 4HCl \rightarrow SnCl_2 + 2H_2O$
- $SnO_2 + 2NaOH \rightarrow Na_2SnO_3 + H_2O$
- CaO is basic in nature while SiO_2 and CO_2 are acidic in nature.

92.

(d) (a + b) may or may not be equal to (x + y)
Explanation: Order of reaction (x + y) is an experimental value. It may have any values.

93.

(c) $\dfrac{\left(E^{\circ}_{A_2} - E^{0}_{A_1}\right)}{0.059}$

Explanation: $\dfrac{\left(E^{\circ}_{A_2} - E^{0}_{A_1}\right)}{0.059}$

94.

(d) white tin plating
Explanation: The bottom of the ship which is made up of iron is protected by white tin plating which prevents the build up of barnicles.

95.

(b) Order cannot be fractional
**Explanation:** Order cannot be fractional

96.

(b) OSF_2

Explanation: OSF_2 has sp^3 hybridization. According to VSEPR theory, we can conclude that the shape of SOF_2 is a trigonal pyramid.

Sulphur has a nonbonding pair of electrons on top, three downward legs of the pyramid are bonded to oxygen with a double bond & to each fluorine with a single bond.

SO_2 is sp^2 hybridized with three bond pairs and is trigonal.

BrF_3 is $sp^3 d$ hybridized with a trigonal bipyramidal shape.

SrO_3^{2-} is sp^2 hybridized with trigonal shape.
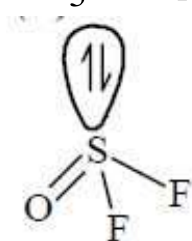
97.

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

98.

(d) The first ionization enthalpy decreases from Sc to Zn as the atomic number increases.
Explanation: The first ionization enthalpy increases with some irregularities as the atomic number increases in the 3d transition series. The irregularities are due to the screening effect of added $(n - 1)d$ electrons.

99. **(a)** Square planar complexes having unsymmetrical bidentate ligands
Explanation: Square planar complexes having unsymmetrical bidentate ligands

100. **(a)**

Explanation:

Aniline (A) reacts with $NaNO_2$ / HCl at 273-278K to form Benzenediazonium chloride (B), which then reacts with N,N-dimethylaniline to form p-(N, N dimetyl) amineazobenzene azodye.
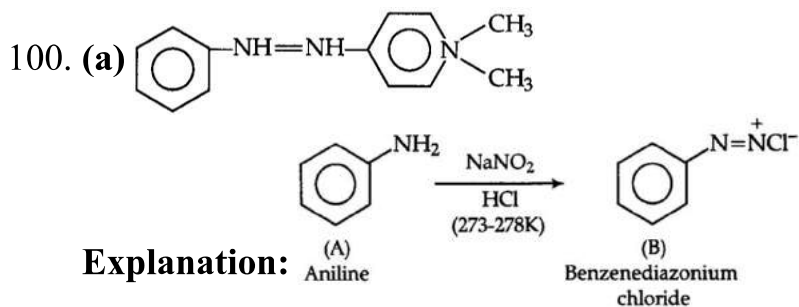
BOTANY (Section-A)

101.

(b) Subtribe

Explanation: The suffix - inae signifies the rank subtribe.

102.

(d) Non-living objects is also grow by accumulation of material from inside

Explanation: Non-living objects grow by increase in body mass as a criterion for growth. Non-living objects also grow by the accumulation of material on the surface from outside.

103.

(b) (i), (ii) and (iii)

Explanation: Dinoflagellates are mostly single-celled organisms classified in the kingdom protista. Dinoflagellates characteristically have two flagella for locomotion and most have a rigid cell wall of cellulose encrusted with silica. Their cell wall is divided into two halves called theca that may fit as two halves of a soap box or a petri dish.

104.

(d) All of these

Explanation: Kingdom fungi contain eukaryotic, multicellular, and organism with a cell wall formed of chitin.

105.

(b) dioecy

Explanation: Bisexual or cleistogamous flowers exhibit self-pollination.

106.

(b) Both Artificial system and Arbitary system

Explanation:
- Artificial system of classification was based on one or a few easily observable characters of plants, such as habit (trees, shrubs, herbs, etc.) or floral characters (particularly the number of stamens and carpels).
- The arbitrary system indicates a system in which easily observable characteristics are the basis for classification. Arbitrary characters include characters like the morphology of all parts of plants.

107.
(d) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)
Explanation: (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)
- Ulothrix is a genus of non-branching filamentous green algae.
- Kelps forms profusely branched massive plant body.
- Chlamydomonas is a unicellular alga.
- Volvox forms spherical colonies.

108. **(a)** male gametophyte is to female gametophyte.
Explanation: Pollen grain carries male gametes so it represents the male gametophyte and the embryo sac carries egg or female gamete so it represents the female gametophyte.

109. **(a)** treating the plants with low concentrations of gibberellic acid and auxins.
**Explanation:** Parthenocarpy can be induced through the application of growth hormones.

110.

(d) Both Mustard and Argemone
Explanation: In parietal placentation, the ovules develop on the inner wall of the ovary or on the peripheral part. Ovary is one-chambered but it becomes two-chambered due to the formation of the false septum, e.g., mustard and Argemone. Free central placentation is found in Primrose, the ovules develop on the central axis of the ovary and the septum is absent in this type of placentation.

111.

(d)
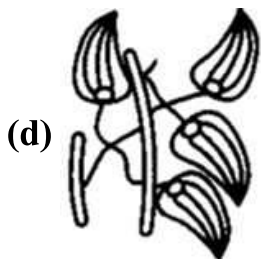
Explanation: In tendrillar petiole, petiole is tendrillar in nature and helps the plant to climb up as in clematis and Nepenthes. The petiole, rachis and the stalk of the leaflets (petiolule) in clematis are sensitive to contact and can coil around the support to help the plant in climbing. Such tendrils are known as rachis and petiolule tendrils.

112.

(c) Many xylem bundles
Explanation: Dicot root is diarch to hexarch (no. of vascular bundle is 2 to 6), while in monocot polyarch (no. of vascular bundle is numerous, i.e., 6 to many) conditions is present. So, the monocot root has many xylems and phloems in comparison with the dicot root. Vascular bundles are radial in dicot root where xylem and phloem occur in separate patches and are arranged on alternate radii whereas, in monocot root radial arrangement of vascular bundle, xylem and phloem form an equal number of separate bundles.

113. **(a)** (C)
Explanation: (C)

114.

(b) GUG
Explanation: GUG

115.

(c) Lactose would not be converted into the inducer and the operon could not be induced.

Explanation: A low level of lac Z expression is required for the conversion of lactose to the inducer, allolactose.

116.

(b) 1-Inactive repressor, 2-β-Galactosidase, 3-Permease, 4-Transacetylase

Explanation: 1-Inactive repressor, 2-β-Galactosidase, 3-Permease, 4-Transacetylase

117.

(b) (i), (ii), (iv) and (vi)

Explanation: (i), (ii), (iv) and (vi)

118. **(a)** Four

Explanation: Four

119. **(a)** Allergic reaction of the mast cells in the lungs

Explanation: Allergy is due to the release of chemicals like histamine and serotonin from the mast cells.

120. **(a)** Aedes

Explanation: These pathogens of typhoid generally enter the small intestine through food and water contaminated with them and migrate to other organs through blood. Sustained high fever (39° to 40°C), weakness, stomach pain, constipation, headache, and loss of appetite are some of the common symptoms of this disease. Intestinal perforation and death may occur in severe cases.

121.

(b) (A) - (ii), (B) - (i), (C) - (iii), (D) - (iv)

Explanation: (A) - (ii), (B) - (i), (C) - (iii), (D) - (iv)

122. **(a)** Tropical rain forest

Explanation: Tropical rain forest

123.

(c) the rate of conversion of light into chemical energy in an ecosystem.

Explanation: Primary Productivity (PP) is defined as the rate at which radiant energy is converted by the photosynthetic and chemosynthetic autotrophs to organic substances.

124.

(d) Molasses

Explanation: Molasses

125.

(d) Nilgiri Tahr

Explanation: Nilgiri Tahr

126.

(b) Quantifying the species genome

Explanation: Quantifying or measuring the species genome does not help to recognise biodiversity. Biodiversity is the variety of plant and animal life found in a particular habitat.

127.

(d) A - Minimum diversity, B - Greater diversity, C - Maximum diversity

Explanation: A, B and C respectively show minimum, greater and maximum diversity.

Since the number of individuals in all the three boxes are same but the variety of animals in all the boxes are different, like box A shows diversity of single animal - bird, box B shows diversity of birds and mammals whereas box C shows diversity of three animals - birds, mammals and insects.

128.

(c) Statement (a) is correct.

Explanation: Metaphase is the stage of mitosis where the highly coiled chromosome align in the middle of cell.

129. **(a)** Anaphase - II

Explanation: Anaphase II: It begins with the simultaneous splitting of the centromere of each chromosome, now individual chromosomes allow to move toward opposite poles of the cell.

130.

(d) C_3-Maize

Explanation:

- Maize is C_4-plant C_4-plant have Kranz type anatomy of leaves.
- PGA (3-phosphoglyceric acid) is found during the Calvin cycle.
- OAA (Oxalo Acetic Acid) a 4C compound is formed during Hatch and Slack cycle (C_4 cycle).

131. **(a)** Effect of light intensity on photosynthesis-rate of photosynthesis

Explanation: Effect of light intensity on photosynthesis-rate of photosynthesis

132.

(b) Oxygen

Explanation: In the case of photosynthesis, oxygen is never a limiting factor, because oxygen is a bi-product released after photosynthesis and never an element required for photosynthesis.

133.

(b) Mn, Cl, and Ca ions.

Explanation: Photolysis of water occurs in the oxygen-evolving complex associated with PS II. This protein-bound inorganic complex contains cofactors: four manganese (Mn) ions, calcium ions and chloride ions.

134.

(c) Only C

Explanation: Carbohydrate - 1, Fat - 0.7, Protein - 0.9

135.

(d) More amount of auxin in apical bud.

Explanation: Apical dominance is the phenomenon by which presence of apical bud does not allow the nearby lateral buds to grow by releasing auxins. When the apical bud is removed, the lateral buds sprout. When a plant is decapitated, i.e., its apical bud is removed then the lateral buds sprout, resulting in dense bushy growth. This phenomenon is widely used in the tea plucking and hedge making.

BOTANY (Section-B)

136.

(d) Perception of events happening in the environment and their memory

Explanation: The most obvious and technically complicated feature of all living organisms is this ability to sense their surroundings or environment and respond to these environmental stimuli which could be physical, chemical or biological. We sense our environment through our sense organs. Plants respond to external factors like light, water, temperature, other organisms, pollutants, etc. All organisms, from the prokaryotes to the most complex eukaryotes can sense and respond to environmental cues. Hence, the correct option is the Perception of events happening in the environment and their memory.

137.

(c) DNA or RNA

Explanation: Viruses that infect animals have either single or double-stranded RNA or double-stranded DNA. No virus contains both RNA and DNA.

138.

(d) Ectocarpus

Explanation: Ectocarpus belongs to the class Phaeophyceae. They are very simple branched, filamentous, and represented by kelps. It stores food as complex carbohydrates in the form of larninarin or mannitol.

139.

(d) Hemitropous

Explanation: Hemitropous

140.

(b) All of these

Explanation: Seed performs all the function.

141.

(d) Heterozygous carrier

Explanation: Heterozygous carrier

142.

(d) AUG

Explanation: AUG

143.

(d) Suspending cellular structures and providing a place for cellular functions to take place.

Explanation: The cytoplasm is a jelly-like substance found inside the cell membrane that suspends all of the cell's internal structures. It also provides a location for many metabolic reactions (such as protein synthesis) to take place.

144.

(b) Chain and Florey

Explanation: In 1939, Ernst Chain, a biochemist who had fled to Britain from Nazi Germany, came across Alexander Fleming's published work on penicillin. He was greatly interested and soon began working on isolating penicillin. Together with lab supervisor Howard Florey, he isolated the antibacterial agent in greater quantity than Fleming had been able to achieve and then tested the extract by injecting it into two mice that had been infected with a bacterial disease.

Ernst Chain was the driving force behind isolating and testing penicillin, but when it came

to manufacturing on a large scale, it was Howard Florey who made more of a contribution, by locating several U.S. companies which were willing to provide resources when U.K. factories were occupied with the war effort.

145. **(a)** The citric acid cycle

Explanation: The citric acid cycle provides most of the electron carriers for the electron transport chain.

146. **(a)** Actinomycetes

Explanation: Actinomycetes

147.

(d) Pyramid of biomass in an aquatic ecosystem.

Explanation: Pyramid of biomass in an aquatic ecosystem.

148.

(d) Cytokinin

Explanation: Presence of cytokinin in an area causes preferential movement of nutrients towards it. When applied to lateral buds, they help in their growth despite the presence of apical bud. Thus, they act antagonistically to auxin.

149. **(a)** Localized growth centres and Indefinite life span

Explanation: Localized growth centres and Indefinite life span

150.

(c) Both surface area of leaf decreases and stomata close and CO_2 cannot enter inside the leaf

Explanation: Water is one of the reactants in the light reaction but its availability affects the plant, rather than directly affecting the photosynthesis. Water stress causes the stomata to close hence, reducing the CO_2 availability. Also, it makes the leaves to wilt which reduces the surface area of the leaves available for photosynthesis.

ZOOLOGY (Section-A)

151.

(d) A-Nerve cord, B-Notochord, C-Post-anal tail, D-Gill slits.

Explanation: The given figure shows the internal organisation of a hypothetical chordate. It possesses notochord (B) either during early embryonic stage or throughout life. The notochord lies ventral to nerve cord (A). It possesses a post anal tail (C) and paired pharyngeal gill slits (D).

152.

(b) It is ejected on contact and pierce the prey

Explanation: Cnidocytes are the stinging cells present on the tentacles of Hydra. These cells get activated by touch, chemicals present in water, vibration or nerve impulse in the organism itself and discharge nematocysts at prey or predator causing its paralysis or death. Once discharged, cnidocytes and nematocysts are not reused and new ones are formed immediately by cell division in an interstitial cell of the epidermis. Hence, nematocysts are ejected from cnidoblasts on contact and pierce the prey.

153. **(a)** Scales on their hind limbs

Explanation: The hind limbs of birds have scales that are modified for walking, swimming, or clasping the tree branches. The body of reptiles is also covered by dry and

cornified skin, epidermal scales or scutes. This feature indicates that birds have reptilian ancestry.

154.

(b) Keratin

Explanation: Keratin

155.

(b)

Figure	1	2
Cartilage	Collagen	Chondrocytes

Explanation: The given figure represents the image of cartilage. Cartilage is an important structural component of the body. It is a firm tissue but is softer and much more flexible than bone. It is a Connective tissue found in joints between bones e.g. the elbows, knee and ankles; ends of the ribs; between the vertebrae in the spine; ears and nose; bronchial tubes or airways. Cartilage is made up of specialised cells called chondrocytes (B). These chondrocytes produce large amounts of extracellular matrix composed of collagen (A) fibres, proteoglycan, and elastin fibres. There are no blood vessels in cartilage to supply the chondrocytes with nutrients.

156. **(a)** Dissolved in plasma

Explanation: About 70% of carbon dioxide molecules that are dissolved in blood is transported to lungs as bicarbonates. Carbon dioxide diffuses into capillaries and then to bloodstream and bicarbonate is produced in erythrocytes. Enzyme carbonic anhydrase causes carbon dioxide and water to form carbonic acid which dissociates into bicarbonate and hydrogen ion.

157.

(d) Oxygen

Explanation: Oxygen

158.

(c) Rectangular hyperbola

Explanation: Rectangular hyperbola

159.

(c) Decreased partial pressure of oxygen

Explanation: Altitude sickness (also known as mountain sickness), is caused by gaining altitude too rapidly, which does not allow the body enough time to adjust to reduced oxygen and changes in air pressure and causes hypobaric hypoxia (a lack of oxygen reaching the tissues of the body).

160.

(c) Only D

Explanation: All of these

161.

(b) Statement (d) is correct.

Explanation: Both LH and FSH attain a peak level during ovulatory phase. Oogenesis starts during the embryonic development stage when a couple of million oogonia are

formed within each foetal ovary; no more oogonia are formed and added after birth. These cells start division and enter into prophaseI of the meiotic division and get temporarily arrested at that stage. Sperms released from seminiferous tubules are non-motile.

162. **(a)** Atresia

Explanation: Atresia

163.

(c) glandular

Explanation: The mammary glands contain glandular tissue and variable amount of fat.

164.

(b) (ii) and (iii)

Explanation: (ii) and (iii)

165.

(d) (b) and (c) only

Explanation: Some diseases are transmitted through sexual intercourse. Such diseases are called sexually transmitted diseases or venereal diseases. It can spread by the transfusion of blood from an infected person to a healthy person and from an infected mother to a fetus.

166.

(d) Homo erectus

Explanation: Homo erectus

167. **(a)** Saltation

Explanation: Saltation

168. **(a)** Left kidney at a higher level than the right one

Explanation: The kidney is retroperitoneal, located in the abdominal cavity. The left kidney is slightly elevated than right kidney due to the larger size of the liver on the right side of the body. The ribs and muscles of the back protect the kidneys from external damage. Adipose tissue known as perirenal fat surrounds the kidneys and acts as protective padding. So, the correct answer is 'Left kidney at a higher level than the right one'.

169. **(a)** Na^+

Explanation: The ascending limb of the loop of Henle is a segment of the nephron in the kidney divided into a thin and thick ascending limb. The thin ascending limb is impermeable to water and ions, except sodium and chloride, which cross by diffusion. In the thick ascending limb, sodium (Na^+), potassium (K^+), and chloride (Cl^-) ions are reabsorbed by active transport.

170. **(a)** Urea

Explanation: Ornithine cycle occurs in the liver where the deamination of the amino acids makes ammonia which further is converted into urea. Hence, urea is the end product of ornithine cycle which is excreted out by the kidneys.

171. **(a)** Upper arm

Explanation: Upper arm

172.

(d) Ca^{2+}

Explanation: The action potential in the sarcolemma causes the release of Ca^{2+} ions in the

sarcoplasm. Increase in the Ca^{2+} level leads to the binding of Ca^{2+} with a sub unit of troponin on the actin filaments and thereby removing the masking of actin sites for myosin.

173.

(c) Only C

Explanation: Joint between atlas and axis is a pivot joint, a type of synovial joint. Synovial joints are characterised by presence of fluid filled cavity between the articulating surface of the two bones.

174.

(b) Ventral root

Explanation: Ventral root

175. **(a)** Learning and memory

Explanation: Learning and memory

176. **(a)** Medulla oblongata

Explanation: Hypothalamus is the region of the forebrain in the floor of the third ventricle, linked with the thalamus above and the pituitary gland below. It contains important control temperature (at $37^{o}C$), It functions as a centre for the integration of hormonal and autonomic nervous activity through its control o fthe pituitary secretions.

177.

(c) 3-carries oxytocin and vasopressin to pituitary gland

Explanation: 3-carries oxytocin and vasopressin to pituitary gland

178.

(b) no ducts.

Explanation: Endocrine glands lack ducts and pass their secretions into the surrounding blood for transport to the site of action. They are also called the ductless glands. Their secretions are known as hormones.

179.

(c) 6-maintains AMI

Explanation: 6-maintains AMI

180.

(b) Four-chambered heart- Birds and mammals

Explanation: Fishes have two-chambered hearts. Amphibians and reptiles have three chambered hearts. Birds and mammals have four chambered hearts.

181.

(d) Pacemaker

Explanation: A patch of nodal tissue is present in the right upper comer of the right atrium called the sino-atrial node (SAN) and it is responsible for initiating and maintaining the rhythmic contractile activity of the heart. Therefore, it is called the pacemaker.

182. **(a)** Statement (iv) is incorrect.

Explanation: When cut by the same restriction enzyme, the resultant DNA fragments have the same kind of 'sticky ends' and, these can be joined together (end-to-end) using DNA ligases.

183.

(b) When a piece of foreign DNA gets integrated into the genome of the recipient, it may
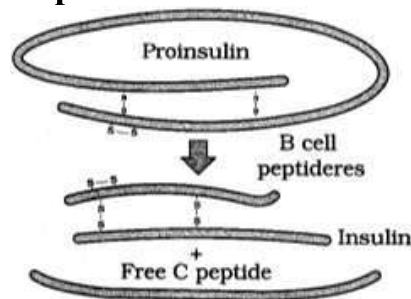
multiply.
Explanation: When a piece of foreign DNA gets integrated into the genome of the recipient, it may multiply.

184.

(d) maturation of proinsulin into insulin.
Explanation: Maturation of pro insulin into insulin by removal of C-peptide.

185.

(c) fertilisers and pesticides
Explanation: Agrochemical based agriculture is used to increase the food production. It includes use of agrochemicals such as fertilisers and pesticides.

ZOOLOGY (Section-B)

186.

(d) Torpedo
Explanation: Torpedo produces electric current. Torpedo is commonly known as electric ray. It has a pair of electric organs formed from metamorphosed muscles, they lie between the head and pectoral fins and run through the entire thickness of the body, they receive nerves from an electric lobe of the medulla, they give a powerful electric shock of about 100 volts.

187. **(a)** Connective tissue
Explanation: Connective tissues are the most abundant and widely distributed in the body of complex animals. They are named connective tissues because of their special function of linking and supporting other tissues/organs of the body.

188. **(a)** With irregularity in the heart rhythm
Explanation: Artificial pacemakers are electronic devices that restore a normal rhythm. Hence, an artificial pacemaker provides an electrical impulse (discharge) that can stimulate the heart, thus restoring or maintaining a regular heartbeat.

189.

(d) Pregnant females
Explanation: Pregnant females

190.

(d) A - (iii), B - (iv), C - (ii), D - (i)
Explanation: Rete testis carries sperms from the seminiferous tubules (where sperms are produced through meiosis) of the testes into the vasa efferentia. Leydig cells synthesise and secrete testicular hormones called androgens. The penis is the male external genitalia that facilitates insemination.

191.

(d)

Explanation: The images in options represent the condoms for female and male, respectively. Condoms are barriers made of thin rubber or latex sheath that are used to cover the penis in the male or vagina and cervix in the female, just before coitus so that the ejaculated semen does not enter the female reproductive tract. The image in option represents an IUD, copper T which is inserted by doctors or expert nurses in the uterus through vagina. The image in option represents the implants which are tiny, thin rods placed under the skin.

192.

(b) Oparin and Haldane

Explanation: Oparin and Haldane

193. **(a)** D-Adrenal gland-Secrete catecholamines which stimulate glycogen breakdown.

Explanation: D-Adrenal gland-Secrete catecholamines which stimulate glycogen breakdown.

194. **(a)** 8 bones

Explanation: 8 bones

195.

(d) Unable to speak

Explanation: Unable to speak

196.

(b) Pars distalis, pars intermedia and pars nervosa

Explanation: Pars distalis, pars intermedia and pars nervosa

197.

(d) A

Explanation: Pituitary is the master of endocrine gland.

198.

(c) Statement (d) is correct.

Explanation: In a standard ECG, a patient is connected to the machine with three electrical leads, one to each wrist and one to the left ankle.

199.

(b) lysozyme

Explanation: Lysozyme is capable of breaking the chemical bonds in the outer cell wall of the bacteria. Bacterial cell walls contain a layer of peptidoglycan, which is the specific site that lysozyme targets.

200. **(a)** Either RNA or DNA

Explanation: ss DNA or ss RNA attached with the probe is allowed to hybridised with its complementary DNA.