NEET (UG) 2024

SAMPLE PAPER - 10

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 method of dimensional analysis: **[4]**

   a) can be applied

   b) both can be applied and depends upon factors involved

   c) depends upon factors involved

   d) cannot be applied

2. The physical quantity denoted by $\frac{mass \times pressure}{density}$ is: **[4]**

   a) work

   b) force

   c) angular momentum

   d) momentum

3. A bus starts moving with acceleration 2 ms^{-2}. A cyclist 96 m behind the bus starts simultaneously towards the bus at 20 m/s, After some time the bus will be left behind. If the bus continues moving with the same acceleration, after what time from the beginning, the bus will overtake the cyclist? **[4]**

   a) 10 s

   b) 12 s

   c) 16 s

   d) 14 s

4. If a unit vector is represented by $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$, then the value of c is: **[4]**

a) $\sqrt{0.11}$

b) $\sqrt{0.01}$

c) 1

d) $\sqrt{0.39}$

5. An object is thrown along a direction inclined at an angle of 45^{o} with the horizontal direction. The horizontal range of the particle is equal to: **[4]**

a) vertical height

b) twice the vertical height

c) four times the vertical height

d) thrice the vertical height

6. A bullet when fired at a target has its velocity decreased to 50% after penetrating 30 cm into it. Then, the additional thickness it will penetrate before coming to rest is: **[4]**

a) 10 cm

b) 30 cm

c) 40 cm

d) 60 cm

7. A rope ladder with a length l carrying a man with a mass m at its end is attached to the basket of a balloon with a mass M. The entire system is in equilibrium in the air. As the man climbs up the ladder into the balloon, the balloon descends by a height h. Then, the potential energy of the man is: **[4]**

a) increases by mg(l - h)

b) increases by mgh

c) increases by 2mgh

d) increases by mg(2l - h)

8. A weightlifter lifts a weight off the ground and holds it up: **[4]**

i. work is done in lifting as well as holding the weight

ii. no work is done in both lifting and holding the weight

iii. work is done in lifting the weight but no work is required to be done in holding it up

iv. no work is done in lifting the weight but work is required to be done in holding it up

a) i and ii

b) only iii

c) iv and i

d) ii and iii

9. A pulley fixed to the ceiling carries a string with blocks of mass m and 3 m attached to its ends. The masses of string and pulley are negligible. When the system is released, its centre of mass moves with what acceleration? **[4]**

a) $-\frac{g}{2}$

b) 0

c) $-\frac{g}{4}$

d) $\frac{g}{2}$

10. A mass m hangs with the help of a string wrapped around a pulley on a frictionless bearing. The pulley has mass m and radius R. Assuming pulley to be a perfect uniform circular disc, the acceleration of the mass m, if the string does not slip on the pulley, is: **[4]**

a) $\frac{2}{3}g$

b) $\frac{g}{3}$

c) g

d) $\frac{3}{2}g$

11. At the surface of a certain planet acceleration due to gravity is one-quarter of that on the earth. If a brass ball is transported to this planet, then which one of the following statements is not correct? **[4]**

i. The mass of the brass ball on this planet is a quarter of its mass as measured on the earth.

ii. The weight of the brass ball on this planet is a quarter of the weight as measured on the earth.

iii. The brass ball has the same mass on the other planet as on the earth.

iv. The brass ball has the same volume on the other planet as on the earth.

a) iii and iv

b) only i

c) ii and iii

d) iv and i

12. One end of a uniform rod of mass M and cross-sectional area **A** is suspended from a rigid support and an equal mass M is suspended from the other end. The stress at the mid-point of the rod is **[4]**

a) $\frac{3Mg}{2A}$

b) $\frac{2Mg}{A}$

c) $\frac{Mg}{A}$

d) $\frac{Mg}{2A}$

13. Which of the following has the highest specific-heat? **[4]**

a) Water

b) Copper

c) Hydrogen

d) Mercury

14. If the temperature of the sun is doubled, then: **[4]**

a) emission of energy will be doubled

b) emission of energy will become four times

c) mostly ultraviolet radiation will be emitted

d) mostly infrared radiation will be emitted

15. In the condensation of a gas the mean KE (K) and potential energy (U) of molecules change; thus: **[4]**

a) K decreases, U decreases

b) K keeps constant, U decreases

c) K increases, U keeps constant

d) K decreases, U increases

16. You are given samples of $1cm^3$ of H_2, $1cm^3$ of O_2 and $1cm^3$ of Cl_2, which are at NTP. The sample which has maximum number of molecules is: **[4]**

a) All have same values

b) O_2

c) H_2

d) Cl_2

17. A spring of force constant k is cut into two equal parts, which are then joined in parallel to each other. The force constant of the combination will be: **[4]**

a) 4 k

b) 2 k

c) $\frac{k}{2}$

d) k

18. A wave travelling through a medium shows initial shift (Δx) of 0.3 cm for small interval of time (Δt) of 0.5s. On further propagation, the wave shift decreases by the relation $\Delta x^2 - 0.5\Delta x$ and time interval is increased by the relation $\Delta t^2 - \frac{\Delta t}{2}$. What will be the velocity of wave for 6^{th} interval? **[4]**

a) 2.39 cm/s

b) 2.03 cm/s

c) 1.52 cm/s

d) 1.46 cm/s

19. The loudness and pitch of a sound note depends on: **[4]**

i. intensity and frequency

ii. frequency and number of harmonics

iii. intensity and velocity

iv. frequency and velocity

a) iv and i

b) ii and iii

c) iii and iv

d) only i

20. Three charges, each of value q, are placed at the comers of an equilateral triangle. A fourth charge Q is placed at the centre of the triangle. If Q = - q, then: **[4]**

a) the charges will remain stationary

b) the charges will move towards the centre

c) the charges will move away from the centre

d) the charges may move in any direction

21. A slab of dielectric constant K has the same cross sectional area as the plate of a parallel plate capacitor and thickness $\frac{3}{4}$d, where d is the separation of plates. **[4]**

The capacitance of the capacitor when the slab is inserted between the plates will be:
(Given C_0 = capacitance of capacitor with air as medium between plates.)

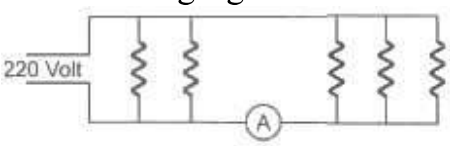
a) $\frac{K}{4+K}$

b) $\frac{4KC_0}{3+K}$

c) $\frac{3+K}{4KC_0}$

d) $\frac{3KC_0}{3+K}$

22. Five identical lamps, each of resistance 1100 ohm are connected to 220 volt as shown in the following figure. The reading of an ideal ammeter A is: **[4]**



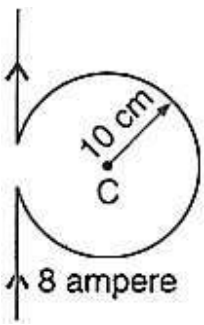
a) $\frac{220}{1100} \times 1\text{amp}$

b) $\frac{220}{1100} \times 5\text{ amp}$

c) $\frac{220}{1100} \times 2\text{ amp}$

d) $\frac{220}{1100} \times 3\text{amp}$

23. A long, straight wire is turned into a loop of radius 10 cm (see figure). If a current of 8 A is passed through the loop, then the value of the magnetic field and its direction at the centre C of the loop shall be close to: **[4]**



a) 3.4×10^{-5} newton/(amp-meter), upward

b) 5.0×10^{-5} newton/(amp-meter), upward

c) 1.6×10^{-5} newton/(amp-meter), downward

d) 1.6×10^{-5} newton/(amp-meter), upward

24. The susceptibility of a paramagnetic substance was found for different temperatures and a graph of χ against $\frac{1}{T}$ was plotted. From the graph, it was found that when $\chi = 0.5$, $\frac{1}{T} = 5 \times 10^{-3}$ /K. What is the Curie constant for the substance? **[4]**

a) 75 K
b) 125 K
c) 50 K
d) 100 K

25. The effective length of a magnet is 31.4 cm and its pole strength is 0.8 Am. The magnetic moment, if it is bent in the form of a semicircle is _____ Am^2. **[4]**

a) 1.2
b) 0.16
c) 1.6
d) 0.12

26. Two coils have a mutual inductance of 0.005 H. The current changes in first coil according to equation $I = I_0 \sin \omega t$ where $I_0 = 10$ A and $\omega = 100\pi$ radian/sec. The max value of emf in s coil is: **[4]**

a) π
b) 5π
c) 2π
d) 4π

27. Eddy currents may be reduced by using: **[4]**

a) thick piece of cobalt
b) thick piece of nickel
c) laminated core of soft iron
d) laminated core of steel

28. In a circuit L,C and R are connected in series with an alternating voltage source of frequency v. The current leads the voltage by 45^o. The value of C is: **[4]**

a) $\frac{1}{\pi v(2\pi vL - R)}$
b) $\frac{1}{2\pi v(2\pi vL + R)}$
c) $\frac{1}{2\pi v(2\pi vL - R)}$
d) $\frac{1}{\pi v(2\pi vL + R)}$

29. Match List-I (Electromagnetic wave type) with List-II (Its association/application) and select the correct option from the choices given below the lists: **[4]**

List-I	**List-II**
(P) Infrared waves	(i) To treat muscular strain
(Q) Radio waves	(ii) For broadcasting
(R) X-rays	(iii) To detect fracture of bones
(S) Ultraviolet rays	(iv) Absorbed by the ozone layer of the atomsphere

a) (P) - (iv), (Q) - (iii), (R) - (ii), (S) - (i)

b) (P) - (iii), (Q) - (ii), (R) - (iv), (S) - (i)

c) (P) - (i), (Q) - (ii), (R) - (iii), (S) - (iv)

d) (P) - (i), (Q) - (ii), (R) - (iv), (S) - (iii)

30. The refractive index of a piece of transparent quartz is greatest for: **[4]**

a) violet light

b) yellow light

c) red light

d) green light

31. The main difference in the phenomenon of interference and diffraction is that: **[4]**

a) diffraction is due to the interaction of light from the same wavefront, whereas the interference is the interaction of two waves derived from the same source

b) diffraction is caused by the reflected waves from a source whereas interference is caused due to refraction of waves from a source

c) diffraction is due to the interaction of light from the same wavefront whereas interference is the interaction of waves from two isolated sources

d) diffraction is due to the interaction of waves derived from the same source, whereas the interference is the bending of light from the same wavefront

32. An α particle and a proton are accelerated from rest by a potential difference of 200 V. **[4]**

After this, de Broglie wavelengths are λ_α and λ_P respectively. The ratio $\frac{\lambda_\rho}{\lambda_\alpha}$ is:

a) 8

b) 2.8

c) 3.8

d) 7.8

33. The stopping potential in the context of the photoelectric effect depends on the following property of incident electromagnetic radiation: **[4]**

a) Intensity

b) Frequency

c) Phase

d) Amplitude

34. The light coming from a commercial lighted mercury fluorescence tube consists of: **[4]**

a) emission lines of mercury only

b) emission lines of mercury and those of electrode material

c) emission lines of mercury atom with a few bands of Hg_2 only

d) emission lines of mercury with a continuous background

35. From the following equations, pick out the possible nuclear reaction: **[4]**

a) ${}^{12}_{6}C + {}^{1}_{1}H \rightarrow {}^{13}_{7}N + 2\ MeV$

b) ${}^{13}_{6}C + {}^{1}_{1}H \rightarrow {}^{14}_{6}C + 4.3\ MeV$

c) ${}^{14}_{7}N + {}^{4}_{2}He \rightarrow {}^{15}_{8}O + 7.3\ MeV$

d) ${}^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{140}_{54}X + {}^{94}_{38}Si + 2{}^{1}_{0}n + \gamma + 200\ MeV$

PHYSICS (Section-B)

Attempt any 10 questions

36. A particle of mass m is driven by a machine that delivers a constant power of k watts. If the particle starts from rest the force on the particle at time t is: **[4]**

a) $\frac{1}{2}\sqrt{mkt}^{\frac{-1}{2}}$

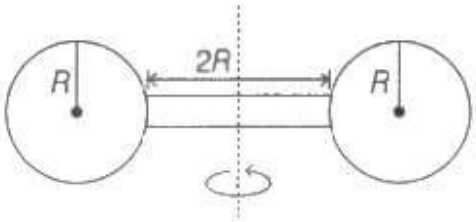
b) $\sqrt{mkt}^{\frac{-1}{2}}$

c) $\sqrt{2mkt}^{\frac{-1}{2}}$

d) $\sqrt{\frac{mk}{2}}t^{\frac{-1}{2}}$

37. Two identical spherical balls of mass M and radius R each are stuck on two ends of a rod of length 2R and mass M (see figure). The moment of inertia of the system about **[4]**

the axis passing perpendicularly through the centre of the rod is



a) $\frac{209}{15}MR^2$

b) $\frac{17}{15}MR^2$

c) $\frac{137}{15}MR^2$

d) $\frac{152}{15}MR^2$

38. A geostationary satellite is orbiting the earth at a height of 6R above the surface of the earth, where R is the radius of the earth. The time period of another satellite at a height of 2.5R from the surface of the earth is: **[4]**

a) 12 hrs

b) 4 hrs

c) 6 hrs

d) $6\sqrt{2}$ hrs

39. A black body has a maximum wavelength λ_m at 2000 K. Its corresponding wavelength at 3000 K will be: **[4]**

a) $\frac{81}{16}\lambda m$

b) $\frac{16}{81}\lambda m$

c) $\frac{3}{2}\lambda m$

d) $\frac{2}{3}\lambda m$

40. Light can travel in vacuum but not sound, because: **[4]**

a) sound waves are electromagnetic in nature

b) speed of sound is very much slower than light

c) light waves are not electromagnetic in nature

d) light waves are electromagnetic in nature

41. A wave is propagating along x-axis and another wave is propagating along y-axis. If they superimpose each other, the resultant wave will be: **[4]**

a) Circular

b) Straight line

c) Elliptical

d) Parabolic

42. A cell is connected between two points of a uniformly thick circular conductor and I_1 and l_2 are the currents flowing in two parts of the circular conductor of radius a. The magnetic field at the centre of the loop will be: **[4]**

a) $\frac{\mu_0}{4\pi}(I_1 - I_2)$

b) Zero

c) $\frac{\mu_0}{a}(I_1 + I_2)$

d) $\frac{\mu_0}{2a}(I_1 + I_2)$

43. A magnet is suspended in such a way that it oscillates in the horizontal plane. It makes 20 oscillations per minute at a place where the dip angle is 30^o and 15 oscillations per minute at a place where the dip angle is 60^o. The ratio of the total the earth's magnetic field at the two places is: **[4]**

a) $2\sqrt{3} : 9$

b) $4 : 9$

c) $16 : 9\sqrt{3}$

d) $3\sqrt{3} : 8$

44. The work is done in establishing current I in a coil of self-inductance L: **[4]**

a) $\frac{LI^2}{\sqrt{2}}$

b) $\sqrt{2}LI^2$

c) LI^2

d) $\frac{LI^2}{2}$

45. A 10 ohm resistance, 5 mH coil and 10 μF capacitor are joined in series. When a suitable frequency alternating current source is joined to the combination the circuit resonates. If the resistance is halved, the resonance frequency: **[4]**

a) remains unchanged

b) is quadrupled

c) is halved

d) is doubled

46. A transparent sphere of radius R has a cavity of radius $\frac{R}{2}$ as shown in figure. Find the refractive index of the sphere if a parallel beam of light falling on left surface focuses at point P: **[4]**

a) $\mu = \frac{1 + \sqrt{5}}{2}$

b) $\mu = \frac{3 - \sqrt{5}}{2}$

c) $\mu = 3 + \sqrt{5}$

d) $\mu = \frac{3 + \sqrt{5}}{2}$

47. At what angle will a ray of light be incident on one face of an equilateral prism, so that the emergent ray may graze the second surface of the prism ($\mu = 1.5$)? **[4]**

a) 32^o

b) 38^o

c) 28^o

d) 18^o

48. The de-Broglie wavelength of a neutron in thermal equilibrium with heavy water at a temperature T (Kelvin) and mass m, is: **[4]**

a) $\frac{2h}{\sqrt{mKT}}$

b) $\frac{h}{\sqrt{3mKT}}$

c) $\frac{2h}{\sqrt{3mKT}}$

d) $\frac{h}{\sqrt{mKT}}$

49. When white light is passed through the hydrogen gas at room temperature, absorption lines will be observed in: **[4]**

a) Neither in Lyman series nor in Balmer series

b) Both Lyman and Balmer series

c) Lyman series

d) Balmer series

50. Two isotopes $_{92}U^{238}$ and $_{92}U^{235}$ occur in nature in the ratio 138: 1. Assume that in the beginning, i.e., at the time of formation of the earth they were present in equal numbers. If the half-value periods for the two isotopes are 4.5×10^{10} years and 7.1×10^{8} years respectively, then the age of the earth is approximate: (given $\log_e 138 = 4.911$) **[4]**

a) 6×10^{7} years

b) 6×10^{8} years

c) 6×10^{9} years

d) 6×10^{6} years

CHEMISTRY (Section-A)

51. The number of atoms present in one mole of an element is equal to the Avogadro number. Which of the following elements contains the greatest number of atoms? **[4]**

a) 4 g He

b) 12 g He

c) 46 g Na

d) 0.40 g Ca

52. The difference in angular momentum associated with the electron in two successive orbits of hydrogen atom is: **[4]**

a) $\frac{h}{2}$

b) $\frac{h}{2\pi}$

c) $\frac{(n-1)h}{2\pi}$

d) $\frac{h}{\pi}$

53. Which of the following elements have same value of principal quantum number (n) for their valence shell? **[4]**

i. The first element of group 16.

ii. The element having atomic number 16.

iii. The most electronegative element in the periodic table.

iv. The third element of group 2.

a) (iii) and (iv)

b) (i) and (ii)

c) (i) and (iii)

d) (ii) and (iv)

54. The correct order of dipole moment is: **[4]**

A. $CH_3F < CH_3Cl < CH_3Br < CH_3I$

B. $CH_3Cl > CH_3F > CH_3Br > CH_3I$

C. $CH_3F > CH_3Cl > CH_3Br > CH_3I$

D. $CH_3Cl > CH_3F > CH_3I > CH_3Br$

a) A

b) B

c) D

d) C

55. The pair of compounds having similar geometry are: **[4]**

a) BCl_3, PCl_3

b) BF_3, $CH3^+$

c) BF_3, NF_3

d) BeF_2, H_2O

56. Of the species, NO, NO^+, NO^{2+} and NO^-, the one with minimum bond strength is: **[4]**

a) NO^+

b) NO^{2+}

c) NO^-

d) NO

57. Consider the reactions given below. On the basis of these reactions find out which of the algebric relations is correct? **[4]**

i. $C_{(graphite,\ s)} + 4H_{(g)} \longrightarrow CH_{4(g)}$; $\Delta_r H = x$ kJ mol^{-1}

ii. $C_{(graphite,\ s)} + 2H_{2(g)} \longrightarrow CH_{4(g)}$; $\Delta_r H = y$ kJ mol^{-1}

a) $x = 2y$ b) $x < y$

c) $x = y$ d) $x > y$

58. The percentage of pyridine (C_5H_5N) that forms pyridinium ion ($C_5H_5N^+H$) in a 0.10 M aqueous pyridine solution (K_b for $C_5H_5N = 1.7 \times 10^{-9}$) is: **[4]**

a) 1.6 % b) 0.77 %

c) 0.0060 % d) 0.013 %

59. Which of the following is true? **[4]**

$0\,^\circ C$

i. Reaction $F_2 + H_2O \longrightarrow HF + HOF$ is intermolecular redox reaction

ii. F_2 forms only one oxoacid

iii. Oxidation number of oxygen in HOF is zero

iv. All of these

a) only iv b) only ii

c) i and ii d) iii and iv

60. The oxidation states of sulphur in the anions SO_3^{2-}, $S_2O_4^{2-}$ and $S_2O_6^{2-}$ follow the order: **[4]**

a) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$ b) $S_2O_6^{2-} < S_2O_3^{2-} < S_2O_4^{2-}$

c) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$ d) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$

61. Artificial gem used for cutting glass is: **[4]**

a) graphite

b) diamond

c) SiC

d) $CaCN_2$

62. Which of the following representations is correct? **[4]**

A. ${}_6C^{12}\left({}_1H^1, {}_0n^1\right){}_7N^{13}$

B. ${}_{25}Mn^{55}(n, p)\ {}_{25}Mn^{56}$

C. ${}_{20}Ca^{40}(p, n)\ {}_{21}Sc^{40}$

D. ${}_4Be^5(p, n)\ {}_3Li^6$

a) (D) Only

b) (C) Only

c) (A) Only

d) (B) Only

63. Arrange the following compounds in decreasing order of acidity: **[4]**
$C_6H_5CH_2(P)OH,\ C_6H_5C(Q)OOH, C_6H_5O(R)CH, C_6H_5O(S)H$

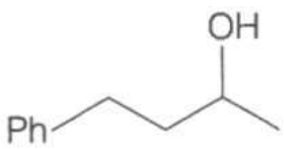
a) Q > S > P > R

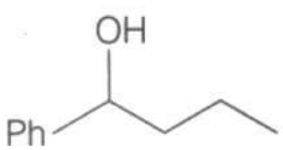
b) Q > P > S > R

c) R > Q > S > P

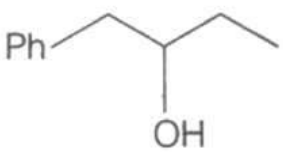
d) P > Q > R > S

64. Heating of 2-chloro-1 -phenyl butane with E_tOK/E_tOH gives X as the major product. **[4]**
Reaction of X with $Hg(OAc)_2/H_2O$ followed by $NaBH_4$ gives Y as the major product.
Y is

a) 

b) 

c) 

d) 

65. The Cl — C — Cl angle in 1, 1, 2, 2-tetra chloroethene and tetrachloromethane respectively will be about: **[4]**

a) 90° and 109.5°

b) 109.5° and 120°

c) 120° and 109.5°

d) 109.5° and 90°

66. If 8 g of a non-electrolyte solute is dissolved in 114 g of n-octane to reduce its vapour pressure to 80%, the molar mass (in g mol^{-1}) of the solute is: [Given that molar mass of n-octane is 114 g mol^{-1}] **[4]**

a) 40 b) 80

c) 20 d) 60

67. Calculate ppm concentration of sodium ions in 0.02 M NaCl. **[4]**

a) 920 ppm b) 1170 ppm

c) 200 ppm d) 460 ppm

68. Nernst equation is: $E = E^o - \frac{RT}{nF}$ in Q. If $Q = K_c$ then which one is not correct? **[4]**

a) E = zero b) $\frac{RT}{nF}$ in $Q = E^o$

c) $K_c = e^{\frac{nE^\circ F}{RT}}$ d) $E = E^o$

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

i. The potential energy of the activated complex is greater than the potential energy of either reactants or products.

ii. The potential energy of the activated complex is less than the potential energy of either reactants or products.

iii. The enthalpy of the product is greater than the enthalpy of the reactant in endothermic reactions.

iv. The enthalpy of the product is less than the enthalpy of the reactant in exothermic reactions.

a) Option (ii) b) Option (i)

c) Option (iii) d) Option (iv)

70. For a first order reaction, A $\rightarrow$ P, $t_{\frac{1}{2}}$ (half-life) is 10 days. The time required for $\frac{1}{4}^{th}$ **[4]**

conversion of A(in days) is: (In 2 = 0.693, In 3 = 1.1).

a) 3.2 b) 2.5

c) 5 d) 4.1

71. **Mischmetal** alloy does not contain: **[4]**

a) S, C, Ca and Al traces b) iron ($\sim$ 5 %)

c) lanthanoid metal ($\sim$ 95%) d) Mg traces

72. The number of bonds between sulphur and oxygen atoms in and the number of bonds between sulphur and sulphur atoms in rhombic sulphur, respectively, are: **[4]**

a) 8 and 6 b) 4 and 8

c) 8 and 8 d) 4 and 6

$4KOH, O_2$ **[4]**

73. A $\longrightarrow$ 2 B (Green) + $2H_2O$

4HCl

B $\longrightarrow$ 2C(Purple) + MnO_2 + $2H_2O$

H_2O, KI

2C $\longrightarrow$ $2A + KOH + D$

In the above sequence of reactions, A and D, respectively, are:

a) MnO_2 and KIO_3 b) KI and $KMnO_4$

c) KIO_3 and MnO_2 d) KI and K_2MnO_4

74. Aqueous solution of Ni^{2+} contains $[Ni(H_2O)_6]^{2+}$ and its magnetic moment is 2.83 B.M. When ammonia is added in it, comment on the magnetic moment of the solution: **[4]**

a) It decreases from 2.83 B.M.

b) It will remain same

c) It increases from 2.83 B.M.

d) It cannot be predicted theoretically

75. Which of the following has the longest C—O bond length? (Free C—O bond length in CO is 1.128$\overset{o}{A}$) **[4]**

a) $[Mn(CO)_6]^+$

b) $[Fe(CO)_4]^{2-}$

c) $Ni(CO)_4$

d) $[Co(CO)_4]^-$

76. Predict the IUPAC name of $(CH_3)_3CCH = C(Br)C_6H_4Cl$-p. **[4]**

a) 1 -Bromo-1-(4-Chlorophenyl)-3, 3-dimethylbut-1-ene

b) 4-(1-Bromodimethylbutyl)-1-chlorobenzene

c) 1-Chloro-4-(1-Bromobutyl)-benzene

d) 4-Bromo-4-(4-chlorophenyl)-3-methylpent-4-ene

77. The IUPAC name of $CH_3OC_2H_5$ is: **[4]**

a) methyl ethyl ether

b) ethyl methyl ether

c) methoxyethane

d) ethoxymethane

78. The IUPAC name of $OHC - CH = CH - CH - CH = CH_2$ is: **[4]**

$CH_2CH_2CH_2CH_3$

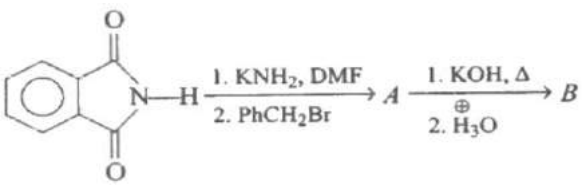
a) 3-methyl-2-ethylpentane

b) 2-vinyloct-5-ene-8-al

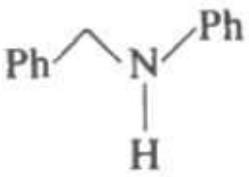
c) 4-butyl-2, 5-hexadien-1-al

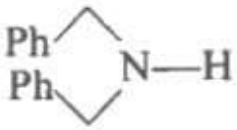
d) 5-vinyloct-3-en-1-al

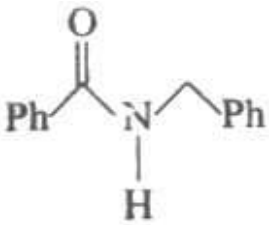
79. **[4]**



The end product B of the above reaction is:

a) 

b) 

c) 

d) 

80. The naturally occurring amino acid that contains only one basic functional group in its chemical structure is **[4]**

a) lysine

b) histidine

c) arginine

d) asparagine

81. Glucose is hydrolysed by an enzyme zymase into: **[4]**

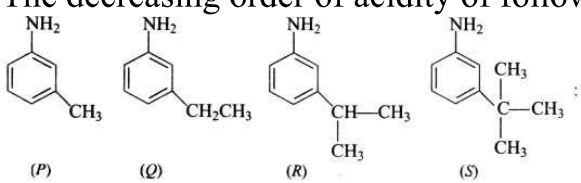
a) dicarboxylic acid

b) alcohol

c) aromatic acid

d) amino acid

82. The decreasing order of acidity of following benzoic acid derivatives is **[4]**



(P) (Q) (R) (S)

a) R > Q > P > S

b) S > P > R > Q

c) P > Q > R > S

d) S > R > Q > P

83. The standard e.m.f. of a galvanic cell involving cell reaction with n = 2 is found to be 0.295V at 25^{o}C. The equilibrium constant of the reaction would be: (Given F = 96500 C mol^{-1}, R = 8.314 JK^{-1} mol^{-1}) **[4]**

a) 1.0×10^{2}

b) 2.0×10^{11}

c) 1.0×10^{10}

d) 4.0×10^{12}

84. Sugar containing an impurity of common salt can be purified by crystallization from **[4]**

a) Water

b) Benzene

c) Ethanol

d) Petroleum ether

85. Identify the formula of potash alum. **[4]**

a) $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

b) $KCl \cdot MgCl_2 \cdot 6H_2O$

c) $2KAl(SO_4)_2 \cdot 12H_2O$

d) Both $2KAl(SO_4)_2 \cdot 12H_2O$ and $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

CHEMISTRY (Section-B)

Attempt any 10 questions

86. In BClBr I molecule, the maximum % s-character provided from the central atom is in bond: **[4]**

a) cannot be predicted

b) B—Cl

c) B—I

d) B—Br

87. In which of the following compounds, an element exhibits two different oxidation states? **[4]**

a) NH_4NO_3

b) N_3H

c) NH_2OH

d) N_2H_4

88. BaC_2 when heated with N_2 gas, produces: **[4]**

a) $Ba(CN)_2$

b) Ba_3N_2

c) Ba_2C_3

d) $BaCN_2$

89. After the filling of np-orbitals next orbital filled will be: **[4]**

a) ns

b) (n - 1)d

c) nd

d) (n + 1)s

90. Suppose 10^{-17} J of light energy is needed by the interior of human eye to see an object. The photons of green light (λ = 550 nm) needed to see the object are: **[4]**

a) 28

b) 29

c) 27

d) 30

91. An aqueous solution of borax is: **[4]**

a) neutral
b) basic
c) acidic
d) amphoteric

92. The rate constant for the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ is 3.0×10^{-5} sec^{-1}, if the rate is 2.40×10^{-5} mol $litre^{-1}$ sec^{-1}, then the concentration of N_2O_5 (mol $litre^{-1}$) is: **[4]**

a) 0.04
b) 1.4
c) 0.8
d) 1.2

93. Electrolysis of aqueous $MnSO_4$ solution is used to prepare MnO_2: $Mn \longrightarrow Mn^{4+} + 2e$ On passing a current of 26.8 ampere for 2 hour, 43.5 g MnO_2 is formed. The current efficiency is: (Atomic mass of Mn = 55) **[4]**

a) 25%
b) 83%
c) 75%
d) 50%

94. For the following electrochemical cell at 298 K, Pt(s) | H_2 (g, 1 bar) | H^+ (aq, 1 M) || M^{4+}(aq), M^{2+}(aq) | Pt(s) **[4]**

E_{cell} = 0.092 V when $\frac{\left[M^{2+}(aq)\right]}{\left[M^{4+}(aq)\right]} = 10^x$

Given: $E^0_{M^{4+}/M^{2+}}$ = 0.151 V; $2.303\frac{RT}{F}$ = 0.059 V

The value of x is:

a) -1
b) -2
c) 2
d) 1

95. The rate constant of a first order reaction is 3×10^{-6} sec^{-1}. If initial concentration is 0.10 M, the initial rate is (Ms^{-1}): **[4]**

a) 3×10^{-7}

b) 3×10^{-5}

c) 3×10^{-8}

d) 3×10^{-6}

96. Which of the following is the CORRECT statement? **[4]**

i. The order of ionization energy is: C < N < O.

ii. The order of abundance of elements in the earth's crust is: P < N > As < Sb.

iii. The correct order with respect to covalent radii is: N > P > As > Sb > Bi.

iv. Minimum and maximum oxidation number of nitrogen are -3 and +5, respectively.

a) Option (iv)

b) Option (i)

c) Option (ii)

d) Option (iii)

97. When chlorine gas is passed through an aqueous solution of a potassium halide in the presence of chloroform, a violet colouration is obtained. On passing more of chlorine water, the violet colour disappears and solution becomes colourless. This test confirms the presence of _____ in aqueous solution. **[4]**

a) iodine

b) bromine

c) chlorine

d) fluorine

98. In which of the following five 3d -orbitals are degenerated? **[4]**

a) $[Co(NH_6)_3]^{3-}$

b) $Co^{3+}_{(g)}$

c) $[Co(NH_3)_6]^{3+}$

d) $Co^{3+}_{(Aq)}$

99. What will be the theoretical value of **spin only** magnetic moment when $Fe(SCN)_3$ reacts with a solution containing F^- ions to yield a colourless complex? **[4]**

a) 5.92 BM

b) 1.73 BM

c) 3..87 BM

d) 2.83 BM

100. Identify the reagents required for the conversion of 1-nitropropane to N-methylpropylamine. **[4]**

a) Sn/conc.HCl, $CHCl_3$ + alc. KOH
Δ, $LiAlH_4$/dry ether

b) H_2O/H^+ - Δ, NH_3, Br_2/NaOH - Δ , CH_3CH_2COCI/C_5H_5N -Δ

c) $H3O^+$/Δ, $SOCI_2/C_5H_5N$, CH_3NH_2/C_5H_5N - Δ

d) Fe/HCl, HNO_2/0 - 5°C, H_2O, $CrO_3/H_2SO_4/CH_3COCH_3$

BOTANY (Section-A)

101. The science of naming the plant is known as : **[4]**

a) Nomenclature

b) Taxonomy

c) Classification

d) Identification

102. Plants respond to factors like : **[4]**

a) Chemicals

b) Pollutants

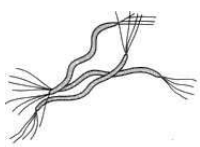
c) All of these

d) Other organisms

103. In given diagram (a), (b), (c) and (d) represents : **[4]**

a. 

b. 

c. 

d. 

a) A - Spirillum, B - Bacillus,C - Vibrio, D - Coccus

b) A - Bacillus, B - Coccus, C - Spirillum, D - Vibrio

c) A - Coccus, B - Bacillus, C - Spirillum, D - Vibrio

d) A - Vibrio, B - Coccus, C - Bacillus, D - spirillum

104. Bacteria occur: **[4]**

a) Everywhere

b) Only in hot springs

c) Only in deserts

d) Only in snow and deep oceans

105. Dichogamy which helps in cross-pollination is a floral mechanism in which: **[4]**

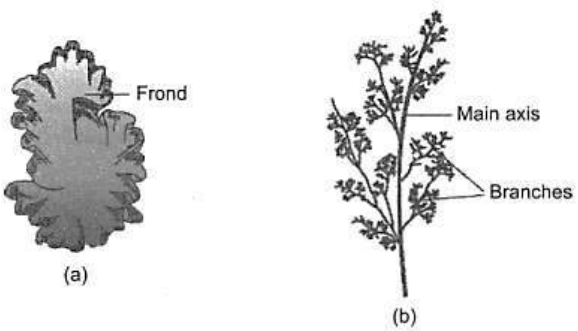
a) Anther and stigma matures at different times

b) Pollen sac and stigma are at different heights

c) Structure of pollen sac and stigma functions as hurdles

d) Pollen grain is unable to germinate on the stigma of the same flower

106. In given diagrams (a) and (b) belongs to which group and it represents respectively : **[4]**



a) Green algae- Chara, Chlamydomonas

b) Red algae-Porphyra, Polysiphonia

c) Green algae- Volvox, Chlamydomonas

d) Brown algae-Laminaria, Fucus

107. Which of the following is true for Chlamydomonas? **[4]**

a) Unicellular

b) None of these

c) Colonial

d) Filamentous

108. The product of sexual reproduction generally generates **[4]**

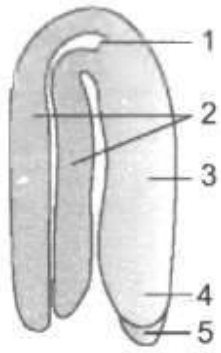
a) Prolonged dormancy

b) New genetic variations

c) Large biomass

d) Longer viability of seeds

109. The diagram given below shows a typical dicot embryo. Identify structures 1 to 5 respectively: **[4]**



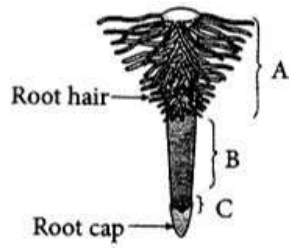
a) 1-Suspensor, 2-Cotyledons, 3-Plumule, 4-Radicle, 5-Ccleorhiza

b) 1-Plumule, 2-Cotyledons, 3-Hypocotyl, 4-Radicle, 5-Root cap

c) 1-Radicle, 2-Cotyledons, 3-Hypocotyl, 4-Plumule, 5-Root cap

d) 1-Plumule, 2-Cotyledons, 3-Epicotyl, 4-Radicle, 5-Root cap

110. The figure given below shows the region of root tips with their region marked as A, B and C. **[4]**



a) Region C is the active state of division and is the main growing region of the root.

b) Region A is the area of origin lateral root.

c) All of the these

d) Region B lead to the increase in the length of the root.

111. How many plants in the list given below have marginal placentation? **[4]**
Mustard, Gram, Tulip, Asparagus, Arhar, Sun hemp, Chilli, Colchicine, Onion, Moong, Pea, Tobacco, Lupin.

a) Five

b) Three

c) Six

d) Four

112. Casparian bands (strips) are characteristic feature of: **[4]**

a) Endodermis

b) Epidermis

c) Epiblema

d) Exodermis

113. Choose the right sequence from table: **[4]**

S. No.	Syndrome	Genotype	Bar body
(A)	Turner syndrome	44 + XO	1
(B)	Criminal syndrome	44 + XYY	0
(C)	Klinefelter syndrome	44 + XXY	1
(D)	Cri-du-chat syndrome	44 + XXX	2

Find out the correct statements of above table:

a) B, C
b) A, B
c) C, D
d) A, D

114. Which one of the following conditions of the zygotic cell would lead to the birth of a normal human female, child? **[4]**

a) one X and one Y chromosome
b) two X chromosomes
c) only one X chromosome
d) only one Y chromosome

115. E.coli has only 4.6×10^6 base pairs and completes the process of replication within 18 minutes; then the average rate of polymerisation is approximately **[4]**

a) 1000 base pairs/second
b) 2000 base pairs/second
c) 4000 base pairs/second
d) 3000 base pairs/second

116. Mark the nucleotide found in DNA: **[4]**

a) Deoxyadenylic acid
b) Deoxycytidine
c) Uridine
d) Uridylic acid

117. Select the wrong statement: **[4]**

a) Cyanobacteria lack flagellated cells
b) Mycoplasma is a wall-less microorganism
c) Bacterial cell wall is made up of peptidoglycan
d) Pili and fimbriae are mainly involved in motility of bacterial cells

118. The osmotic expansion of a cell kept in water is chiefly regulated by: **[4]**

a) Ribosomes
b) Mitochondria
c) Vacuoles
d) Plastids

119. Which of the following is the characteristics of cancer? **[4]**

a) Cancers show metastasis.

b) Cancerous cells show property of contact inhibition.

c) All viruses are oncogenic.

d) All tumours are cancers.

120. Mumps is a viral disease which involves swelling of: **[4]**

a) Infra orbital gland

b) Sub-lingual gland

c) Parotid gland

d) Sub-maxillary gland

121. The type of meiosis occurring before fertilization is called: **[4]**

a) Sporic

b) Azygotic

c) Gametic

d) Zygotic

122. In a population, maximum reproductive capacity under optimum environmental conditions is called **[4]**

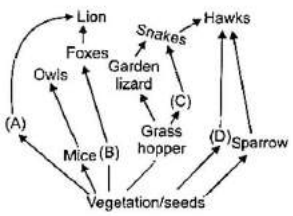
a) biotic potential.

b) fertility.

c) carrying capacity.

d) birth rate.

123. Identify the likely organisms (A), (B), (C) and (D) in the food web shown ahead: **[4]**



a) A - Rat, B - Dog, C - Tortoise, D - Deer

b) A - Dog, B - Squirrel, C - Bat, D - Deer

c) A - Squirrel, B - Cat, C - Rat, D - Pigeon

d) A - Deer, B - Rabbit, C - Frog, D - Rat

124. Match the following columns. **[4]**

Column I	Column II
A. Symbiotic nitrogen-fixing bacteria	(i) Mosquitoes
B. Dragonflies	(ii) Rhizobium
C. Bacillus thuringiensis	(iii) Azotobacter
D. Free-living N_2-fixing bacteria	(iv) Butterfly, caterpillars

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

125. Which one of the following has maximum genetic diversity in India? **[4]**

a) Mango
b) Teak
c) Tea
d) Wheat

126. Which of the following characteristics would cause a country to be considered a high-priority region for conservation efforts? **[4]**

a) Having little natural habitat remaining
b) A high degree of endemism
c) Having low species richness
d) Having high species richness

127. The hot spots in World and India are recognised by: **[4]**

a) Less diversity
b) More diversity
c) Both More diversity and No endangered species
d) No endangered species

128. Golgi complex, nucleolus, nuclear envelope and endoplasmic reticulum disappear in: **[4]**

a) Anaphase
b) Metaphase
c) Telophase
d) Prophase

129. Longest stage in M - phase of cell cycle is: **[4]**

a) Interphase
b) Prophase
c) Metaphase
d) Telophase

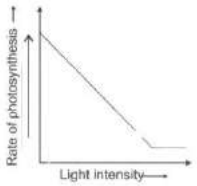
130. Rate of photosynthesis is independent of: **[4]**

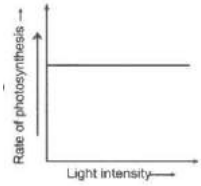
a) Quality of light
b) Duration of light
c) Intensity of light
d) Temperature

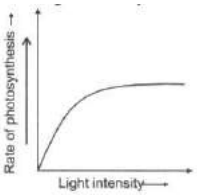
131. Carbon dioxide takes part in the photosynthetic pathway **[4]**

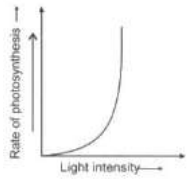
a) during light reaction.
b) during dark reaction.
c) All of these
d) in thylakoid membranes.

132. Which of the following graphs correctly gives the relationship between the rate of photosynthesis and light intensity? **[4]**

a) 

b) 

c) 

d) 

133. Which pigment is present universally in all green plants? **[4]**

a) Chlorophyll - b

b) Chlorophyll - m

c) Chlorophyll - c

d) Chlorophyll - a

134. The respiratory quotient during cellular respiration would depend on the **[4]**

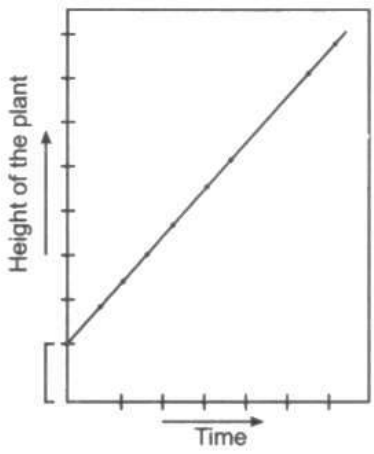
a) nature of the substrate.

b) amount of oxygen utilised.

c) nature of enzymes involved.

d) amount of carbon dioxide released.

135. Given graph represent which type of growth: **[4]**



a) Arithmetic growth and geometric growth

b) Geometric growth

c) Arithmetic growth

d) scalar growth

BOTANY (Section-B)

Attempt any 10 questions

136. What is full form of ICBN? **[4]**

a) International Code for Botanical Nomenclature

b) International Code for Biological Naming

c) International Code for Biological Nomenclature.

d) International Classification of Biological Nomenclature.

137. Viruses can multiply in: **[4]**

a) Specific living cells

b) All living cells

c) Rotten food

d) Bacteria only

138. Which of the following statements is correct? **[4]**

a. Horsetails are gymnosperms

b. Selaginella is heterosporous, while Salvinia is homosporous

c. Ovules are not enclosed by ovary wall in gymnosperms

d. Stems are usually unbranced in both Cycas and Cedrus

a) Statement d is correct

b) Statement a is correct

c) Statement c is correct

d) Statement b is correct

139. In angiosperm functional megaspore develops into: **[4]**

a) Pollen sac

b) Embryo sac

c) Ovule

d) Endosperm

140. A student was given a sample tissue to observe under the microscope. He observes the tissue and concludes that the tissue is a type of simple plant tissue and provides mechanical support to young stem and petiole of leaf. **[4]**
Identify the tissue.

a) Sclerenchyma

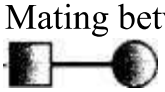
b) Phloem fibres

c) Prosenchyma

d) Collenchyma

141. Select the option with correct combination of pedigree symbol and its representation. **[4]**

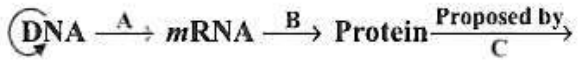
a) Affected male- 

b) Mating between relatives- 

c) Unaffected female- 

d) Unaffected male- 

142. The diagram shows an important concept in the genetic implication of DNA. Fill in the blanks A to C **[4]**



a) A-translation, B-transcription, C-Erevin Chargaff

b) A-translation, B-extension, C-Rosalind Franklin

c) A-transcription, B-translation, C-Francis Crick

d) A-transcription, B-replication, C-James Watson

143. Which of the following endoplasmic reticulum involve in synthesis of lipids or steroids? **[4]**

a) Rough endoplasmic reticulum (RER)

b) Simple endoplasmic reticulum (SER)

c) Both Rough endoplasmic reticulum (RER) and Smooth endoplasmic reticulum (SER)

d) Smooth endoplasmic reticulum (SER)

144. Match the columns. **[4]**

Biological control agent	**Pests**
(A) Lady birds	(i) Butterfly caterpillar
(B) Bacillus thuringiensis	(ii) Mosquitoes
(C) Dragon fly	(iii) Jassids
(D) Trichoderma	(iv) Aphids
	(v) Root pathogen

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

b) (A)-(iv); (B)-(i); (C)-(v); (D)-(iii)

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

d) (A)-(iv); (B)-(i); (C)-(ii); (D)-(v)

145. The reaction involved in reduction of NAD^+ is: **[4]**

a) PGAL ⟶ PGA

b) Glucose ⟶ Glucose 6-P

c) Fructose 1,6-diphosphate ⟶ PGAL + DiHAP

d) Glucose 6-P ⟶ Fructose 6-P

146. The bacteria Pseudomonas is useful because of its ability to **[4]**

a) Fix atmospheric nitrogen in the soil

b) Transfer genes from one plant to another

c) Produce a wide variety of antibiotics

d) Decompose a variety of organic compounds

147. Organisms which are associated with first as well as third trophic level are **[4]**

a) chemoautotrophs

b) insectivorous plants

c) acrophytes

d) phytoplanktons

148. Gibberellins cause or gibberellins stimulate: **[4]**

a) Elongation of intemodes

b) Curvature of coleoptile

c) Cell division

d) Initiation of lateral roots

149. It takes very long time for pineapple plants to produce flowers. Which combination of hormones can be applied to artificially induce flowering in pineapple plants throughout the year to increase yield? **[4]**

a) Gibberellin and Cytokinin

b) Gibberellin and Abscisic acid

c) Cytokinin and Abscisic acid

d) Auxin and Ethylene

150. Identify the wrong statement: **[4]**

A. Carotenoids protect chlorophyll from photo-oxidation

B. Antenna is a system including all pigments except chlorophyll-a

C. Absorption maxima of PS-I and PS-II is 680 nm and 700 nm respectively

D. More than one

a) C

b) B

c) D

d) A

ZOOLOGY (Section-A)

151. Which of the follwoing statement/s is/are correct for Hemichordates? **[4]**

a) Excretory system comprises a proboscis gland

b) Worm-like marine animals

c) Sexes are separate and fertilisation is external

d) All of these

152. Choose the wrong statements for Annelida. **[4]**

i. They are triploblastic, metamerically segmented and coelomate animals.

ii. They possess longitudinal and circular muscles that help in locomotion.

iii. Aquatic annelids like Nereis possess lateral appendages, parapodia, which help in swimming.

iv. Nereis, an aquatic form, is monoecious.

v. Earthworms and leeches are dioecious.

a) (iv) and (v)

b) (iii), (iv) and (v)

c) (i), (ii) and (v)

d) (iii) and (iv)

153. In Porifera, water enters into central cavity spongocoel through minute pores in the body wall called: **[4]**

a) Both Ostia and Osculum

b) Ostia

c) Medriporite

d) Osculm

154. One of the following is immortal: **[4]**

a) Somatic cell

b) Pituitary cell

c) Glomerular cell

d) Germ cell

155. Neuroglia is **[4]**

a) excitable cells of neural tissue.

b) 2-3 times in volume of neural tissue.

c) supporting and non-excitable cells of neural tissue.

d) protective and excitable cells of neural tissue.

156. Which of following statements is not true? **[4]**

a. The partial pressure of oxygen in deoxygenated blood is 40 mm Hg.

b. The partial pressure of oxygen in oxygenated blood is 95 mm Hg.

c. The partial pressure of oxygen in alveolar air is 104mm Hg.

d. The partial pressure of CO_2 in the alveolar air is 40 mm Hg.

a) Statement (c) is not true.

b) Statement (a) is not true.

c) Statement (b) is not true.

d) Statement (d) is not true.

157. Match the following and mark the correct options **[4]**

(A) Earthworm	(i) Moist cuticle
(B) Insects	(ii) Gills
(C) Fishes	(iii) Lungs

(D) Birds/Reptiles	(iv) Trachea

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

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

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

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

158. What is true about RBCs in humans? **[4]**

a) They carry about 20-25% of CO_2.

b) They transport 99.5% of O_2.

c) They transport about 80% oxygen only and the rest 20% of it is transported in dissolved state in blood plasma.

d) They do not carry CO_2 at all.

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

Column- I	Column- II
(A) Pneumotaxic Centre	(i) Alveoli
(B) O_2 dissociation curve	(ii) Pons region of brain
(C) Carbonic anhydrase	(iii) Haemoglobin
(D) Primary site of exchange of gases	(iv) RBC

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

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

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

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

160. Glottis is opening in the floor of: **[4]**

a) Trachea

b) Buccopharyngeal cavity

c) Nostri

d) Esophagus

161. A human female is born with a million of primary follicles at the time of birth. At puberty, only 60,000-80,000 primary follicles are left in each ovary. What happens to the rest of the primary follicles? **[4]**

a) They nourish the rest of the follicular cells.

b) They degenerate.

c) They move out of the ovary and are destroyed by leucocytes.

d) They generate.

162. How many statements are correct with respect to corpus luteum? **[4]**

A. It is generated after surge of LH.
B. In a pregnant woman, it is maintained by LH during early pregnancy.
C. It's degeneration is responsible for menstrual bleeding.
D. It releases pregnancy maintaining hormone.

a) 4 b) 2

c) 3 d) 1

163. Normal time period of gestation in human female is: **[4]**

a) 10 weeks b) 28 weeks

c) 32 weeks d) 40 weeks

164. Identify the odd one. **[4]**
Vaults, Condoms, Diaphragms, Periodic abstinence

a) Condoms b) Vaults

c) Periodic abstinence d) Diaphragms

165. Which of the following is wrongly matched? **[4]**

Option		
(a)	ZIFT	Transfer of embryos up to 8 blastomeres into the fallopian tube.
(b)	ICSI	Direct injection of sperms into the ovum.
(c)	lUI	Artificial introduction of the semen collected from husband or donor either into the vagina or into the uterus.
(d)	GIFT	Transfer of embryos with more than 8 blastomeres into the fallopian tube.

a) Option (b) is wrongly matched. b) Option (a) is wrongly matched.

c) Option (c) is wrongly matched. d) Option (d) is wrongly matched.

166. In our modern understanding of natural selection, the fittest individuals are those who: **[4]**

a) Leave many living descendants b) Are best adapted to the environment

c) Are best equipped to cope with the special environmental conditions d) Produce many offsprings, but a few survive upto sexual maturity

167. In a population of 1000 individuals, 360 belong to genotype AA, 480 to Aa and the remaining 160 to aa. Based on this data, the frequency of allele A in the population is: **[4]**

a) 0.5 b) 0.7

c) 0.6 d) 0.4

168. Choose the correct option from given statements. **[4]**

i. Glomerular filtration rate is 125 mL/min.

ii. Ultrafiltration is opposed by colloidal osmotic pressure of plasma.

iii. Tubular secretion takes place in loop of Henle.

iv. Tubular secretion takes place in glomerulus.

v. Aldosterone induces greater sodium reabsorption.

The correct option is

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

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

169. Which of the following are uricotelic animals? **[4]**

A. Fish and frog

B. Lizard and birds

C. Camel and frog

D. Earthworm and eagle

a) Only B b) Only A

c) Only D d) Only C

170. Aquatic reptiles are: **[4]**

a) Ureotelic b) Ureotelic in water

c) Ureotelic over land d) Ammonotelic

171. Tail vertebrae in birds form: **[4]**

a) Chevron bone b) Pygostyle

c) Urostyle d) Wish bone

172. Which of the following is the most abundant mineral element in muscle? **[4]**

a) Calcium b) Potassium

c) Magnesium d) Boron

173. The floating ribs are: **[4]**

a) 1 and 2 b) 9 and 10

c) 7 and 8 d) 11 and 12

174. The cranial nerves which control the movement of eyeball are: **[4]**

a) 3, 4 and 6 b) 2, 3 and 5

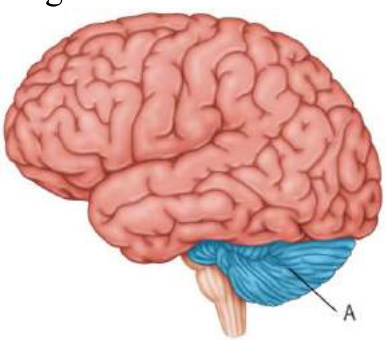
c) 5, 8 and 9 d) 4, 6 and 7

175. Which of the following does not participate in the formation of brain stem? **[4]**

a) Mid brain b) Pons varolii

c) Medulla Oblongata d) Cerebellum

176. Identify the part of brain and its function which is represented by A in the given diagram. **[4]**



i. Cerebellum, responsible for motor control. This includes muscle tone, equilibrium, and balance as it relates to movement.

ii. Cerebrum, responsible for the integration of complex sensory and neural functions and the initiation and coordination of voluntary activity in the body.

iii. Medulla oblongata, responsible for autonomic (involuntary) functions ranging from vomiting to sneezing.

iv. Both (i) and (ii)

a) Option (a) is correct. b) Option (b) is correct.

c) Option (d) is correct. d) Option (c) is correct.

177. Which one affects liver, muscle and adipose tissue? **[4]**

a) Progesterone b) Androgen

c) Glucagon d) Insulin

178. GnRH, a hypothalamic hormone, needed in reproduction, acts on: **[4]**

a) anterior pituitary gland and stimulates secretion of LH and oxytocin

b) anterior pituitary gland and stimulates secretion of LH and FSH

c) posterior pituitary gland and stimulates secretion of oxytocin and FSH

d) posterior pituitary gland and stimulates secretion of LH and relaxin

179. Which one of the statement is correct with reference to the circulation of blood in a mammal? **[4]**

a) Venous blood is returned to the left auricle.

b) Left auricle receives oxygenated blood from the lungs.

c) Pulmonary artery returns oxygenated blood from the lungs to the left auricle.

d) Pulmonary vein carries venous blood from right auricle to lungs.

180. Covering of heart is called: **[4]**

a) Peritoneum

b) Periosteum

c) Pericardium

d) Perineurium

181. Open circulatory system is present in: **[4]**

a) mollusca and aves

b) arthropods and mammals

c) mammals and aves

d) arthropods and molluscs

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

a) Separation and purification of foreign gene product is known as downstream processing

b) Bioreactor (stirring type) is not suitable for obtaining large scale foreign gene products

c) In PCR taq polymerase has been used

d) Protein obtain by recombinant technology are called recombinant protein

183. The process of separation and purification of expressed protein before marketing is called: **[4]**

a) Bioprocessing

b) Down stream processing

c) Postproduction processing

d) Up stream processing

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

Column-I	Column-II
(A) Bt cotton	(i) Gene therapy
(B) Adenosine deaminase deficiency	(ii) Cellular defence
(C) RNAi	(iii) Detection of HIV infection
(D) PCR	(iv) Bacillus thuringiensis

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

185. Rennet enzyme was purified by: **[4]**

a) S.A. Waksman
b) Payen and Persoz
c) Christian Hansen
d) A. Flemming

ZOOLOGY (Section-B)

Attempt any 10 questions

186. Which of the following is commonly called Pearl oyster? **[4]**

a) Limulus
b) Chaetopleura
c) Dentalium
d) Pinctada

187. The hardest substance of the body: **[4]**

a) Bone
b) Cartilage
c) Enamel
d) Muscle

188. Which of the following cells does not exhibit phagocytotic activity? **[4]**

a) Monocyte
b) Neutrophil
c) Basophil
d) Macrophage

189. Respiratory process is regulated by certain specialized centres in the brain. One of the following listed centres can reduce the inspiratory duration upon stimulation : **[4]**

a) Chemosensitive centre
b) Pneumotoxic centre
c) Apneustic centre
d) Medullary inspiratory centre

190. In human females at the time of birth there are four lakhs ova. How many of them normally reach at maturity in the course of normal reproductive life? **[4]**

a) 5,000

b) 2,000

c) 400

d) 1,000

191. Select the incorrect statement regarding ZIFT. **[4]**

a) In this process, embryo is formed by injecting ovum into the sperm.

b) It is one of the techniques known as assisted reproductive technologies.

c) In this technique, zygote or embryo with up to 8 blastomeres is collected and transferred into the fallopian tube.

d) ZIFT stands for zygote intra fallopian transfer.

192. The law of continuity of germplasm was given by: **[4]**

a) Mendel

b) Darwin

c) Lamarck

d) Weismann

193. Presence of glucose in urine is called: **[4]**

a) Galactosemia

b) Diabetes insipidus

c) Diabetes mellitus

d) None of these

194. Choose the incorrect pair. **[4]**

a. Facial bones - Made up of 14 skeletal elements

b. Sacral vertebrae - 2 fused

c. Vertebrochondral ribs - False ribs (8th, 9th, 10th)

d. Pivot joint - Between atlas and axis

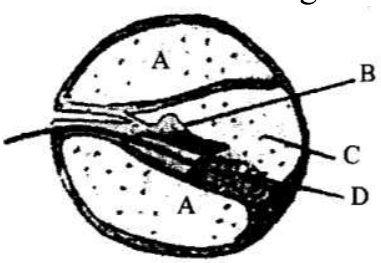
a) Option C is incorrect pair.

b) Option B is incorrect pair.

c) Option A is incorrect pair.

d) Option D is incorrect pair.

195. Given below is a diagrammatic cross section of a single loop of human cochlea. **[4]**



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

a) B: tectorial membrane, C: perilymph, D: secretory cells

b) D: sensory hair cells, A: endolymph B: tectorial membrane

c) A: perilymph, B: tectorial membrane C: endolymph

d) C: endolymph, D: sensory hair cells, A: serum

196. All the hormone are proteins, peptides and amino acid derivatives except: **[4]**

a) hormone of ovary

b) pancreas hormone

c) parathyroid hormone

d) thyroid hormone

197. Hormone from adenohypophysis that stimulates the gonads in male and female are called: **[4]**

a) FSH

b) LTH

c) Gonadotropin

d) PL

198. If due to some injury the chordae tendinea of the tricuspid valve of the human heart is partially nonfunctional, what will be the immediate effect? **[4]**

a) The blood will lend to flow back into the left atrium.

b) The flow of blood into the pulmonary artery will be reduced.

c) The flow of blood into the aorta will be slowed down.

d) The 'pacemaker' will stop working.

199. Which of the following statement is not true? **[4]**

i. DNA being a hydrophilic molecule cannot pass through cell membranes.

ii. Agrobacterium tumefaciens delivers a piece of DNA known as 'Z-DNA' in the Ti-plasmid, which transforms normal plant cells into tumour cells to produce chemical against pathogens.

iii. Retrovirus, adenovirus,papilloma virus are also now used as cloning vectors in animal because of their ability to transform normal cells into cancerous cell.

iv. In genetic engineering, DNA from different sources is cut with the same restriction enzymes so that both DNA fragments have same kind of sticky ends.

a) Only (i)

b) Only (iii)

c) Only (iv)

d) Only (ii)

200. An example of gene therapy is: **[4]**

a) Production of injectible Hepatitis-B vaccine

b) Introduction of gene for adenosine deaminase in persons suffering

from severe combined immuno-deficiency (SCID)

c) Production of vaccines in food crops like potatoes which can be eaten

d) Production of test tube babies by artificial insemination and implantation of fertilized eggs

Solution

SAMPLE PAPER - 10

PHYSICS (Section-A)

1. **(d)** cannot be applied
   Explanation: If a quantity depends upon more than three factors, each having dimensions, then the method of dimensional analysis cannot be applied. It is because applying the principle of homogeneity will give only three equations.
2. **(a)** work
   Explanation: $\frac{\text{mass} \times \text{force} \times \text{volume}}{\text{area} \times \text{mass}} = \text{force} \times \text{length} = \text{work}$
3. **(b)** 12 s
   Explanation: $\frac{1}{2} \times 2 \times t^2 + 96 = 20 \times t$
   or $t^2 - 20t + 96 = 0$
   This gives, t = 8 or 12 sec.
   Hence, the bus will overtake the cyclist after a time of 12 sec.
4. **(a)** $\sqrt{0.11}$
   Explanation: The magnitude of unit vector is '1' so
   $(0.5)^2 + (0.8)^2 + C^2 = 1$
   $C^2 = 1 - (0.5)^2 - (0.8)^2 = 1 - 0.25 - 0.64$
   $= 1 - 0.89 = 0.11$
   $\therefore$ $C = \sqrt{0.11}$
5. **(c)** four times the vertical height
   Explanation: At $\theta = 45^o$
   $R = \frac{u^2 \sin 2\theta}{g} = \frac{u^2 \sin 90°}{g} = \frac{u^2}{g}$
   $H = \frac{u^2 \sin^2 \theta}{2g} = \frac{u^2 \sin^2 45°}{2g} = \frac{u^2}{4g}$
   $\therefore$ R = 4H.
6. **(a)** 10 cm
   Explanation: Given: S = 30 cm = 30 $\times$ 10^{-2} m and loss in velocity is 50%
   Equation of motion:
   $v^2 = u^2 + 2as$
   Here, $\frac{u^2}{4} = u^2 + 2a \times 30 \times 10 - 2$ .. (i)
   $0 = \frac{u^2}{4} + 2a \times x$ ... (ii)
   On solving Eqs. (i) and (ii),
   we get x = 10 cm
7. **(a)** increases by mg(l - h)
   Explanation: increases by mg(l - h)

8.

(b) only iii

Explanation: When a weight lifter lifts a weight,

i. Work done by the lifting force F, W_1 = Fs cos 0° = + Fs but

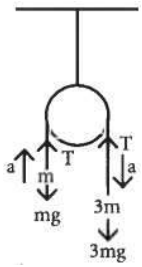
ii. Work done in holding it up, $W_2 = 0$. (because the displacem ent $\vec{s} = 0$)

9.

(d) $\frac{g}{2}$

Explanation:

When the system is released, the heavier mass moves downwards and the lighter one upwards. Thus, centre of mass will move towards the heavier mass with acceleration.

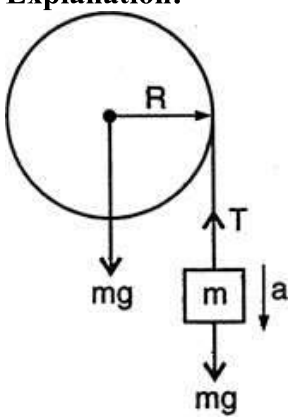


$$a = \left(\frac{3m-m}{3m+m}\right)g$$

$$= \frac{g}{2}$$

10. **(a)** $\frac{2}{3}g$

Explanation:



The free body diagram of pulley and mass

mg - T = ma

$$\therefore \quad a = \frac{mg-T}{m} \quad ...(i)$$

As per question, pulley to be consider as a circular disc.

∴ Angular acceleration of disc

$$\alpha = \frac{\tau}{I} \quad ...(ii)$$

Here $\tau = T \times R$

and $I = \frac{1}{2}mR^2$ (for circular disc)

$\therefore \quad T = \frac{mR\alpha}{2}$ [Using eqn. (ii)]

Therefore, $a = \frac{mg - \frac{mR\alpha}{2}}{m}$ [Using eqn. (i)]

$ma = mg - \frac{ma}{2} \quad \left(\because \alpha = \frac{a}{R} \right)$

$\therefore \quad a = \frac{2g}{3}$

11. **(b)** only i
Explanation: Mass of the ball always remains constant. It does not depend upon the acceleration due to gravity.
12. **(a)** $\frac{3Mg}{2A}$
Explanation: Weight suspended = wt. of suspended mass + wt. of half the rod
$= Mg + \frac{Mg}{2} = \frac{3Mg}{2}$
$\therefore$ Stress at mid-point $= \frac{F}{A} = \frac{3Mg}{2\,A}$
13. **(c)** Hydrogen
Explanation: Hydrogen has the highest specific heat (= 3.5 cal/gm-°C)
14. **(c)** mostly ultraviolet radiation will be emitted
Explanation: According to Wien's law, $\lambda_m T = b$
As the temperature is increased, λ_m is decreased, i.e., mostly ultraviolet radiation is emitted.
15. **(b)** K keeps constant, U decreases
Explanation: In the condensation of a gas, there occurs a change of state from gas to liquid. During change of state, as temperature remains constant, hence mean kinetic energy (K) of the molecules remains same. But during condensation, as intermolecular separation decreases hence potential energy (U) of the molecules decreases.
16. **(a)** All have same values
Explanation: All have same values
17. **(a)** 4 k
Explanation: As from above concept 1, the constant of each spring will be 2k. When they are joined together in parallel, the equivalent constant will be 4k. Hence, the option is correct.
18. **(a)** 2.39 cm/s
Explanation: Given:
$\Delta x = 0.3$ cm $= 0.3 \times 10^{-2}$ m
$\Delta t = 0.5$ s
Let $\Delta x'$ and $\Delta t'$ represent shift and time interval for 6^{th} interval respectively.
$\therefore \quad \Delta x' = \Delta x - 6(\Delta x^2 - 0.5\,\Delta x)$
$\Delta x' = (0.3 \times 10^{-2}) - 6[(0.3 \times 10^{-2})^2 - (0.5 \times 0.3 \times 10^{-2})]$
$\Delta x' = 0.01195$ m $= 1.195$ cm

$$\Delta t' = \Delta t + 6\left(\Delta t^2 - \frac{\Delta t}{2}\right)$$

$$\Delta t' = 0.5 + 6\left(0.5^2 - \frac{0.5}{2}\right) = 0.5s$$

Velocity of wave for 6th interval is given by,

$$v = \frac{\Delta x'}{\Delta t'}$$

$$v = \frac{1.195}{0.5}$$

$v = 2.39$ cm/s

19.

(d) only i

Explanation: The loudness of sound note depends on intensity according to relation,

$$L = 10 \log_{10}\left(\frac{I}{I_0}\right)$$

Here, I_0 is the intensity of minimum audible sound.

Pitch is the characteristic of sound that depends on frequency. It determines the shrillness and graveness of sound.

20.

(b) the charges will move towards the centre

Explanation: the charges will move towards the centre

21.

(b) $\frac{4KC_0}{3+K}$

Explanation: We have, $x + y + \frac{3d}{4} = d$

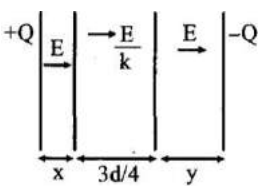
$$\Rightarrow x + y = \frac{d}{4}$$

$$\Delta V = Ex + \frac{E}{k} \times \frac{3\,d}{4} + Ey$$

$$\Rightarrow \Delta V = \frac{3Ed}{4k} + E(x + y) \Rightarrow \Delta V = E\left[\frac{3\,d}{4k} + \frac{d}{4}\right]$$

$$\Delta V = \frac{\sigma}{\epsilon_0}\left[\frac{3\,d + dk}{4k}\right] = \frac{Qd}{A\epsilon_0}\left[\frac{3+k}{4k}\right]$$

$$\frac{Q}{\Delta V} = C = \frac{A\epsilon_0}{d}\left[\frac{4k}{3+k}\right] = \frac{4kC_0}{k+3}\left[\because C_0 = \frac{A\epsilon_0}{d}\right]$$



22.

(d) $\frac{220}{1100} \times 3\text{amp}$

Explanation: $\frac{220}{1100} \times 3\text{amp}$

23. **(a)** 3.4×10^{-5} newton/(amp-meter), upward

Explanation: B at the centre of a coil carrying a current, i is

$B_{\text{coil}} = \frac{\mu_0 i}{2r}$ (upward)

B due to wire,

$B_{\text{wire}} = \frac{\mu_0 i}{2\pi r}$ (downward)

Given : i = 8 A, r = 10×10^{-2} m

$\frac{\mu_0}{4\pi} = 10^{-7}$

Magnetic field at centre C,

$B_C = B_{\text{coil}} + B_{\text{wire}}$

$= \frac{\mu_0 i}{2r}(\text{ upward }) + \frac{\mu_0 i}{2\pi r}$ (downward)

$= \frac{\mu_0 i}{2r} - \frac{\mu_0 i}{2\pi r} = \frac{\mu_0 i}{2r}\left(1 - \frac{1}{\pi}\right)$ (upward)

$= \frac{4\pi \times 10^{-7} \times 8}{2 \times 10 \times 10^{-2}}\left(1 - \frac{1}{3.14}\right)$ (upward)

$= \frac{4 \times 3.14 \times 10^{-7} \times 8 \times 2.14}{2 \times 10 \times 10^{-2} \times 3.14}$ (upward)

$= 3.4 \times 10^{-5}$ (upward)

24.

(d) 100 K

Explanation: When,

$\chi = 0.5$

$\frac{1}{T} = 5 \times 10^{-3}$ /K

$\therefore T = \frac{1}{5 \times 10^{-3}}$

$= \frac{1000}{5}$

= 200 K

According to Curie's law

$\chi = \frac{C}{T}$

$\therefore C = \chi T$

$= 0.5 \times 200$

= 100 K

25.

(b) 0.16

Explanation: New magnetic moment,

$M' = \frac{2M}{\pi}$

$= \frac{2ml}{\pi}$

$= \frac{2 \times 0.8 \times 31.4 \times 10^{-2}}{3.14}$

$= 0.16\ Am^2$

26.

(b) 5π

Explanation: We know that,

$e = M\frac{dI}{dt}$

$= 0.005 \times I_0 \cos \omega t \times \omega$

$e_{max} = 0.005 \times I_0 \times \omega = 0.005 \times 10 \times 100\pi$

$= 5\pi$

27.

(c) laminated core of soft iron

Explanation: To reduce the eddy current, the resistance of the core should be increased.

28.

(b) $\frac{1}{2\pi v(2\pi vL + R)}$

Explanation: As the current leads the voltage by 45^o, therefore $X_C > X_L$

$\tan \phi = \frac{X_C - X_L}{R} = \tan 45^o = 1$

$\therefore\ X_C - X_L = R$ or $X_c = X_L + R = \omega L + R$

or $\frac{1}{\omega C} = \omega L + R$

$\therefore\ C = \frac{1}{\omega(\omega L + R)} = \frac{1}{2\pi v(2\pi vL + R)}$

29.

(c) (P) - (i), (Q) - (ii), (R) - (iii), (S) - (iv)

Explanation: (P) - (i), (Q) - (ii), (R) - (iii), (S) - (iv)

30. **(a)** violet light

Explanation: As we know that,

$\mu \propto \frac{1}{\lambda}$

$\because \lambda_r > \lambda_v$

$\Rightarrow \mu_v > \mu_r$

31. **(a)** diffraction is due to the interaction of light from the same wavefront, whereas the interference is the interaction of two waves derived from the same source

Explanation: diffraction is due to the interaction of light from the same wavefront, whereas the interference is the interaction of two waves derived from the same source

32.

(b) 2.8

Explanation: de-Broglie wavelength, $\lambda = \frac{h}{P}$

$\lambda_P = \frac{h}{\sqrt{2m_P \times (e \times V)}}$ and $\lambda_\alpha = \frac{h}{\sqrt{2m_\alpha \times (2e \times V)}}$

$\therefore \frac{\lambda_P}{\lambda_\alpha} = \sqrt{\frac{m_\alpha}{m_P}} \times 2 = \sqrt{4 \times 2} = 2\sqrt{2} = 2.8.$

33.

(b) Frequency

Explanation: According to Einstein's photoelectric equation,

$K_{max} = hv - \phi_0 \Rightarrow eV_0 = hv - \phi$

Where, V_0 = Stopping potential,

ϕ = Work function,

v = Frequency of incident light

$\therefore$ Stopping potential depends on frequency.

34.

(d) emission lines of mercury with a continuous background

Explanation: emission lines of mercury with a continuous background

35. **(a)** ${}^{12}_{6}C + {}^{1}_{1}H \rightarrow {}^{13}_{7}N + 2$ MeV

Explanation: ${}^{12}_{6}C + {}^{1}_{1}H \rightarrow {}^{13}_{7}N + 2$ MeV

PHYSICS (Section-B)

36.

(d) $\sqrt{\frac{mk}{2}} t \frac{-1}{2}$

Explanation: As we know that

Power, $p = \frac{dW}{dt}$

$\Rightarrow W = Pt$

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

So, $v = \sqrt{\frac{2Pt}{m}}$

Hence, acceleration

$a = \frac{dv}{dt}$

$= \sqrt{\frac{2P}{m}} \cdot \frac{1}{2\sqrt{t}}$

Therefore, force on the particle at times 't'

$ma = \sqrt{\frac{2km^2}{m}} \cdot \frac{1}{2\sqrt{t}}$

$$= \sqrt{\frac{km}{2t}}$$

$$= \sqrt{\frac{mk}{2}} t \frac{-1}{2}$$

37.

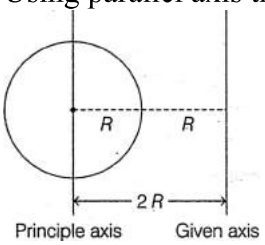
(c) $\frac{137}{15} MR^2$

Explanation:

We know that moment of inertia (MI) about the principle axis of the sphere is given by

$I_{\text{sphere}} = \frac{2}{5} MR^2$ ...(i)

Using parallel axis theorem, moment of inertia about the given axis in the figure below will be



$I_1 = \frac{2}{5} MR^2 + M(2R)^2$

$I_1 = \frac{22}{5} MR^2$ ...(i)

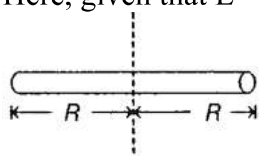
Considering both spheres at equal distance from the axis, moment of inertia due to both spheres about this axis will be

$2I_1 = 2 \times 22/5 MR^2$

Now, moment of inertia of the rod about its perpendicular bisector axis is given by

$I_2 = \frac{1}{12} ML^2$

Here, given that L = 2 R



$\therefore I_2 = \frac{1}{12} M(2R)^2 = \frac{1}{3} MR^2$

So, the total moment of inertia of the system is

$I = 2I_1 + I_2 = 2 \times \frac{22}{5} MR^2 + \frac{1}{3} MR^2$

$I = \left(\frac{44}{5} + \frac{1}{3}\right) MR^2 = \frac{137}{15} MR^2$

38.

(d) $6\sqrt{2}$ hrs

Explanation: $6\sqrt{2}$ hrs

39.

(d) $\frac{2}{3}\lambda_m$

Explanation: $\frac{2}{3}\lambda_m$

40.

(d) light waves are electromagnetic in nature

Explanation: We know that light waves are electromagnetic in nature. Therefore, they do not require a medium for propagation. Thus, the light wave can travel in a vacuum. On the other hand, sound waves require a medium for their propagation. They are mechanical waves and cannot travel in a vacuum.

41.

(b) Straight line

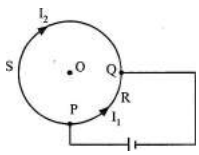
Explanation: Straight line

42.

(b) Zero

Explanation:

Let l_1, l_2 be the lengths of the two parts PRQ and PSQ of the conductor and ρ be the resistance per unit length of the conductor. The resistance of the portion PRQ will be $R_1 = l_1\rho$



The resistance of the portion PSQ will be,

$R_2 = l_2\rho$

Potential difference across P and Q = $I_1R_1 = I_2R_2$

or $I_1l_1\rho = I_2l_2\rho$

or $I_2l_1 = I_2l_2$ ....(i)

Magnetic field induction at the centre O due to currents through circular conductors PRQ and PSQ will be

$= B_1 - B_2$

$$= \frac{\mu_0}{4\pi}\frac{I_1 l_1 \sin 90^\circ}{r^2} - \frac{\mu_0}{4\pi}\frac{I_2 l_2 \sin 90^\circ}{r^2}$$

= 0 ...(from (i))

43.

(c) $16 : 9\sqrt{3}$

Explanation: $\theta_1 = 300$

$\theta_2 = 600$

$\omega_1 = 20$ osc/min

$\omega_2 = 15$ osc/min

$\frac{1}{2}I\omega_1^2 = mI_1\cos\theta_1$ ...(i)

$\frac{1}{2}I\omega_2^2 = mI_2\cos\theta_2$ ...(ii)

divide (ii) by (i)

$$\frac{(20)^2}{(15)^2} = \frac{I_1 \cos 30^\circ}{I_2 \cos 60^0}$$

or, $\frac{I_1}{I_2} = \frac{16}{9\sqrt{3}}$

44.

(d) $\frac{LI^2}{2}$

Explanation: $\frac{LI^2}{2}$

45. **(a)** remains unchanged

Explanation: Resonant frequency = $\frac{1}{2\pi\sqrt{LC}}$ does not depend on resistance.

46.

(d) $\mu = \frac{3 + \sqrt{5}}{2}$

Explanation: Let refractive index of glass be μ.

Let after first refraction, image distance be v then,

$\frac{\mu}{v} - \frac{1}{0} = \frac{\mu - 1}{R}$

$\Rightarrow v = \frac{\mu R}{\mu - 1}$

Now second refraction will take place. So, a distance of the first image from O is,

$u_1 = \frac{\mu R}{\mu - 1} - R$

$= \frac{R}{\mu - 1}$

And image is formed at R

$\therefore \frac{1}{R} - \frac{\mu(\mu - 1)}{R} = \frac{2(1 - \mu)}{R}$

$\Rightarrow \mu^2 - 3\mu + 1 = 0$

So, $\mu = \frac{3 + \sqrt{5}}{2}$

47.

(c) 28^o

Explanation: Given that; $A = 60^o$, $\mu = 1.5$. We know that when a ray of light is to emerge grazingly at the second surface of the prism, the angle of incidence at first surface should be limiting angle of incidence. We also know that relation for the limiting angle of incidence:

$i_{lim} = \sin A\sqrt{\mu^2 - 1} - \cos A$

$= \sin 60^\circ \sqrt{(1.5)^2 - 1} - \cos 60^\circ$

$= \frac{\sqrt{3}}{2} \times 1.118 - \frac{1}{2} = 0.4682$

Hence, $i_{lim} = 28^{o}$.

48.

(b) $\frac{h}{\sqrt{3mKT}}$

Explanation: Kinetic energy of thermal neutrons is $\frac{3}{2}$ KT.

$\therefore \lambda = \frac{h}{mv} = \frac{h}{\sqrt{2m(K.E.)}} = \frac{h}{\sqrt{2m\left(\frac{3}{2}KT\right)}}$

$= \frac{h}{\sqrt{3mKT}}$

49. **(a)** Neither in Lyman series nor in Balmer series
Explanation: At room temperature, all atoms are in the ground state. The minimum potential energy required for absorption is 10.2 eV. While light has photon energies less than this and hence it is not absorbed.

50.

(c) 6×10^{9} years

Explanation: 6×10^{9} years

CHEMISTRY (Section-A)

51.

(b) 12 g He
Explanation: Higher is the number of mole, more will be number of atoms.

Mole of He = $\frac{4}{4} = 1$

Mole of Na = $\frac{46}{23} = 2$

Mole of Ca = $\frac{0.40}{40} = 0.01$

Mole of He = $\frac{12}{4} = 3$

52.

(b) $\frac{h}{2\pi}$

Explanation: Angular momentum for n and (n + 1) shells are $\frac{nh}{2\pi}$ and $(n+1)\frac{h}{2\pi}$

Thus, difference in angular momentum of two successive orbits is $(n+1)\frac{h}{2\pi} - \frac{nh}{2\pi} = \frac{h}{2\pi}$

53.

(c) (i) and (iii)
Explanation: For the elements in the same period, valence electrons are added to the orbitals in the same principal quantum level (n).

i. is oxygen,

ii. is sulphur,
iii. is fluorine and
iv. is calcium

The elements belonging to the same period are oxygen and fluorine.

54.

(b) B

Explanation: $CH_3Br > CH_3I$

$CH_3Cl > CH_3F$ Here, bond length dominates charge.

55.

(b) BF_3, CH_3^+

Explanation: BF_3 and CH_3^+ are trigonal planar.

56.

(c) NO^-

Explanation: Molecular orbital configuration for NO is

$\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \pi 2p_y^2 \sigma 2p_z^2 \pi^* 2p_z^1$

Species	Bond order
NO^+	3
NO^{2+}	2.5
NO^-	2
NO	2.5

Bond strength is directly proportional to the bond order, so NO^- has minimum bond strength.

57.

(b) x < y

Explanation: x < y

58.

(d) 0.013 %

Explanation: $C_5H_5N + H_2O \rightleftharpoons C_5H_5N^+H + OH^-$

For pyridine, C = 0.1 M and $K_b = 1.7 \times 10^{-9}$

$$\alpha = \sqrt{\frac{K_b}{C}} = \sqrt{\frac{1.7 \times 10^{-9}}{0.1}} = \sqrt{1.7 \times 10^{-8}} = 1.3 \times 10^{-4}$$

$\%\alpha = 1.3 \times 10^{-4} \times 100 = 1.3 \times 10^{-2} = 0.013$

59. **(a)** only iv

Explanation: $\overset{0}{H_2O} + \overset{0}{F_2} \longrightarrow \overset{-1}{HF} + \overset{+1}{H}\overset{0}{O}\overset{-1}{F}$

60.

(c) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

Explanation: Oxidation state of $S_2O_4^{2-}$

2(x) + 4(−2) = −2

2x = 8 − 2

2x = 6

x = 3

Oxidation state of SO_3^{2-}

x + 3(−2) = −2

x = 6 − 2

x = 4

Oxidation state of $S_2O_6^{2-}$

2(x) + 6(−2) = −2

2x = 12 − 2

2x = 10

x = 5

So the oxidation state of sulphur in the anions $S_2O_4^{2-}$, $S_2O_4^{2-}$ and $S_2O_6^{2-}$ follows the order.

$S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

61.

(c) SiC

Explanation: Artificial gem used for cutting glass is SiC.

62.

(b) (C) Only

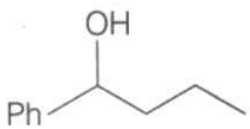
Explanation: $20Ca^{40} + {}_1^1H \longrightarrow {}_{21}Sc^{40} + {}_0^1n$

63. **(a)** Q > S > P > R

Explanation: Carboxylic acid is more acidic than alcohols.

64.

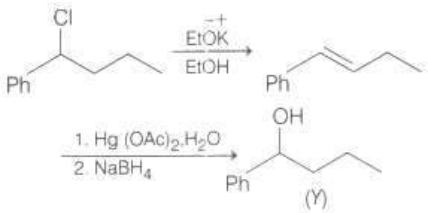
(b)



Explanation:

Heating of 2-chloro-l-phenylbutane with EtOK/EtOH gives 1-phenyl but-l-ene(X).

Reaction of X with $Hg(OAc)_2/H_2O$ followed by $NaBH_4$ gives 1-phenyl butan-1-ol (y)- Reaction involved is as follows:



65.

(c) 120° and 109.5°

Explanation: In 1, 1, 2, 2-tetrachloroethene, each carbon is sp^2-hybridised, thus having bond angle 120° and in tetrachloromethane carbon is sp^3 -hybridised, hence bond angle is 109.5°.

66. **(a)** 40

Explanation: $X = \frac{8}{M}$

$X_{n\text{-octane}} = \frac{114}{114} = 1$

$P^{\circ}_{n\text{-octane}} - P^{\circ}_{n\text{-octane}} X = 0.2\ P^{\circ}_{n\text{-octane}}$

$P^{\circ}_{n\text{-octane}} (1 - X_{n\text{-octane}}) = 0.2\ P^{\circ}_{n\text{-octane}}$

$(1 - X_{n\text{-octane}}) = 0.2$

$X_{solute} = 0.2$

$$\frac{8}{M} = 0.2$$

$$M = \frac{8}{0.2}$$

$$M = 40$$

67.

(d) 460 ppm

Explanation: 0.02 M NaCl means 0.02 mole NaCl in 1 L solution

$$0.02\frac{mol}{L}NaCl = 0.02\frac{mol}{L}Na^{+}$$

$$= 0.02 \times 23\frac{g}{L}Na^{+}$$

$$= 0.46\frac{g}{L}Na^{+}$$

$$= 0.46 \times 1000\frac{mg}{L}Na^{+}$$

$$= 460 \text{ ppm } (\because \text{ ppm} = \frac{mg}{L})$$

68.

(c) $K_c = e^{\frac{nE^\circ F}{RT}}$

Explanation: According to equation,

$E = E^o - \frac{RT}{nF}$ in Q

At equilibrium, E = 0

$E^o = \frac{RT}{nF}$ in K_c

$\therefore \ K_c = e^{\frac{nE^\circ F}{RT}}$

69. **(a)** Option (ii)

Explanation: In the formation of activated complex, the kinetic energy of reactants is converted into potential energy of activated complex, which is required to overcome the repulsions between reactant molecules. Hence, the potential energy of the activated complex is greater than the potential energy of either reactants or products. In an endothermic reaction, the enthalpy of the product is greater than the reactant because heat is absorbed in the reaction. An exothermic reaction, the enthalpy of the product is less than the reactant because heat is evolved in the reaction.

70.

(d) 4.1

Explanation: The half life $t\frac{1}{2}$ = 10 days The decay constant,

$$K = \frac{0.693}{t\frac{1}{2}} = \frac{0.693}{10 \text{ days}} = 0.0693 \text{ days}^{-1}$$

The time required for one fourth conversion

$$t = \frac{2.303}{k}\log_{10}\frac{a}{a-x}$$

$$= \frac{2.303}{0.0693\ \text{day}^{-1}}\log_{10}\frac{1}{1-(\frac{1}{4})} = 4.1\ \text{days}$$

71.

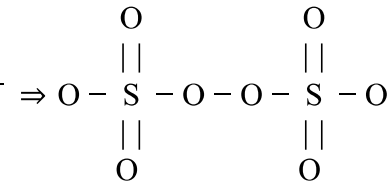
(d) Mg traces

Explanation: Mischmetal alloy does not contain Mg traces.

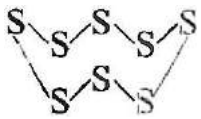
72.

(c) 8 and 8

Explanation:

$S_2O_8^{2-} \Rightarrow$ 

No. of S - O bond = 8

$S_8 \Rightarrow$ 

No. of S - S bond = 8

73. **(a)** MnO_2 and KIO_3

Explanation: $2MnO_2 \xrightarrow{KOH, O_2} 2K_2MnO_4 + 2H_2O$

(A) $(Green)$ (B)

$K_2MnO_4 \xrightarrow{4\,HCl} 2KMnO_4 + MnO_2 + 2H_2O$

$(Purple)$ (C)

$2KMnO_4 \xrightarrow{H_2O,\ KI} 2MnO_2 + 2KOH + KIO_3$

(A) (D)

74.

(b) It will remain same

Explanation: $[Ni(NH_3)_6]^{2+} = sp^3d^2$

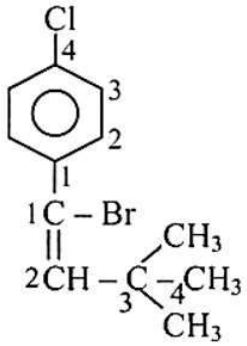
75.

(b) $[Fe(CO)_4]^{2-}$

Explanation: The greater the negative charge on the carbonyl complex, the easier it would be for the metal to permit its electrons to participate in the back bonding, the higher would be the M—C bond order and simultaneously there would be a larger reduction in the C—O bond order. Thus, $[Fe(CO)_4]^{2-}$ has the lowest C—O bond order means the longest bond length.

76. **(a)** 1 -Bromo-1-(4-Chlorophenyl)-3, 3-dimethylbut-1-ene

Explanation:



1 -Bromo-1-(4-Chlorophenyl)-3, 3-dimethylbut-1-ene

77.

(c) methoxyethane

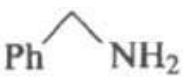
Explanation: methoxyethane

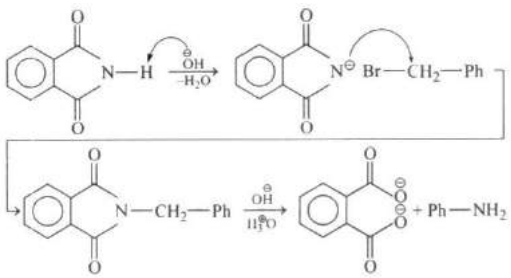
78.

(c) 4-butyl-2, 5-hexadien-1-al

Explanation: 4-butyl-2, 5-hexadien-1-al

79.

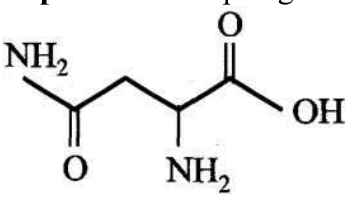
(d) 

Explanation: 

80.

(d) asparagine

Explanation: Asparagine has only one basic functional group in its chemical structure.



Others are basic amino acid with more than one basic functional group.

81.

(b) alcohol

Explanation: alcohol

82.

(d) S > R > Q > P

Explanation: S > R > Q > P

83.

(c) 1.0×10^{10}

Explanation: From Nernst Equation we have

$$E_{cell} = E^{\circ}_{cell} - \frac{2.303RT}{n\,F}\log_{10}K$$

At equilibrium $E_{cell} = 0$

$$0 = E^{\circ}_{cell} - \frac{2.303 \times 8.3140 \times 298}{2 \times 96500}\log K$$

E°_{cell} = 0.295 V (given)

$0.295 = \frac{0.0591}{2} \log K$

$\log K = \frac{0.295 \times 2}{0.0591} = 10$

$\log K = 10 \Rightarrow K = \text{antilog } 10 \Rightarrow K = 1 \times 10^{10}$

84.

(c) Ethanol

Explanation: Ethanol

85.

(d) Both $2KAl(SO_4)_2 \cdot 12H_2O$ and $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

Explanation: Both $2KAl(SO_4)_2 \cdot 12H_2O$ and $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

CHEMISTRY (Section-B)

86.

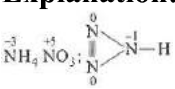
(c) B—I

Explanation: B—Cl has maximum % p-character while B—I has maximum % s-character.

87.

(b) N_3H

Explanation:



88. **(a)** $Ba(CN)_2$

Explanation: $BaC_2 + N_2 \xrightarrow{\Delta} Ba(CN)_2$

$CaC_2 + N_2 \xrightarrow{\Delta} CaCN_2 + C$

89.

(d) (n + 1)s

Explanation: According to (n + 1) rule after the completion of np shell next electron entered in (n + 1)s-orbital.

90. **(a)** 28

Explanation: $E_{\text{Needed}} = 10^{-17} = n \cdot \frac{hc}{\lambda} = \frac{n \times 6.625 \times 10^{-34} \times 3.0 \times 10^{8}}{550 \times 10^{-9}}$

$\therefore$ n = 27.67 or minimum no. of photon needed is 28.

91.

(b) basic

Explanation: basic

92.

(c) 0.8

Explanation: The unit of rate constant suggests it to be I order.

$\therefore$ rate = K $[N_2O_5]$

or $[N_2O_5] = \frac{2.40 \times 10^{-5}}{3.0 \times 10^{-5}} = 0.8$ mol litre^{-1}

93.

(d) 50%

Explanation: 50%

94.

(c) 2

Explanation: $E_{cell} = E_{OP_{H^+}} + E_{RP_{M^{4+}/M^{2+}}} = E^{\circ}_{OP_H} - \frac{0.059}{2}\log\frac{[H^+]^2}{P_{H_2}}$

$+E^{\circ}_{RP_{M^{4+}/M^{2+}}} + \frac{0.059}{2}\log\frac{[M^{4+}]}{[M^{2+}]}$

$E_{cell} = E^{\circ}_{RP_{M^{4+}/M^{2+}}} + \frac{0.059}{2}\log_{10}\frac{[M^{4+}]\cdot P_{H_2}}{[M^{2+}][H^+]^2}$

$0.092 = 0.151 + \frac{0.059}{2}\log_{10} 10^{-x}$

$\therefore$ x = 2

The cell reaction is $H_2 + M^{4+}(aq) \longrightarrow M^{2+}(aq) + 2H^+$

95. **(a)** 3×10^{-7}

Explanation: As we know,

Rate = K × [A] = $3 \times 10^{-6} \times 0.1 = 3 \times 10^{-7}$

96. **(a)** Option (iv)

Explanation: Ionization energy: C < O < N

Abundance in the earth's crust: P > N > As > Sb

The correct order with respect to covalent radii:

N < P < As < Sb < Bi

97. **(a)** iodine

Explanation: iodine

98.

(b) $Co^{3+}_{(g)}$

Explanation: $Co^{3+}_{(g)}$ has degenerated 3d-orbitals.

99. **(a)** 5.92 BM

Explanation: $[FeF_6]^{3-}$ is formed $t_{2g}^1, ^1, ^1 eg^1, ^1$

100. **(a)** Sn/conc.HCl, $CHCl_3$ + alc. KOHΔ, $LiAlH_4$/dry ether

Explanation: $CH_3 - CH_2 - CH_2 - NO_2 1 - Nitropropane \xrightarrow[conc.HCl]{Sn/} CH_3 - CH_2 - CH_2 - NH_2 Propanamine \xrightarrow[\text{dry ether}]{CHCl_3 + alc.KOH, \Delta} CH_3 - CH_2 - CH_2 - NC$Propyl isocyanide $\xrightarrow{LiAlH_4} CH_3 - CH_2 - CH_2 - NH - CH_3 N - Methylpropylamine$

BOTANY (Section-A)

101. **(a)** Nomenclature

Explanation: The scientific naming of an organism whether plant or an animal is called nomenclature.

102.

(d) Other organisms

Explanation: Plants respond to both biotic and abiotic stresses accordingly. Certain plant species absorb few gaseous air pollutants. Root bends downwards in the direction of gravity showing positive geotropism whereas stems grow upwards showing negative geotropism. The movement of a plant part in response to a chemical stimulus is called chemotropism. Pollen tubes show chemotropism by growing towards the ovules.

103.

(c) A - Coccus, B - Bacillus, C -Spirillum, D - Vibrio

Explanation: Bacteria are grouped under four categories based on their shape: the spherical Coccus (pl.: cocci), the rod-shaped Bacillus (pl.: bacilli), the comma-shaped Vibrium (pl.: vibrio) and the spiral Spirillum (pl.: spirilla).

104. **(a)** Everywhere

Explanation: Bacteria occur everywhere except flame.

105. **(a)** Anther and stigma matures at different times

Explanation: Anther and stigma matures at different times

106.

(b) Red algae-Porphyra, Polysiphonia

Explanation: (a) is Porphyra, and (b) is Polysiphonia.
They are examples of Red algae.

107. **(a)** Unicellular

Explanation: Chlamydomonas is a unicellular green algae.

108.

(b) New genetic variations

Explanation: The sexual reproduction involves meiosis and fusion of gametes so it leads to the products with great genetic variability.

109.

(b) 1-Plumule, 2-Cotyledons, 3-Hypocotyl, 4-Radicle, 5-Root cap

Explanation: The image represents a typical dicot embryo in which the labels 1-5 represents the following: 1-Plumule, 2-Cotyledons, 3-Hypocotyls, 4-Radicle, 5-Root cap

110.

(c) All of the these

Explanation: In the given figure, the root tip shows their different regions marked as A, B and C. The correct labelling of A, B and C are region of maturation, region of elongation and region of meristematic activity respectively.

111.

(c) Six

Explanation: In members of family Fabaceae placentation is marginal.

112. **(a)** Endodermis

Explanation: **Casparian strip** is a characteristic feature of plant anatomy. The **Casparian strip** is a **band** of cell wall material deposited in the radial and transverse walls of the endodermis and is chemically different from the rest of the cell. The cell wall has a deposition of lignin and suberin in the form of bands.

113.

(d) A, D

Explanation: A, D

114.

(b) two X chromosomes

Explanation: two X chromosomes

115.

(b) 2000 base pairs/second

Explanation: The average rate of polymerisation of DNA in E.coli is 2000 bp per second. It has only 4.6 × 10^6 bp and completes the process of replication within 18 minutes.

116. **(a)** Deoxyadenylic acid
Explanation: Deoxyadenylic acid

117.
(d) Pili and fimbriae are mainly involved in motility of bacterial cells
Explanation: Pili and fimbriae are mainly involved in motility of bacterial cells is incorrect statement. Pili and Fimbriae are involved in reproduction and Flagella help in the motility of bacterial cells.

118.
(c) Vacuoles
Explanation: The osmotic expansion of a cell kept in water is chiefly regulated by Vacuoles. It helps to maintain the turgidity of the cell.

119. **(a)** Cancers show metastasis.
Explanation: Cancers show metastasis.

120.
(c) Parotid gland
Explanation: Parotid gland

121.
(c) Gametic
Explanation: The term gametic refers to the fact that gametes are the result of meiosis. During the gametic life cycle, a reproductive cell produces haploid gametes (sex cells such as egg and sperm) that combine to produce a zygote. The zygote grows by cell division and cell elongation to produce a multicellular diploid individual.

122. **(a)** biotic potential.
Explanation: Chapman, (1928) proposed the term biotic potential to designate. Maximum Reproductive Power Chapman defined it as the inherent power of an organism to reproduce to survive, I.e. to increase in number. But there is natural check called environment resistance.

123.
(d) A - Deer, B - Rabbit, C - Frog, D - Rat
Explanation: A - Deer, B - Rabbit, C - Frog, D - Rat

124.
(c) A-(ii), B-(i), C-(iv), D-(iii)
Explanation: The correct match is

Column I	Column II
A. Symbiotic nitrogen-fixing bacteria	(ii) Rhizobium
B. Dragonflies	(i) Mosquitoes
C. Bacillus thuringiensis	(iv) Butterfly, caterpillars
D. Free-living N_2-fixing bacteria	(iii) Azotobacter

125. **(a)** Mango
Explanation: Genetic diversity is the diversity in the number and types of genes as well as chromosomes present in different species and the variation in the genes and their alleles in the same species. India has more than 1000 varieties of mango.

126.
(b) A high degree of endemism
Explanation: A country with a high proportion of endemic species should receive high conservation priority because if the endemic species are lost there, they generally become completely extinct.

127.
(b) More diversity
Explanation: More diversity

128.

(d) Prophase

Explanation: In mitosis, prophase is the longest phase of karyokinesis. In prophase Golgi complex, nucleolus, nuclear envelope and endoplasmic reticulum disappear in Prophase.

129.

(b) Prophase

Explanation: The first and longest phase of mitosis is prophase. During prophase, chromatin condenses into chromosome, and the nuclear envelope (the membrane surrounding the nucleus) breaks down.

130.

(b) Duration of light

Explanation: Rate of photosynthesis is independent on duration of light. There are several limiting factors which affect photosynthesis. It was proposed by Blackman.

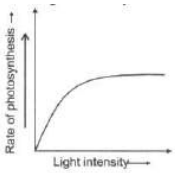
131.

(b) during dark reaction.

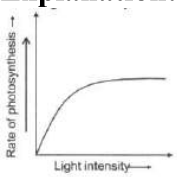
Explanation: During biosynthetic phase or dark reaction, the enzymes in the stroma utilise carbon dioxide from the atmosphere, as well as the ATP and NADPH molecules released from grana, to synthesise sugar molecules and starch.

132.

(c)



Explanation:



133.

(d) Chlorophyll - a

Explanation: Chlorophyll a is widely distributed in green plants and it is also called primary photosynthetic pigment and universal photosynthetic pigment. Chlorophyll absorbs most from the blue portion and then the red portion of the electromagnetic spectrum. It reflects green colour. It is the primary electron donor in electron transport chain.

134. **(a)** nature of the substrate.

Explanation: RQ is the ratio of the volume of carbon dioxide released to the volume of oxygen taken in respiration. It depends on the nature of the substrate, which is oxidised. For carbohydrates RQ is one, for fats, and proteins less than one but more than one for organic acids, etc.

135.

(c) Arithmetic growth

Explanation: Arithmetic growth

BOTANY (Section-B)

136. **(a)** International Code for Botanical Nomenclature

Explanation: The International Code of Botanical Nomenclature (ICBN) is the set of rules and recommendations dealing with the formal botanical names that are given to plants.

137. **(a)** Specific living cells

Explanation: Once viruses infect a cell they take over the machinery of the host cell to replicate themselves, killing the host. These hosts are specific for each type of virus.

138.

(c) Statement c is correct

Explanation: Gymnosperms are plants in which ovules are not enclosed by any ovary wall and remain

exposed, both before and after fertilisation:

- Horsetails are Pteridophytes.
- Stems are branched in Cycas and unbranchedin Cedrus.

139.

(b) Embryo sac

Explanation: In a majority of flowering plants, one of the megaspores is functional while the other three degenerate. Only the functional megaspore develops into the female gametophyte (embryo sac).

140.

(d) Collenchyma

Explanation: Collenchyma is a type of simple tissue which occurs in layers below the epidermis of dicotyledonous plants. It consists of living usually elongated cells with unevenly thickened walls (due to deposition of cellulose, hemicellulose and pectin). It acts as support especially in areas of primary growth. This tissue provides mechanical support to the growing parts of the plants such as young stem andpetiole of a leaf.

141.

(d) Unaffected male- 

Explanation:  presents the affected female and  represents mating.

142.

(c) A-transcription, B-translation, C-Francis Crick

Explanation: A-transcription, B-translation, C-Francis Crick

143.

(d) Smooth endoplasmic reticulum (SER)

Explanation: Smooth endoplasmic reticulum (SER) is when no ribosomes are attached, the ER surface is free.

144.

(d) (A)-(iv); (B)-(i); (C)-(ii); (D)-(v)

Explanation: (A)-(iv); (B)-(i); (C)-(ii); (D)-(v)

145. **(a)** PGAL ⟶ PGA

Explanation: This reaction takes place during glycolysis that involves a breakdown of glucose the reduction of NAD takes place and it forms in NADH + H^+. This occurs when 1,3- phosphoglyceraldehyde is converted into 13-phosphoglyceric acid. The enzyme used here is triose phosphate dehydrogenase.

146.

(d) Decompose a variety of organic compounds

Explanation: Pseudomonas is a gram-negative bacteria which has the ability to decompose a variety of organic compounds.

147.

(b) insectivorous plants

Explanation: Trophic level is a functional level. A single species may occupy more than one trophic level. Insectivorous plants are producers, occupying first trophic level. They also eat inserts and thus, occupy third trophic level also.

148. **(a)** Elongation of intemodes

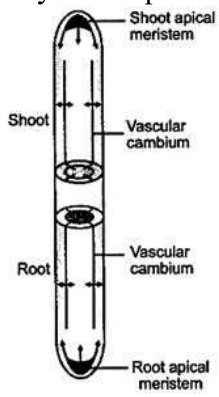
Explanation: Elongation of intemodes

149.

(d) Auxin and Ethylene

Explanation: Auxin and Ethylene, both these hormones are helpful for flowering and fruit synchronisation.

They are responsible for growth and maturation as well.



Locations of root apical meristem. shoot apical meristem and vascular cambium.

150.

(c) D

Explanation: More than one

ZOOLOGY (Section-A)

151.

(d) All of these

Explanation: Hemichordates consist of a small group of worm-like marine animals. Their excretory organ is proboscis gland. Sexes are separate and fertilization is external. Development is indirect. Hence, all of these are the characteristics of Hemichordates.

152. **(a)** (iv) and (v)

Explanation:

i. They are triploblastic, metamerically segmented, and coelomate animals.
ii. They possess longitudinal and circular muscles that help in locomotion.
iii. Aquatic annelids like Nereis possess lateral appendages, parapodia, which help in swimming.
iv. Nereis, an aquatic form, is dioecious.
v. Earthworms and leeches are monoecious.

Hence, (iv) and (v) are the wrong statements for Annelida.

153.

(b) Ostia

Explanation: In Porifera, water enters through minute pores called ostia in the body wall into a central cavity, spongocoel, from where it goes out through the osculum.

154.

(d) Germ cell

Explanation: Germ cells produce gametes and are the only cells that can undergo meiosis as well as mitosis. These cells are immortal because they are the link between generations.

155.

(c) supporting and non-excitable cells of neural tissue.

Explanation: The neuroglial cells are non-excitable cells that protect and support neurons.

156.

(d) Statement (d) is not true.

Explanation: The partial pressure of CO_2 in deoxygenated blood is 40 mm of Hg.

157.

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

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

158. **(a)** They carry about 20-25% of CO_2.

Explanation: Blood is the medium of transport for O_2 and CO_2. About 97% of O_2 is transported by RBCs in the blood. The remaining 3% of O_2 is carried in a dissolved state through the plasma. Nearly 20-25% of

CO_2 is transported by RBCs whereas 70% of it is carried as bicarbonate. About 7% of CO_2 is carried in a dissolved state through plasma.

159. **(b)** (A)-(ii), (B)-(iii),(C)-(iv), (D)-(i)
Explanation: Pneumotaxic centre primarily limits the inspiration. Itis present in the pons region of the brain.
O_2 dissociation curve is also known as oxygen haemoglobin dissociation curve. It is obtained on plotting percentage saturation of haemoglobin with O_2 against the pO_2.
Carbonic anhydrase (zinc containing enzyme) is mainly present in the RBCs and its minute quantity is present in the plasma. Alveoli are the primary sites of exchange of gases.

160. **(a)** Trachea
Explanation: Trachea

161. **(b)** They degenerate.
Explanation: A large number of primary follicles degenerate during the phase from birth to puberty. Therefore, at puberty only 60,000-80,000 primary follicles are left in each ovary.

162. **(a)** 4
Explanation: 4

163. **(d)** 40 weeks
Explanation: 40 weeks

164. **(c)** Periodic abstinence
Explanation: Diaphragms, vaults, and condoms are barriers methods of contraception whereas periodic abstinence is a natural contraceptive method.

165. **(d)** Option (d) is wrongly matched.
Explanation: GIFT is the transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce one but can provide suitable environment for fertilisation and further development.

166. **(b)** Are best adapted to the environment
Explanation: Are best adapted to the environment

167. **(c)** 0.6
Explanation: According to Hardy-Weinberg principle:
$(p + q)^2 = p^2 + 2pq + q^2$
$= 1$
$= 1 - (p + q)^2$
Given,
P^2 (AA) = 360 out of 1,000 individuals
or p^2 = 36 out of 100
q^2 = 160 out of 1,000 or q^2 = 16 out of 100
So,
$p = \sqrt{0.36}$
$= 0.6$
$q = \sqrt{0.16}$
$= 0.4$

168.
(c) (i), (ii), and (v)
Explanation: Tubular secretion takes place in the proximal convoluted tubule (PCT) and distal convoluted tubule (DCT) and also ultrafiltration takes place in glomerulus.
169. **(a)** Only B
Explanation: Reptiles (e.g., lizard), birds (e.g., birds), land snails, and insects excrete nitrogenous wastes, as uric acid in the form of pellet or paste with a minimum loss of water and are called as uricotelic animals.
170. **(a)** Ureotelic
Explanation: An ammonotelic organism excretes soluble ammonia as a result of deamination. Ammonia is highly toxic to tissues and extremely soluble in water. Ammonotelic animals include protozoans, crustaceans, platyhelminths, cnidarians, poriferans, echinoderms, and other aquatic invertebrates, among others. Ammonotelism is one of the three major forms of excretion of nitrogenous waste in organisms, the others being ureotelism and uricotelism.
171.
(b) Pygostyle
Explanation: Pygostyle
172.
(b) Potassium
Explanation: Potassium is the most abundant mineral element in muscle.
173.
(d) 11 and 12
Explanation: 11 and 12
174. **(a)** 3, 4 and 6
Explanation: Cranial nerves III (CNIII) (oculomotor), IV (trochlear), and VI (abducens) control the position of the eyeballs.
175.
(d) Cerebellum
Explanation: Brain stem is formed by mid brain, pons varolli and medulla oblongata.
176. **(a)** Option (a) is correct.
Explanation: The cerebellum receives information from the sensory systems, the spinal cord, and other parts of the brain and then regulates motor movements. The cerebellum coordinates voluntary movements such as posture, balance, coordination, and speech, resulting in smooth and balanced muscular activity.
177.
(d) Insulin
Explanation: Insulin
178.
(b) anterior pituitary gland and stimulates secretion of LH and FSH
Explanation: GnRH secreted by hypothalamus stimulates anteriory pituitary gland for the gonadotropins-FSH and LH.
179.
(b) Left auricle receives oxygenated blood from the lungs.
Explanation: The deoxygenated blood pumped into the pulmonary artery is passed on to the lungs from where the oxygenated blood is carried by the pulmonary veins into the left atrium. This pathway constitutes the pulmonary circulation.
180.
(c) Pericardium
Explanation: The heart is protected by a double-walled membranous bag called pericardium which encloses the pericardial fluid.
181.
(d) arthropods and molluscs
Explanation: Open circulatory pathways are present in arthropods and molluscs in which the blood pumped by the heart passes through the large vessels into the open spaces of body cavity called sinuses.

182.
(b) Bioreactor (stirring type) is not suitable for obtaining large scale foreign gene products
Explanation: Bioreactor (stirring type) is not suitable for obtaining large scale foreign gene products

183.
(b) Down stream processing
Explanation: Down stream processing

184.
(b) (A)-(iv), (B)-(i), (C)-(ii), (D)-(iii)
Explanation: (A) Bt cotton - (iv) Bacillus thuringiensis
(B) Adenosine deaminase deficiency - (i) Gene therapy
(C) RNAi - (ii) cellular defence
(D) PCR - (iii) Detection of HIV infection
In Bt cotton cry gene was isolated from Bacillus thuringiensis. The first clinical gene therapy was done for adenosine deaminase (ADA) deficiency. RNA interference is a new method used to prevent infestation. This strategy is used in eukaryotes as a cellular defense mechanism. PCR is used to detect HIV in suspected AIDS patients.

185.
(c) Christian Hansen
Explanation: Christian Hansen

ZOOLOGY (Section-B)

186.
(d) Pinctada
Explanation: An example of phylum Mollusca - Pinctada is commonly called as Pearl oyster.

187.
(c) Enamel
Explanation: Tooth enamel is the hardest substance in the human body. It is shiny, white enamel that covers the teeth and is stronger than bone.

188.
(c) Basophil
Explanation: Basophils have a smaller number of coarse granules. They release heparin, serotonin and histamine. They are probably like mast cells of connective tissue and are not phagocytic in nature. Macrophages are cells produced by the differentiation of monocytes in the tissues and are phagocytic in nature. Monocytes are the largest of all types of leucocytes. They are motile and phagocytic in nature and engulf bacteria and cellular debris. Neutrophils have fine granules; they are the most numerous of all leucocytes. They eat harmful germs and are, therefore, phagocytic in nature.

189.
(b) Pneumotoxic centre
Explanation: Pneumotaxic centre located in the dorsal part of pons varolii, regulates rate of respiration by reducing the duration of inspiration.

190.
(c) 400
Explanation: In each menstrual cycle, a thousand follicles are lost and only one follicle matures into an ovum, which is released into the fallopian tube, It means out of 1-2 million follicles, only about 400-500 mature.

191. **(a)** In this process, embryo is formed by injecting ovum into the sperm.
Explanation: Zygote intra fallopian transfer (ZIFT) is an infertility treatment which is used when a blockage in the fallopian tubes prevents the normal binding of sperm to the egg. In this technique, egg cells are removed from a woman's ovaries, and in vitro fertilised.

192.
(d) Weismann
Explanation: Weismann

193.

(d) None of these

Explanation: The presence of glucose in the urine is called glycosuria or glucosuria.

194.

(b) Option B is incorrect pair.

Explanation: Sacral vertebrae - 2 fused.

There are 5 sacral vertebral bones. They are represented by the symbols S_1 through S_5 and are situated between the lumbar vertebrae and the coccyx(the lowest segment of the vertebral column). The sacral vertebrae are normally fused to form the sacrum.

195.

(c) A: perilymph, B: tectorial membrane C: endolymph

Explanation: A -perilymph; B -tectorial membrane; C -endolymph; D -sensory hair cells.

196. **(a)** hormone of ovary

Explanation: hormone of ovary

197.

(c) Gonadotropin

Explanation: Gonadotropin

198.

(b) The flow of blood into the pulmonary artery will be reduced.

Explanation: Tricuspid valve is the valve in the heart between the right atrium and right ventricle. The valve reopens to allow blood to flow from the atrium into the ventricle. Thus, if tricuspid valve is partially non-functional.the flow of blood into the pulmonary artery will be reduced.

199.

(d) Only (ii)

Explanation: Agrobacterium tumefaciens delivers a piece of DNA known as 'T-DNA' in the Ti plasmid, which transforms normal plant cells into tumour cells. It does not produce chemicals.

200.

(b) Introduction of gene for adenosine deaminase in persons suffering from severe combined immuno-deficiency (SCID)

Explanation: Introduction of gene for adenosine deaminase in persons suffering from severe combined immuno-deficiency (SCID)