NEET (UG) 2024

SAMPLE PAPER - 4

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. Which of the following units denotes the dimensions $[\frac{ML^2}{Q^2}]$, where Q denotes the electric charge? **[4]**

   a) Weber (Wb)
   b) Wbm^{-2}
   c) Henry
   d) Hm^{-2}

2. The dimensions of emf in MKS is: **[4]**

   a) $[ML^2T^{-2}Q^{-2}]$
   b) $[ML^2T^{-2}Q^{-1}]$
   c) $[ML^{-1}T^{-2}Q^{-2}]$
   d) $[MLT^{-2}Q^{-1}]$

3. A scooter going toward east at 10 ms^{-1} turns right through an angle of 90°. If the speed of the scooter remains unchanged in taking this turn, the change in the velocity of the scooter is: **[4]**

   a) 10.0 ms^{-1} in southern direction
   b) zero
   c) 20.0 ms^{-1} in south-western direction
   d) 14.14 ms^{-1} in south-western direction

4. A spirit level is placed at the edge of a turntable along its radius. The bubble will lie: **[4]**

   i. at the centre
   ii. at the outer edge
   iii. at the inner edge
   iv. will oscillate about the centre

a) only iii

b) i and ii

c) iv and i

d) ii and iii

5. An object of mass 20 kg when projected at an angle of 30^{o} with vertical, attains a height of $4\hat{i}$ - $2\hat{j}$. How much height an object would attain if its velocity is doubled? **[4]**

a) 20.56 m

b) 5.44 m

c) 10.28 m

d) 17.88 m

6. A body moves down along inclined plane of angle of inclination θ. The coefficient of friction between the body and the plane varies as $\mu = 0.25x$, where x is the distance moved down the plane. The body will have the maximum velocity when it has travelled a distance x given by: **[4]**

a) $x = 2 \cot \theta$

b) $x = \frac{4}{\tan \theta}$

c) $x = \frac{2}{\cot \theta}$

d) $x = 4 \tan \theta$

7. A bucket full of water weighs 5 kg, it is bulled from a well 20 m deep. There is a small hole in the bucket through which water leaks at a constant rate of 0.2 kg/m. The total work done in pulling the bucket up from the well is: ($g = 10\ m/s^2$) **[4]**

a) 100 J

b) 600 J

c) 500 J

d) 400 J

8. If two masses m_1 and m_2 collide, the ratio of change in their respective velocities is proportional to: **[4]**

a) $\frac{m_2}{m_1}$

b) $\frac{m_1}{m_2}$

c) $\sqrt{\frac{m_2}{m_1}}$

d) $\sqrt{\frac{m_1}{m_2}}$

9. A constant power is supplied to a rotating disc. Angular velocity (ω) of disc varies with number of rotations (n) made by the disc as: **[4]**

a) $\omega \propto (n)^{3/2}$

b) $\omega \propto (n)^2$

c) $\omega \propto (n)^{2/3}$

d) $\omega \propto (n)^{1/3}$

10. A rigid horizontal smooth rod AB of mass 0.75 kg and length 40 cm can rotate freely about a fixed vertical axis through its mid-point O. Two rings each of mass 1 kg initially at rest at a distance of 10 cm from O on either side of the rod. The rod is set in rotation **[4]**

with an angular velocity of 30 radian per sec and when the rings reach the ends of the rod, the angular velocity (in rad/sec) is:

a) 10 b) 15

c) 5 d) 20

11. The ratio of the radius of the earth to that of moon is 10. The ratio of accelerations due to gravity on earth and on moon is 8. The ratio of the escape velocity from the surface of earth to that from the moon is nearly. **[4]**

a) 9:1 b) 8:1

c) 5:1 d) 1.66:1

12. Consider two cylindrical rods of identical dimensions, one of rubber and the other of steel. Both the rods are fixed rigidly at one end to the roof. A mass M is attached to each of the free ends at the centre of the rods. **[4]**

i. Both the rods will elongate but there shall be no perceptible change in shape.

ii. The steel rod will elongate and change shape but the rubber rod will only elongate.

iii. The steel rod will elongate without any perceptible change in shape, but the rubber rod will elongate and the shape of the bottom edge will change to an ellipse.

iv. The steel rod will elongate, without any perceptible change in shape, but the rubber rod will elongate with the shape of the bottom edge tapered to a tip at the centre.

a) Only (ii) b) The strain produced in the spring is longitudinal.

c) Only (iii) d) Only (i)

13. The value of coefficient of volume expansion of glycerin is $5 \times 10^{-4}\ K^{-1}$. The fractional change in the density of glycerin for a rise of 40° C in its temperature, is **[4]**

a) 0.015 b) 0.010

c) 0.025 d) 0.020

14. A black body at 227°C radiates heat at the rate of 7 cal/cm^2. At a temperature of 727°C, the rate of heat radiated in the same units will be: **[4]**

a) 50 b) 80

c) 60 d) 112

15. In a process, temperature and volume of one mole of an ideal monoatomic gas are varied according to the relation VT = k, where k is a constant. In this process, the **[4]**

temperature of the gas is increased by ΔT. The amount of heat absorbed by gas is (where, R is gas constant)

a) $\frac{1}{2}kR\Delta T$

b) $\frac{1}{2}R\Delta T$

c) $\frac{2k}{3}\Delta T$

d) $\frac{3}{2}R\Delta T$

16. A sample of a perfect gas occupies a volume V at a pressure P and absolute temperature T. The mass of each molecule is m. Which of the following expressions gives the density of the gas? **[4]**

a) $\frac{Pm}{kT}$

b) mkT

c) $\frac{P}{kTV}$

d) $\frac{m}{V}$

17. A spring is stretched by 5 cm by a force 10 N. The time period of the oscillations when a mass of 2 kg is suspended by it is: **[4]**

a) 0.0628 s

b) 0.628 s

c) 3.14 s

d) 6.28 s

18. Two identical piano wires, kept under the same tension T have a fundamental frequency of 600 Hz. The fractional increases in the tension of one of the wires which will lead to the occurrence of 6 beats when both the wires oscillate together would be: **[4]**

a) 0.03

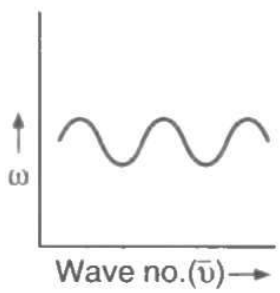
b) 0.04

c) 0.01

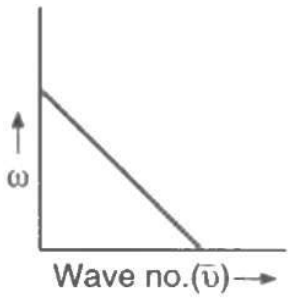
d) 0.02

19. The graph between wave number $(\bar{v})$ and angular frequency (ω) is: **[4]**

a)



b)



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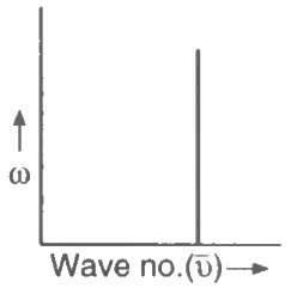
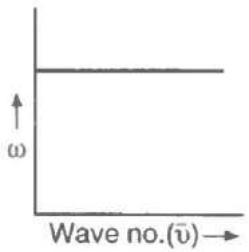


d)



20. Two positive point charges are 3 m apart and their combined charge is 20 μC. If the force between them is 0.075 N, then the charges are: **[4]**

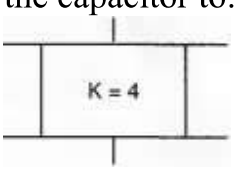
a) 14 μC, 6 μC

b) 12 μC, 8 μC

c) 15 μC, 5 μC

d) 10 μC, 10 μC

21. Consider a parallel plate capacitor of 10μF with air filled in the gap between the plates. Now, one-half of the space between the plates is filled with a dielectric of dielectric constant 4, as shown in the figure. The capacity of shown in the figure. The capacity of the capacitor to: **[4]**



a) 20μF

b) 40μF

c) 5μF

d) 25μF

22. The operating temperature of the filament of lamp is 2000°C. The temperature coefficient of the material of filament is $\frac{0.005}{^\circ C}$. If the atmospheric temperature be 0°C, then the current in the 100W-200V lamp when it is switched on is nearest to: **[4]**

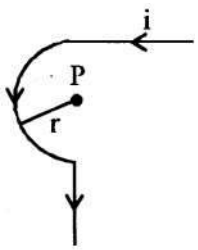
a) 5.5 A

b) 3.5 A

c) 4.5 A

d) 2.5 A

23. Find the magnetic field at the point P in figure. The curved portion is a semicircle connected to two long straight wires. **[4]**



a) $\frac{\mu_o i}{2r}\left(\frac{1}{2}+\frac{1}{\pi}\right)$

b) $\frac{\mu_0 i}{2r}\left(\frac{1}{2}+\frac{1}{2\pi}\right)$

c) $\frac{\mu_o i}{2r}\left(1+\frac{2}{\pi}\right)$

d) $\frac{\mu_0 i}{2r}\left(1+\frac{1}{\pi}\right)$

24. A bar magnet used in a vibration magnetometer is heated, so as to reduce the magnetic moment by 36%. The time period of magnet: (neglecting the changes in dimension of magnet) **[4]**

a) decreases by 16%

b) increases by 16%

c) increases by 36%

d) decreases by 36%

25. At a temperature of 30°C, the susceptibility of a ferromagnetic material is found to be χ. Its susceptibility at 333°C is: **[4]**

a) 2χ

b) χ

c) 11.1χ

d) 0.5χ

26. A series LCR circuit containing 5.0 H inductor, 80 μF capacitor and 40 Ω resistor is connected to 230 V variable frequency ac source. The angular frequencies of the source at which power transferred to the circuit is half the power at the resonant angular frequency are likely to be: **[4]**

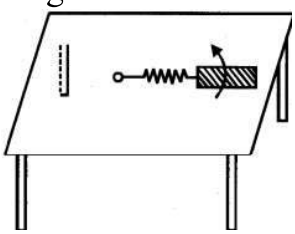
a) 46rad/s and 54 rad/s

b) 42rad/s and 58rad/s

c) 25rad/s and 75rad/s

d) 50rad/s and 25rad/s

27. A metallic rod of length ℓ is tied to a string of length 2ℓ and made to rotate with angular speed ω on a horizontal table with one end of the string fixed. If there is a vertical magnetic field **B** in the region, the emf induced across the ends of the rod is **[4]**



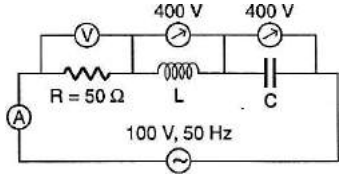
a) $\frac{5B\omega l^2}{2}$

b) $\frac{2B\omega l^3}{2}$

c) $\frac{3B\omega l^3}{2}$

d) $\frac{4B\omega l^3}{2}$

28. In the series LCR circuit, the voltmeter and ammeter readings are: **[4]**



a) V = 300 volt, I = 1 amp

b) V = 100 volt, I = 5 amp

c) V = 100 volt, I = 2 amp

d) V = 1000 volt, I = 2 amp

29. The wavelength of the characteristic X-ray K_α line emitted by a hydrogen-like element is $0.32\overset{o}{A}$. The wavelength of K_β line emitted by the same element will be: **[4]**

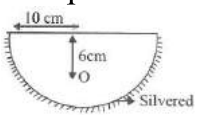
a) $0.32\overset{o}{A}$

b) $0.24\overset{o}{A}$

c) $0.48\overset{o}{A}$

d) $0.27\overset{o}{A}$

30. A hemispherical glass body of radius 10 cm and refractive index 1.5 is silvered on its curved surface. A small air bubble is 6 cm below the flat surface inside it along the axis. The position of the image of the air bubble made by the mirror is seen: **[4]**



a) 16 cm below flat surface

b) 14 cm below flat surface

c) 30 cm below flat surface

d) 20 cm below flat surface

31. Polaroid glass is used in sunglasses because: **[4]**

a) it is cheaper

b) it is fashionable

c) it has good colour

d) it reduces the light intensity to half on account of polarisation

32. A modern 200 watt sodium street lamp emits yellow light of wavelength 0.6 μm. Assuming it to be 25% efficient in converting electrical energy to light, the number of photons of yellow light it emits per second is: **[4]**

a) 6×10^{18}

b) 1.5×10^{20}

c) 3×10^{19}

d) 6×10^{20}

33. For which one of the following, Bohr model is not valid? **[4]**

a) Singly ionized helium atom (He^+)

b) Hydrogen atom

c) Singly ionized neon atom (Ne^+)

d) Deuteron atom

34. In which of the following systems will the radius of the first orbit be minimum? **[4]**

a) Doubly ionized lithium

b) Deuterium atom

c) Hydrogen atom

d) Singly ionized helium

35. Masses of two isobars $_{29}Cu^{64}$ and $_{30}Zn^{64}$ are 63.9298 u and 63.9292 u respectively. It can be concluded from these data that **[4]**

a) Cu^{64} is radioactive, decaying to Zn^{64} through β-decay

b) Cu^{64} is radioactive, decaying to Zn^{64} through γ-decay

c) both the isobars are stable

d) Zn^{64} is radioactive, decaying to Cu^{64} through β-decay

PHYSICS (Section-B)

Attempt any 10 questions

36. The work done in pulling up a block of wood weighing 2 kN for a length of 10 m on a smooth plane inclined at an angle of 15^{o} with the horizontal is: **[4]**

a) 5.17 kJ

b) 9.82 kJ

c) 4.36 kJ

d) 8.91 kJ

37. The moment of inertia of a straight thin rod of mass M, length L about an axis perpendicular to its length and passing through its one end is: **[4]**

a) ML^2

b) $\frac{1}{3}ML^2$

c) $\frac{1}{12}ML^2$

d) $\frac{1}{2}ML^2$

38. The Earth is an approximate sphere. If the interior contained matter which is not of the same density everywhere, then on the surface of the Earth, the acceleration due to gravity: **[4]**

a) will be same everywhere in magnitude directed towards the centre

b) will be directed towards the centre but not the same everywhere

c) will have the same value everywhere but not directed towards the centre

d) cannot be zero at any point

39. Thermal conductivity of the air is of the order of: (unit $Js^{-1}m^{-1}k^{-1}$) **[4]**

a) 0.24

b) 0.024

c) 4.2 d) 2.4

40. The equation for the vibration of a string fixed at both ends vibrating in its third harmonic is given by: **[4]**

$y = 2\ cm\ \sin[(0.6\ cm^{-1})x]\ \cos[(500\pi\ s^{-1})t]$.

The length of the string is:

a) 24.6 cm b) 15.7 cm

c) 20.6 cm d) 12.5 cm

41. If $x = a \sin\left(\omega t + \frac{\pi}{6}\right)$ and $x' = a\cos\omega t$ then what is the phase difference between the two waves? **[4]**

a) $\pi/2$ b) $\pi/3$

c) π d) $\pi/6$

42. A long horizontal rigidly supported wire carries a current $i_a = 96$ A. Directly above it and parallel to it at a distance, another wire of 0.144 N weight per metre carrying a current $i_b = 24$ A, in a direction opposite to that of i_a. If the upper wire is to float in air due to magnetic repulsion, then its /distance (in mm) from the lower wire is: **[4]**

a) 3.2 b) 9.6

c) 4.8 d) 1.6

43. A magnet is parallel to a uniform magnetic field. If it is rotated by 60^o, the work done is 0.8 J. How much work is done in moving it 30^o further? **[4]**

a) 0.8×10^7 erg b) 0.8 erg

c) 0.4 J d) 8 J

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

a) four times per revolution b) twice per revolution

c) six times per revolution d) once per revolution

45. An AC source is connected to a capacitor when the current in the circuit is I_V. Now, a dielectric slab is inserted into the capacitor, then the new current is: **[4]**

a) less than I_V b) more than I_V

c) maybe more than or less than I_V d) equal to I_V

46. A telescope has an objective lens of focal length 200 cm and an eye-piece with focal length 2 cm. If this telescope is used to see a 50 metre tall building at a distance of 2 km, what is the height of the image of the building formed by the objective lens? **[4]**

a) 10 cm b) 1 cm

c) 5 cm d) 2 cm

47. A light wave enters from medium 1 into medium 2. Its velocity in the 2nd medium is double than that of in 1st medium. For total internal reflection, the angle of incidence must be greater than: **[4]**

a) 90^o b) 45^o

c) 60^o d) 30^o

48. If the work function of the metal is 3 eV, then the threshold wavelength will be **[4]**

a) 4500 $\mathring{A}$ b) 4133 $\mathring{A}$

c) 5000 $\mathring{A}$ d) 4000 $\mathring{A}$

49. In the Bohr model of a hydrogen atom, the centripetal force is furnished by the coulomb attraction between the proton and the electron. If a_0 is the radius of the ground state orbit, m is the mass and e is the charge on the electron and $\in_0$ is the permittivity of vacuum, the speed of the electron is: **[4]**

a) $\frac{e}{\sqrt{\epsilon_0 a_0 m}}$ b) $\frac{\sqrt{\epsilon_0 a_0 m}}{e}$

c) $\sqrt{\frac{4\pi\epsilon_0 a_0 m}{e}}$ d) $\frac{e}{\sqrt{4\pi\epsilon_0 a_0 m}}$

50. For the stability of any nucleus: **[4]**

a) number of electrons will be less b) binding energy per nucleon will be more

c) binding energy per nucleon will be less d) number of electrons will be more

CHEMISTRY (Section-A)

51. The number of atoms of oxygen present in 44.8 L of ozone at S.T.P. are _____. **[4]**

a) 9.03×10^{23}

b) 40.04×10^{23}

c) 18.06×10^{23}

d) 36.13×10^{23}

52. The energy levels for $Z^{A^{+(z-1)}}$ can be given by: **[4]**

a) E_n for $A^{+(z-1)} = Z \times E_n$ for H

b) E_n for $A^{+(z-1)} = Z^2 \times E_n$ for H

c) E_n for $A^{+(z-1)} = \frac{1}{Z^2} \times E_n$ for H

d) E_n for $A^{+(z-1)} = \frac{1}{Z} \times E_n$ for H

53. The ionization of hydrogen atom would give rise to: **[4]**

a) hydroxyl ion

b) hydronium ion

c) hydride ion

d) proton

54. The structure of F_2SeO is analogous to: **[4]**

a) SO_3

b) ClO_3^-

c) XeO_3

d) Both ClO_3^- and XeO_3

55. Which liquid has the **highest** vapour pressure at 25°C? **[4]**

a) Glycerol, $C_3H_5(OH)^3$

b) Butane, C_4H_{10}

c) Propanol, C_3H_7OH

d) Octane, C_8H_{18}

56. The peroxymonosulphate anion, HSO_5^-, has: **[4]**

a) five sulphur-oxygen bonds and no oxygenoxygen bonds

b) three sulphur-oxygen bonds and two oxygenoxygen bonds

c) one sulphur-oxygen bond and four oxygenoxygen bonds

d) four sulphur-oxygen bonds and one oxygenoxygen bond

57. The difference between ΔH and $\Delta U(\Delta H - \Delta U)$, when the combustion of one mole of heptane (I) is carried out at a temperature T, is equal to: **[4]**

a) 3RT

b) -3 RT

c) -4 RT

d) 4RT

58. Consider the following equilibrium: **[4]**

$\frac{1}{2}A_2B_{4(g)} \rightleftharpoons AB_{2(g)}$ $K_c = 3.3$ at 100^oC

For which of the following equilibria is K_c less than 3.3 at 100^oC?

a) $A_2B_{4(g)} \rightleftharpoons 2AB_2(g)$

b) $2A_2B_{4(g)} \rightleftharpoons 4AB_2(g)$

c) $\frac{1}{4}A_2B_{4(g)} \rightleftharpoons \frac{1}{2}AB_2(g)$

d) $4A_2B_{4(g)} \rightleftharpoons 8AB_2(g)$

59. The pair in which phosphorus atoms have a formal oxidation state of +3 is: **[4]**

a) orthophosphorus and pyrophosphorus acids

b) pyrophosphorus and hypophosphoric acids

c) orthophosphorus and hypophosphoric acids

d) pyrophosphorus and pyrophosphoric acids

60. A, B and C are three elements fonning a part of the compound in oxidation states of +2, +5 and -2 respectively. What could be the compound? **[4]**

a) $A_3(BC_4)_2$

b) $A_2(BC_4)_3$

c) ABC

d) $A_2(BC)_2$

61. The state of hybridization of boron and oxygen atom in boric acid (H_3BO_3) is respectively: **[4]**

a) sp^3, sp^2

b) sp^2, sp^2

c) sp^3, sp^3

d) sp^2, sp^3

62. The silicates having chain and cyclic structures involve: **[4]**

a) sharing of one oxygen atom between two SiO_4^{-4} tetrahedral units.

b) sharing of three oxygen atom of each SiO_4^{-4} tetrahedral unit with three other tetrahedral units.

c) sharing of two oxygen atoms of each SiO_4^{-4} tetrahedral unit with two other tetrahedral units.

d) discrete SiO_4^{-4} tetrahedral.

63. Point out the incorrect statement about resonance. **[4]**

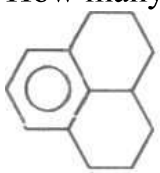
a) In resonance structures, the constituent atom should be in the same position.

b) Resonance structures should differ only in the location of electrons around the constituent atoms.

c) Resonance structure should have equal energy.

d) In resonance structure there should be the same number of electron pairs.

64. How many benzylic hydrogens are present in the hydrocarbon shown? **[4]**



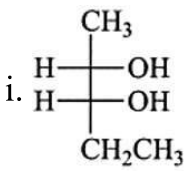
a) 3

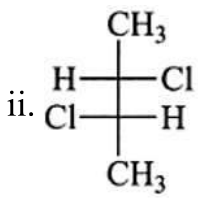
b) 5

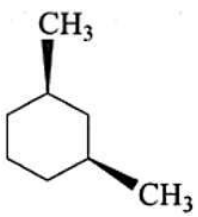
c) 6

d) 4

65. Which of the following compound are meso forms? **[4]**

i. 

ii. 

iii. 

a) iii only

b) i and ii

c) i only

d) ii and iii

66. The freezing point depression of 0.1 molal solutions of a compound in benzene is $0.128^{o}C$. K_f for benzene is 5.12 K kg mol^{-1}. If the calculated molar mass of the compound is 74 g mol^{-1}. What is the observed molar mass of the compound? **[4]**

a) 222 g/mol

b) 296 g/mol

c) 148 g/mol

d) 74 g/mol

67. Osmomolarity of an electrolytic solution is given by: $C \times (1 - \alpha + (x + y)\alpha)$. If 0.2 M Na_2SO_4 show 90% ionisation, its osmomolarity is: **[4]**

a) 0.2 M

b) 3.8 M

c) 0.56 M

d) 0.6 M

68. The plots made for E°_{cell} vs. $\log_e K_c$ for a redox cell reaction showing loss and gain of 6 electrons has intercept equal to: **[4]**

a) $\frac{RT}{6F}$

b) $\frac{RT}{4F}$

c) $\frac{6F}{RT}$

d) $\frac{2.303RT}{6F}$

69. For the reaction, N_2O_4 (g) $\underset{K_2}{\overset{K_1}{\rightleftharpoons}}$ $2NO_2$(g), the rate of K, disappearance of NO_2 will be **[4]**

a) $2K_2[NO_2]^2 - 2K_1[N_2O_4]$

b) $K_1[N_2O_4] - K_2[NO_2]^2$

c) $K_2[NO_2]^2 - K_1[N_2O_4]$

d) $2K_1[N_2O_4] - 2K_2[NO_2]^2$

70. The rate constant of a reaction is 5×10^{-8} mole litre^{-1}sec^{-1}. How long it would take to change concentration for 4×10^{-2} M to 2×10^{-2} M? **[4]**

a) 4×10^5 sec

b) 4×10^3 sec

c) 4×10^6 sec

d) 40 sec

71. Colourless solutions of the following four salts are placed separately in four different test tubes and a strip of copper is dipped in each one of these. Which solution will turn blue? **[4]**

a) $ZnSO_4$

b) $AgNO_3$

c) KNO_3

d) $Zn(NO_3)_2$

72. The shape of ClO_3^- according to VSEPR model is: **[4]**

a) planar triangle

b) square planar

c) pyramidal

d) tetrahedral

73. More number of oxidation states are exhibited by the actinoids than by the lanthanoids. The main reason for this is: **[4]**

a) greater metallic character of the lanthanoids than that of the

b) more active nature of the actinoids.

corresponding actinoids.

c) more energy difference between 5f and 6d orbitals than that between 4f and 5d orbitals.

d) lesser energy difference between 5f and 6d orbitals than that between 4f and 5d orbitals.

74. Which is **not** a π-bonded complex? **[4]**

a) Ziese's salt

b) bts(benzene) chromium

c) Tetraethyl lead

d) Ferrocene

75. Nickel (Z = 28) combines with a uninegative monodentate ligand X^- to form a paramagnetic complex $[NiX_4]^{2-}$. The number of unpaired electron(s) in the nickel and geometry of this complex ion are, respectively : **[4]**

a) two, tetrahedral

b) one, tetrahedral

c) two, square planar

d) one, square planar

76. Among the following, the one which reacts most readily with ethanol is **[4]**

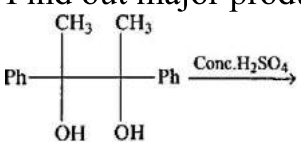
a) p-nitrobenzyl bromide

b) p-methoxybenzyl bromide

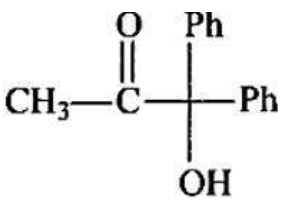
c) p-chlorobenzyl bromide

d) p-methylbenzyl bromide

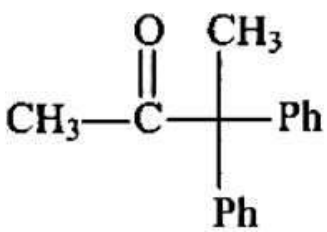
77. Find out major products of the following reactions: **[4]**



a)



b)



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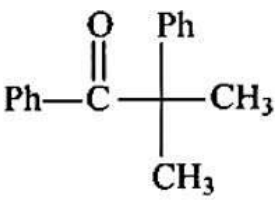

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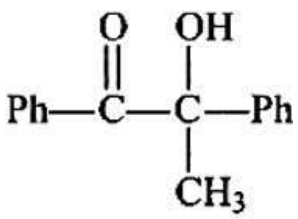


78. Strongest acid among the following is **[4]**

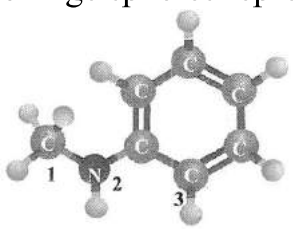
a) F_3CCOOH

b) Acetic acid

c) $F_2CHCOOH$

d) FCH_2COOH

79. Identify the hybridization for the numbered atoms in the following structure. The orange spheres represent hydrogen atoms. **[4]**



a) $1 = sp^3, 2 = sp^3, 3 = sp^3$

b) $1 = sp^2, 2 = sp^3, 3 = sp^3$

c) $1 = sp^2, 2 = sp^3, 3 = sp^2$

d) $1 = sp^3, 2 = sp^3, 3 = sp^2$

80. Pyranose ring consist of a skelton of: **[4]**

a) 6 carbon atoms and one oxygen atom

b) 4 carbon atoms and one oxygen atom

c) 5 carbon atoms and one oxygen atom

d) 6 carbon atoms

81. AGCT are nitrogenous bases of DNA. The pairing is: **[4]**

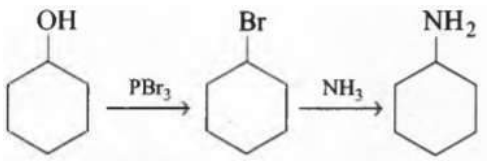
a) A-G, C-T

b) A-T, G-C

c) A-C, G-T

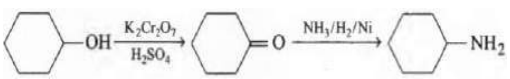
d) A-T, G-T

82. Cyclohexanol can be converted into cyclohexylamine by following two routes. Which of the following methods is expected to give a good yield of cyclohexylamine? **[4]**

a) 

b) both are equally suitable

c) none of these

d) 

83. The standard electrode potentials of Al, Cu, Hg and Ag are -1.66 V, 0.34 V, 0.85 V and 0.80 V, respectively. Select the correct statement. **[4]**

a) $HgCl_2$ can be stored in copper vessel.

b) $CuSO_4$ can be stored in silver vessel.

c) $HgCl_2$ can be stored aluminium vessel.

d) $AgNO_3$ can be stored in copper vessel.

84. p-nitrophenol and o-nitrophenol in the ratio of 1 : 1 are separated by _____. **[4]**

a) steam distillation

b) fractional crystallization

c) crystallization

d) distillation

85. $A \xrightarrow{NaHCO_3}$ Brisk effervescence $B + CHCl_3 + KOH \longrightarrow$ Foul odour **[4]**

Compounds **A** and **B** contain _____ functional group respectively.

a) alcohol and 1^o amine

b) phenol and 1^o amine

c) carboxylic acid and 1^o amine

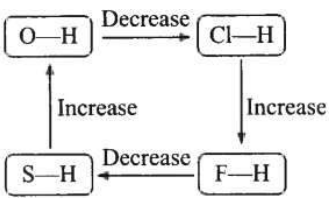
d) ketone and 2^o amine

CHEMISTRY (Section-B)

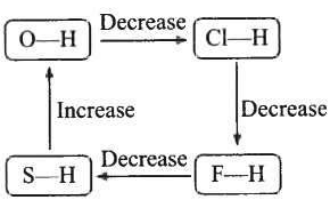
Attempt any 10 questions

86. Which of the following diagrams shows CORRECT change in the polarity of bond? **[4]**

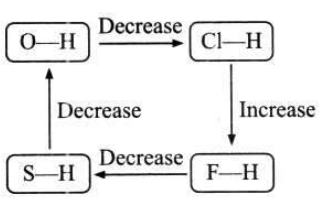
a)



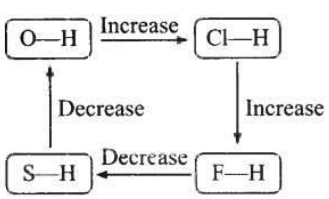
b)



c)



d)



87. An example of a disproportionation reaction is: **[4]**

a) $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$

b) $2MnO_4^- + 10I^- + 16H^+ \rightarrow 2Mn^{2+} + 5I_2 + 8H_2O$

c) $2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$

d) $2CuBr \rightarrow CuBr_2 + Cu$

88. Water-gas is produced by: **[4]**

a) mixing oxygen and hydrogen in the ratio of 1:2

b) heating a mixture of CO_2 and CH_4 in petroleum refineries

c) passing steam through a red hot coke bed

d) saturating hydrogen with moisture

89. Which of these compounds is amphoteric? **[4]**

A. $Al(OH)_3$

B. $Ba(OH)_2$

C. $Zn(OH)_2$

a) A only

b) B only

c) A and C only

d) B and C only

90. The energy absorbed by each molecule (A_2) of a substance is 4.4×10^{-19} J and bond energy per molecule is 4.0×10^{-19} J. The kinetic energy of the molecule per atom will be: **[4]**

a) 4.0×10^{-20} J

b) 2.0×10^{-19} J

c) 2.0×10^{-20} J

d) 2.2×10^{-19} J

91. Al_2O_3 can be converted into anhydrous $AlCl_3$ by heating: **[4]**

a) A mixture of AI_2O_3 and carbon in dry Cl_2 gas

b) AI_2O_3 with HCl gas

c) AI_2O_3 with Cl_2 gas

d) $AI_2O_3$with NaCl in solid state

92. For a reaction, activation energy $E_a = 0$ and the rate constant at 200 K is 1.6×10^6 s^{-1}. The rate constant at 400 K will be _____. [Given that gas constant, R = 8.314 J K^{-1} mol^{-1}] **[4]**

a) 3.2×10^6 s^{-1}

b) 3.2×10^4 s^{-1}

c) 1.6×10^6 s^{-1}

d) 1.6×10^3 s^{-1}

93. Given that **[4]**

$E^o_{\frac{O_2}{H_2O}} = 1.23$ V; $E^o_{\frac{S_2O_8^{2-}}{SO_4^{2-}}} = 2.05$ V

$E^o_{\frac{Br_2}{Br}} = +1.09$ V; $E^o_{\frac{Au^{3+}}{Au}} = +1.4$ V

the strongest oxidizing agent is _____.

a) Au^{3+}

b) O_2

c) $S_2O_8^{2-}$

d) Br_2

94. Calorimetric determination of ΔH for the reaction at 0^oC: $2Ag + ZnCl_2 \rightarrow Zn + 2AgCl$ + AgCl is + 52.05 kcal. If the emf of the cell for $Zn + 2AgCl \rightarrow 2Ag + ZnCl_2$ is 1.015 volt, what is the temperature coefficient of cell? **[4]**

a) 2.73×10^{-3} V/degree

b) 7.86×10^{-3} V/degree

c) $+4.311 \times 10^{+4}$ V/degree

d) -4.311×10^{-4} V/degree

95. The temperature dependence of rate constant (k) of a chemical reaction is written in terms of Arrhenius equation, $k = Ae^{\frac{-Ea^*}{RT}}$ Activation energy (E*) of the reaction can be calculated by plotting: **[4]**

a) k vs $\frac{1}{\log T}$

b) k vs T

c) log k vs $\frac{1}{\log T}$

d) log k vs $\frac{1}{T}$

96. Shapes of certain interhalogen compounds are stated below. Which one of them is not correctly stated? **[4]**

a) IF_7 : pentagonal bipyramid

b) BrF_5 : trigonal bipyramid

c) ICl_3 : planar dimeric

d) BrF_3 : planar T-shaped

97. Which of the following option is CORRECT regarding XeF_6? **[4]**

a) It undergoes complete hydrolysis to give XeO_3.

b) All of these

c) It acts as Lewis acid when it reacts with RbF.

d) It fluorinates silica (SiO_2) to give $XeOF_4$.

98. In which of the following Mn does not show its highest oxidation state? **[4]**

a) MnO_3^+

b) MnO_3 F

c) K_2MnO_4

d) MnO_4^-

99. $[Co_2(CO)_8]$ displays: **[4]**

a) no Co-Co bond, four-terminal CO and four bridging CO

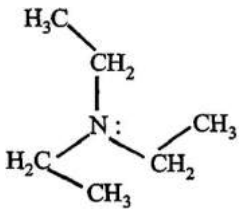
b) no Co-Co bond, six terminal CO and two bridging CO

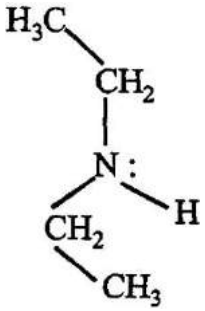
c) one Co-Co bond, six terminal CO and two bridging CO

d) one Co-Co bond, four-terminal CO and four bridging CO

100. Which among the following is the strongest Bronsted base? **[4]**

a) 

b) 

c) 

d) 

BOTANY (Section-A)

101. Which of the following organism is aware of himself? **[4]**

a) All plants

b) Only human

c) All organisms

d) All animals

102. Lion, Tiger, Leopard and Cats are placed in which family? **[4]**

a) Canidae

b) Carnivora

c) Felidae

d) Mammalia

103. Which one of the following statements is wrong? **[4]**

a) Cyanobacteria are also called blue-green algae

b) Phycomycetes are also called algal fungi

c) Eubacteria are also called false bacteria

d) Golden algae are also called desmids

104. In the light of recent classification of living organisms into three domains of life (bacteria, archaea and eukarya), which one of the following statements is true about archaea? **[4]**

a) Archaea completely differ from prokaryotes.

b) Archaea have some novel features that are absent in other prokaryotes and eukaryotes.

c) Archaea completely differ from both prokaryotes and eukaryotes

d) Archaea resembles eukarya in all respects.

105. Angiosperms generally shed their pollen at how many cell stage? **[4]**

a) One

b) Four

c) Two

d) Five

106. What is the methods of sexual reproduction in Chlamydomonas and Spirogyra both? **[4]**

a) Anisogamous

b) All of these

c) Isogamous

d) Oogamous

107. Which of the following has xanthophylls and fucoxanthin pigment? **[4]**

a) Red algae

b) Green algae

c) Brown algae

d) All of these

108. Cleistogamous flowers are **[4]**

a) cross-pollinated

b) Both water-pollinated and cross-pollinated

c) self-pollinated

d) water-pollinated

109. Germ pore is the region where the sporopollenin is: **[4]**

a) Thick or absent

b) Thick

c) Thin

d) Absent

110. Whorled, simple leaves with reticulate venation are present in **[4]**

a) Neem

b) Calotropis

c) China rose

d) Alstonia

111. In insectivorous plant pitcher is modified: **[4]**

a) Petiole

b) Lamina

c) Stipules

d) Leaf apex

112. Which characters for secondary growth are incorrect from given characters? **[4]**

i. The cells of cambium cut off towards pith, mature into secondary phloem and the cells cut off towards periphery mature into secondary xylem.

ii. The vascular cambium is generally more active on the outer side than on the inner.

iii. The primary and secondary phloems get gradually crushed due to the continued formation and accumulation of secondary xylem.

iv. The primary xylem however remains more or less intact, in or around the centre.

v. At some places, the cambium forms a narrow band of parenchyma, in the radial directions called secondary medullary rays.

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

b) (i), (iii) and (v)

c) (i) and (ii)

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

113. Which genotype and phenotype is of aneuploidy of sex chromosomes? **[4]**

a) 22 + Y female

b) 22 + XX female

c) 22 + XXY male

d) 22 + XY male

114. Due to non-disjunction of chromosomes during spermatogenesis, some sperms carry both sex chromosomes (22A + XY) and some sperms do not carry any sex chromosome (22A + 0). If these sperms fertilise normal eggs (22A + X), what types of genetic disorders respectively appear among the offspring? **[4]**

a) Down's syndrome arid Turner's syndrome

b) Turner's syndrome and Klinefelter's syndrome

c) Klinefelter's syndrome and Turner's syndrome

d) Down's syndrome and cri-du-chat syndrome

115. Lysine and tryptophan are: **[4]**

a) Aromatic amino acids

b) Essential amino acids

c) Proteins

d) Non-essential amino acids

116. The genetic code was diccovered by: **[4]**

a) Nirenberg and Holley

b) Nirenberg and Matthaei

c) Holley, Nirenberg and Khorana

d) Kornberg

117. Which one of the following cell organelles is enclosed by a single membrane? **[4]**

a) Mitochondria
b) Lysosomes
c) Nucleus
d) Chloroplasts

118. Which of the following called power houses of the cell? **[4]**

a) Plastids
b) Ribosome
c) Nuclei
d) Mitochondria

119. The synthetic drugs structurally similar to adrenaline are: **[4]**

a) barbiturates
b) hallucinogens
c) nicotinic derivatives
d) amphetamines

120. In alcoholics, liver gets damaged as it **[4]**

a) accumulates excess of fats.
b) secretes more bile.
c) stores excess of glycogen.
d) all of these

121. The separation of two chromatids of each chromosome at early anaphase is initiated by **[4]**

a) the interaction of centromere with the chromosomal fibres.
b) Both the elongation of metaphasic spindle and the force of repulsion between the divided kinetochores.
c) the force of repulsion between the divided kinetochores.
d) the elongation of metaphasic spindle.

122. Verhulst-Pearl Logistic Growth is described by: **[4]**

i. $\frac{dN}{dt} = rN\left[\frac{K-N}{K}\right]$
ii. $\frac{dN}{dt} = rN\left[1-\frac{N}{K}\right]$
iii. $\frac{dN}{dt} = rN$
iv. $\frac{dN}{dt} = rN\left[\frac{N-K}{N}\right]$

a) (i), (ii) and (iii) are correct
b) (ii) and (iv) are correct
c) (i) and (ii) are correct
d) (i) and (iii) are correct

123. A plant, being eaten by a herbivores which in turn is eaten by a carnivores makes: **[4]**

a) Interdependence
b) Omnivores

c) Web of Food
d) Food chain

124. Which of the following food items is produced by the fermenting activity of microbes? **[4]**

A. Ida
B. Dosa
C. Toddy
D. Cheese

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

125. The major cause of extinction of species in tropical countries is: **[4]**

a) Soil erosion
b) Deforestation
c) Pollution
d) Urbanization

126. In your opinion, which is the most effective way to conserve the plant diversity of an area? **[4]**

a) By tissue culture method
b) By creating botanical garden
c) By creating biosphere reserve
d) By developing seed bank

127. The region of biosphere reserve which is legally protected and where no human activity is allowed is known as: **[4]**

a) Restoration zone
b) Transition zone
c) Buffer zone
d) Core zone

128. The chromosomes do not occur in pairs in the: **[4]**

a) Zygote
b) Gametes
c) Muscle cells
d) Body cells

129. The decision of cell division occurs in: **[4]**

a) G_2
b) S
c) G_1
d) Not known

130. The oxygen evolved during photosynthesis comes from water molecules. Which one of the following pairs of elements is involved in this reaction? **[4]**

a) Manganese and Chlorine
b) Manganese and Potassium
c) Magnesium and Molybdenum
d) Magnesium and Chlorine

131. Arrange the following in proper sequence as occurring z-scheme: **[4]**

1. Excitation of electrons of PS - II
2. Down hill transfer of electron to PS - T
3. Excitation of electrons and transfer to another acceptor
4. Up hill transfer of electrons to acceptor
5. Down hill transfer of electrons causing $NADP^+$ to reduce into $NADPH + H^+$

a) 3, 2, 1, 4, 5
b) 1, 4, 2, 3, 5
c) 1, 2, 4, 3, 5
d) 3, 1, 2, 4, 5

132. Pigment system - I conducts: **[4]**

a) Both Cyclic photophosphorylation and Non - cyclic photophosphorylation
b) Terminal photophosphorylation
c) Non - cyclic photophosphorylation
d) Cyclic photophosphorylation

133. Wavelength of light responsible for Emerson's enhancement effect: **[4]**

a) Both 680 nm ↑ and 680 nm ↓
b) Only 680 nm ↓
c) Only 680 nm ↑
d) Infrared wavelength

134. What is the last substrate to be used in respiration? **[4]**

a) Organic acid
b) Glucose
c) Proteins
d) Fats

135. What causes a green plant exposed to the light on only one side, to bend toward the source of light as it grows? **[4]**

a) Green plants need light to perform photosynthesis
b) Auxin accumulates on the shaded side, stimulating greater cell elongation there
c) Green plants seek light because they are phototropic
d) Light stimulates plant cells on the lighted side to grow faster

BOTANY (Section-B)

Attempt any 10 questions

136. An organism with similar traits of any rank is : **[4]**

a) Species
b) Order
c) Taxon
d) Genus

137. Pteridophytes differ from bryophytes and thallophytes in having **[4]**

a) vascular tissues
b) motile antherozoids
c) archegonia
d) alternation of generation.

138. An alga which can be employed as food for human being is: **[4]**

a) Spirogyra
b) Polysiphonia
c) Ulothrix
d) Chlorella

139. Fragrant flowers with nectar are adapted usually for: **[4]**

a) Anemophily
b) Omithophily
c) Hydrophily
d) Entomophily

140. Mustard oil is obtained from **[4]**

a) Capsella bursa pes
b) Brassica olearacea
c) Brassica campestris
d) Brassica rapa

141. A man whose father was colour blind marries a women who had a colour blind mother and a normal father. What percentage of male children of this couple will be colour blind? **[4]**

a) 75%
b) 25%
c) 0%
d) 50%

142. In sea urchin DNA, which is double stranded, 17% of the bases were shown to be cytosine. The percentages of the other three bases expected to be present in this DNA are: **[4]**

a) G 17%, A 16.5%, T 32.5%
b) G 17%, A 33%, T 33%
c) G 8.5%, A 50%, T 24.5%
d) G 34%, A 24.5%, T 24.5%

143. Which of the following dyes is best suited for staining chromosomes? **[4]**

a) Safranin
b) Methylene blue
c) Carmine
d) Basic Fuchsin

144. The yield of paddy can be increased by the application of: **[4]**

a) Nostoc
b) Iron bacteria
c) Archaebacteria
d) Symbiotic bacteria

145. Cell respiration is carried out by: **[4]**

a) Chloroplast
b) Ribosomes
c) Golgi bodies
d) Mitochondria

146. Match the following list of bioactive substances and their roles: **[4]**

Bioactive Substance	Role
(i) Statin	(A) Removal of oil stains
(ii) Cyclosporin A	(B) Removal of clots from blood vessels
(iii) Streptokinase	(C) Lowering of blood cholesterol
(iv) Lipase	(D) Immuno-suppressive agent

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

147. Decomposers like fungi and bacteria are: **[4]**

i. autotrophs
ii. heterotrophs
iii. saprotrophs
iv. chemo-autotrophs

Choose the correct answer:

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

148. Hormone, which replaces the requirement of vernalisation, is **[4]**

a) gibberellin
b) cytokinin

c) kinetin

d) ABA

149. If the growing plant is decapitated, then **[4]**

a) axillary buds are activated.

b) leaves become yellow and fall down.

c) axillary buds are inactivated.

d) its growth stops.

150. First stable product of Calvin cycle has: **[4]**

a) 3 carbon atoms

b) 6 carbon atoms

c) 2 carbon atoms

d) 4 carbon atoms

ZOOLOGY (Section-A)

151. Which one of the following phyla is correctly matched with its two general characteristics? **[4]**

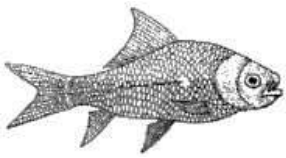
a) Chordata : Notochord at some stage and separate anal and urinary openings to the outside

b) Mollusca : Normally oviparous and development is indirect

c) Echinodermata : Pentamerous radial symmetry and mostly internal fertilization

d) Arthropoda : Body divided into head, thorax and abdomen and respires by tracheae.

152. Observe the following diagram and select the correct option. **[4]**



a) Labeo- Cartilaginus fish

b) Betta- Fighting fish

c) Catla- Bony fish

d) Clarias- Magur

153. Order squamata includes: **[4]**

a) Crocodiles

b) Bats

c) Tortoise and pangolin

d) Snake and lizard

154. Voluntary muscles are controlled by: **[4]**

a) Cerebrum

b) Medulla

c) Cerebellum

d) Cerebral hemisphere

155. Zonula adherens is a kind of **[4]**

a) Membrane
b) Intermediate Junctions
c) Filament
d) Mesosome

156. Vital capacity of lungs of an average human is: **[4]**

a) 3000-4500 ml
b) 500-1000 ml
c) 2000-2500 ml
d) 1500-1800 ml

157. Which of the following has been declared a killer disease under Factory Act? **[4]**

a) Shigellosis
b) Asbestosis
c) Silicosis
d) Tuberculosis

158. Oxygen and carbon dioxide are transported in blood through: **[4]**

a) RBCs and WBCs
b) RBCs and plasma
c) Platelets and corpuscles
d) WBCs and serum

159. Carbon dioxide combines with haemoglobin: **[4]**

a) 200-250 times more readily than oxygen
b) Twice less readily than oxygen
c) 100 times less readily than oxygen
d) 20-25 times more readily than oxygen

160. Which is correct set of air passage from outside into lungs in human beings and other mammals? **[4]**

a) Nasal cavity → Larynx → Pharynx → Trachea → Bronchiole → Alveoli
b) Nasal cavity → Larynx → Pharynx → Trachea → Alveoli → Bronchi
c) Nasal cavity → Pharynx → Larynx → Trachea → Bronchiole → Bronchi → Alveoli
d) Nasal cavity → Pharynx → Larynx → Trachea → Bronchi Bronchiole → Alveoli

161. In menstrual cycle, the secretory phase is also known as **[4]**

a) follicular phase and lasts for 13 days.
b) luteal phase and lasts for 6 days.

c) follicular phase and lasts for 6 days.

d) luteal phase and lasts for 13 days.

162. Where the ova are released from the ovary? **[4]**

a) Abdominal cavity

b) Oviduct

c) Pelvic cavity

d) Oviducal funnel

163. Capacitation refers to changes in the: **[4]**

a) Ovum before fertilization

b) Sperm before fertilization

c) Ovum after fertilizatio

d) Sperm after fertilization

164. Which of the following is true about sterilisation? **[4]**

a) These techniques are highly effective but their reversibility is very poor.

b) This procedure in the female is called 'tubectomy'.

c) This procedure in the male is called 'vasectomy'.

d) All of these

165. Which of the following are the reasons for population explosion? **[4]**

i. Increased health facilities.

ii. Rapid increase in MMR.

iii. Rapid increase in IMR.

iv. Rapid decrease in MMR.

v. Decrease in number of people reaching reproductive age.

a) (iii) and (v)

b) (i) and (iv)

c) (ii) and (iii)

d) (i) and (v)

166. Fill in the blanks: **[4]**
About 15 mya, primates called (i) _____ and (ii) _____ were existing and were hairy and walked like gorilla and chimpanzee. Two mya (iii) _____ probably lived in East African grasslands. This creatures was called the first human-like being the hominid and was called (iv) _____ and their brain capacities were between 650 to 800.

a) (i) Dryopithecus, (ii) Ramapithecus, (iii) Australopithecus (iv) Homo habilis

b) (i) Homo habilis, (ii) Australopithecus, (iii) Dryopithecus (iv) Ramapithecus

c) (i) Homo habilis, (ii) Ramapithecus, (iii) Australopithecus (iv) Dryopithecus

d) (i) Australopithecus, (ii) Homo habilis, (iii) Dryopithecus (iv) Ramapithecus

167. Who proposed that the first form of life come from pre-existing non-living molecules? **[4]**

a) Louis Pasteur and Miller

b) Darwin and Lamarck

c) de Vries and Haldane

d) Oparin and Haldane

168. Vasa recta is minute vessel of Peritubular capillaries network, which is **[4]**

a) running parallel to PCT.

b) running parallel to loop of Henle.

c) running parallel to DCT.

d) also known as juxta-glomerular apparatus.

169. Human urine is usually acidic because: **[4]**

a) Excreted plasm a proteins are acidic

b) The sodium transporter exchanges one hydrogen ion for each sodium ion, in peritubular capillaries

c) Hydrogen ions are actively secreted into the filtrate

d) Potassium and sodium exchange generates acidity

170. Glomerulus is a tuft of capillaries formed by (A) a fine branch of renal artery. Blood from the glomerulus is carried away by an (B). **[4]**
Select the correct option for (A) and (B).

a) afferent arteriole, efferent arteriole

b) vasa recta, efferent arteriole

c) Bowman's capsule, afferent arteriole

d) vasa recta, afferent arteriole

171. A number of bones of the face is: **[4]**

a) 14

b) 30

c) 40

d) 12

172. Relaxation of the muscle takes place due to **[4]**

i. Pumping of Ca^{2+} ions in sarcoplasmic reticulum.
ii. The presence of ATP.
iii. Conformational changes in troponin and masking the actin filament.

a) (ii) and (iii)
b) (i), (ii), and (iii)
c) (i) and (ii)
d) (i) and (iii)

173. Z-lines divides the myofibrils into _____. **[4]**

a) sarcoplasm
b) sarcosome
c) sarcomere
d) sarcolemma

174. Outermost meninges is: **[4]**

a) Pia mater
b) choroidea
c) Choroid
d) Dura mater

175. If dorsal root of spinal cord is broken down then its effect is: **[4]**

a) No effect on impulse
b) Impulse is transmitted fast
c) No impulse is transmitted from receptor
d) Impulse is transmitted but slowly

176. Match the Column I with Column II and select the correct option. **[4]**

Column I	Column II
(A) Axon hillock	(i) Myelinated nerve fibre.
(B) Afferent neurons	(ii) Conduct impulses from CNS to the effectors.
(C) Schwann cells	(iii) Most sensitive part of neuron.
(D) Efferent neurons	(iv) Conduct impulses from receptors to CNS.

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

177. Identify the hormone with its correct matching of source and function: **[4]**

A. Progesterone-corpus-luteum, stimulation of growth and activities of female secondary sex organs
B. Atrial natriuretic factor - ventricular wall increases the blood pressure
C. Oxytocin - posterior pituitary, growth and maintenance of mammary glands
D. Melatonin - pineal gland, regulates the normal rhythm of the sleep-wake cycle

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

178. A person entering an empty room suddenly finds a snake right in front of an opening the door. Which one of the following is likely to happen in his neuro-hormonal control system? **[4]**

a) Sympathetic nervous system is activated releasing epinephrine and norepinephrine from adrenal cortex.

b) Sympathetic nervous system is activated releasing epinephrine and norepinephrine from adrenal medulla.

c) Neurotransmitters diffuse rapidly across the cleft and transmit a nerve impulse.

d) Hypothalamus activates the parasympathetic division of brain.

179. Which one of the following plasma proteins is involved in the coagulation of blood? **[4]**

a) Fibrinogen

b) Globulin

c) Serum amylase

d) Albumin

180. Antigen B and antibody A are present in which blood group? **[4]**

a) A

b) B

c) AB

d) O

181. First heart sound occurs at: **[4]**

a) Sudden closure of AV valves

b) Onset of auricular systole

c) Closing of semilunar valve

d) Opening of semilunar valve

182. Modified antibiotics are manufactured by the technique of: **[4]**

a) Ultracentrifuge

b) Ultrafiltration

c) Genetic engineering

d) Vernalization

183. The term **recombinant DNA** refers to DNA **[4]**

a) with more than one recognition sites.

b) of the host cell.

c) with a piece of foreign DNA.

d) with selectable marker.

184. Genetically engineered bacteria have been used in commercial production of: **[4]**

a) Melatonium

b) Testosterone

c) Thyroxine

d) Human insulin

185. Cry protein is obtained from: **[4]**

a) Clostridium welchi

b) Bacillus subtilis

c) Bacillus thuringiensis

d) E.coli

ZOOLOGY (Section-B)

Attempt any 10 questions

186. Read the following statements. **[4]**

a. Metagenesis is observed in Helminths.

b. Echinoderms are triploblastic and coelomate animals.

c. Roundworms have an organ-system level of body organization.

d. Comb plates present in ctenophores help in digestion.

e. The Water vascular system is characteristic of Echinoderms.

Choose the correct answer from the options given below.

a) (b), (c) and (e) are correct.

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

c) (c), (d) and (e) are correct

d) (a), (d) and (c) are correct

187. Tendons and ligaments are the example of: **[4]**

a) Dense regular connective tissue

b) Areolar connective tissue

c) Loose connective tissue

d) Adipose tissue

188. Which of the following statements is correct regarding veins? **[4]**

a) They are superficially locked under the skin

b) They carry blood from heart towards the organ

c) All veins carry oxygenated blood with single exception.

d) They carry blood from an organ towards the heart.

189. Which of the following conditions is responsible for increase in ventilation rate of lungs? **[4]**

a) Decrease in O_2 content of exhaled air.

b) Increase of CO_2 content in exhaled air.

c) Increase of CO_2 content in inhaled air.

d) Decrease in O_2 Content of inhaled air.

190. Ovulation is regulated mainly by: **[4]**

a) LTH and LH

b) FSH and LH

c) FSH and TSH

d) FSH and LTH

191. In which of the following techniques, the embryos are transferred to assist those females who cannot conceive? **[4]**

a) GIFT and ICSI

b) ZIFT and IUT

c) GIFT and ZIFT

d) ICSI and ZIFT

192. Which one of the following sets of items in the options 1 - 4 are correctly categorised with one exception in it? **[4]**

Items	Category	Exception
(a) Typhoid, Pneumonia, Diphtheria	Bacterial diseases	Diphtheria
(b) UAA, UAG, UGA	Stop codons	UAG
(c) Kangaroo, Koala, Wombat	Australian marsupials	Wombat
(d) Plasmodium, Cuscuta, Trypanosoma	Protozoan parasites	Cuscuta

a) Only b

b) Only c

c) Only d

d) Only a

193. Read the statements given below. **[4]**

i. Reabsorption in this region is minimum.

ii. This region plays a significant role in the maintenance of high osmolarity of intestinal fluid.

iii. Its descending limb is permeable to water, but almost impermeable to electrolytes.

iv. Its ascending limb is impermeable to water but allows transport of electrolyte actively or passively.

v. In descending limb filtrate is hypertonic, while in ascending limb filtrate is hypotonic.

The above characteristics are associated with:

a) DCT

b) Loop of Henle's

c) Bowman's capsule

d) PCT

194. The type of muscle present in our **[4]**

a) upper arm is smooth muscle and fusiform in shape.

b) intestine is striated and involuntary.

c) heart is in voluntary and unstriated smooth muscle.

d) thigh is striated and voluntary.

195. The normal speed of transmission of nerve impulse is: **[4]**

a) 1 metre per minute

b) 1 metre per second

c) 100 metre per second

d) 100 metre per minute

196. Oestrogen and testosterone are steroid hormones, and most likely bind to **[4]**

a) cytoplasmic receptors

b) enzyme-linked membrane receptors

c) G-protein coupled membrane receptors

d) membrane ion channels

197. Organ secreting secretin hormone: **[4]**

a) Pancreas

b) Liver

c) Duodenum and jejunum

d) Whole intestine

198. The cation necessary for coagulation of blood is : **[4]**

a) Cl

b) Na

c) Ca

d) K

199. Microbes which are found to be very useful in genetic engineering: **[4]**

a) Crown gall bacterium and Escherichia coli

b) Escherichia coli and Agrobacterium tumifaciens

c) Vibrio cholera and a tailed bacteriophage

d) Diplococcus sp. and Pseudomonas sp.

200. Tobacco plants resistant to a nematode have been developed by the introduction of DNA that produced (in the host cells): **[4]**

a) An antifeedant

b) Both sense and anti-sense RNA

c) A toxic protein

d) A particular hormone

Solution

SAMPLE PAPER - 4

PHYSICS (Section-A)

1.

(c) Henry

Explanation: Henry denotes the dimensions $[\frac{ML^2}{Q^2}]$.

2.

(b) $[ML^2T^{-2}Q^{-1}]$

Explanation: $\varepsilon = \frac{E}{Q}$

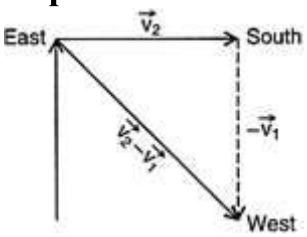
$$[\varepsilon] = \frac{[\varepsilon]}{[Q]} = \frac{\left[M^1L^2T^{-2}\right]}{[Q]}$$

$= [ML^2T^{-2}Q^{-1}]$

3.

(d) 14.14 ms^{-1} in south-western direction

Explanation:



If the magnitude of vector remains same, only directions change by θ then

$|\Delta\vec{v}| = \left|\vec{v}_2 - \vec{v}_1\right|$

Here $\vec{v}_2$ is $\perp$ to $\vec{v}_1$ and

$v_2 = v_1 = 10\ ms^{-1}$

$\therefore |\Delta\vec{v}| = \sqrt{(10)^2 + (10)^2} = 10\sqrt{2}$

$= 10 \times 1.414 = 14.14$ m/s (in south-western direction)

4. **(a)** only iii

Explanation: The bubble acquires equilibrium at the inner edge due to centripetal force and normal reaction.

5.

(d) 17.88 m

Explanation: m = 20 kg

$\vec{h} = 4\hat{i} - 2\hat{j} = \sqrt{4^2 + 2^2}$

$h = 4.47$ m

$$h_1 = \frac{\left(u_1 \sin\theta\right)^2}{2g}$$

$$h_2 = \frac{\left(u_2 \sin\theta\right)^2}{2g}$$

$$\Rightarrow \frac{h_1}{h_2} = \frac{u_1^2}{u_2^2}$$

$u_2 = 2u_1$ ...(given)

$$\therefore \frac{4.47}{h_2} = \frac{u_1^2}{4u_1^2}$$

$$\frac{4.47}{h_2} = \frac{1}{4}$$

$h_2 = 4.47 \times 4$

$h_2 = 17.88$ m

6.

(d) $x = 4 \tan\theta$

Explanation: The acceleration of the body down the plane is $g \sin\theta - \mu g \cos\theta = g (\sin\theta - \mu \cos\theta)$

$= g (\sin\theta - 0.25 \times \cos\theta)$.

Therefore, the body will first accelerate upto $x < 4 \tan\theta$.

The velocity will be maximum at $x = 4 \tan\theta$, because for $x > 4 \tan\theta$, the body starts decelerating.

7.

(b) 600 J

Explanation: M = 5 kg, h = 20 m

Since, the water leaks at a constant rate of 0.2 kg/m, suppose x be the distance pulled up, then the reduced mass, m = 0.2 x.

∴ Effective mass = (M - m) = (5 - 0.2 x)

∴ Total work done,

$$W = \int_{x=0}^{x=20} F \cdot dx = \int_{x=0}^{x=20} (M - m) g dx$$

$$= \int_{x=0}^{x=20} (5 - 0.2x) \times 10 \times dx$$

$$= \left[50x - 2\frac{x^2}{2}\right]_0^{20}$$

$= 1000 - 400 = 600$ J

8. **(a)** $\frac{m_2}{m_1}$

Explanation: Let u_1, u_2 be velocities of m_1, m_2, before the collision, and v_1, v_2 be their respective velocities after the collision. In every collision.

final momentum = initial momentum

$m_1v_1 + m_2v_2 = m_1u_1 + m_2u_2$

$\therefore\ m_1(v_1 - u_1) = m_2(u_2 - v_2)$

or $\frac{v_1 - u_1}{u_2 - v_2} = \frac{m_2}{m_1}$

9. **(d)** $\omega \propto (n)^{1/3}$

Explanation: Comparing this with linear motion, power P = Fv, we have

$P = \tau \cdot \omega$

or $\alpha\left(\omega \cdot \frac{d\omega}{d\theta}\right) \cdot \omega = P$

or $\omega^2 d\omega = \frac{P}{\alpha} d\theta$

On integration,-we find that,

$\omega \propto \theta^{1/3}$

or $\omega \propto (n)^{1/3}$

10. **(a)** 10

Explanation: According to law of conservation of angular momentum,

$I_1\omega_1 = I_2\omega_2$

$$\left(\frac{ML^2}{12} + 2md^2\right)\omega_1 = \left[\frac{ML^2}{12} + 2m\left(\frac{L}{2}\right)^2\right]\omega_2$$

$$\text{or } \left[\frac{0.75 \times (0.4)^2}{12} + 2 \times 1 \times (0.1)^2\right]30 = \left[\frac{0.75 \times (0.4)^2}{12} + 2 \times 1 \times (0.2)^2\right]\omega_2$$

Solving it, we get; ω_2 = 10 rad/sec

11. **(a)** 9:1

Explanation: If ratio of the radii of two planets is r and the ratio of the acceleration due to gravity on their surface is a,

then ratio of escape velocities is $\sqrt{ar}$

$$\frac{v_e}{v_m} = \sqrt{ar}$$

here, a = 10, r = 8

$\therefore \frac{v_e}{v_m} = \sqrt{80} \approx 9$

12.

(b) The strain produced in the spring is longitudinal.

Explanation: Only (iv)

13.

(d) 0.020

Explanation: $\rho = \frac{m}{V}$

$\therefore V = \frac{m}{\rho}$

As, $V_2 = V_1 (1 + \gamma \Delta T)$

$\therefore \frac{1}{\rho_2} = \frac{1}{\rho_1}(1 + \gamma \Delta T)$

$\therefore \rho_2 = \frac{\rho_1}{(1+\gamma \Delta T)}$

Fractional changes $= \frac{\rho_1 - \rho_2}{\rho_1} = 1 - \frac{\rho_2}{\rho_1}$

$= 1 - (1 + \gamma \Delta T)^{-1}$

$= 1 - (1 - \gamma \Delta T)$ ....[$\because (1 + x)^n \approx 1 + nx$]

$= \gamma \Delta T = 5 \times 10^{-4} \times 40$

$= 0.02$

14.

(d) 112

Explanation: Rate of heat radiated at (227 + 273) K = 7 cal/(cm^2)

Rate of heat radiated at (727 + 273) K = x

By Stefan's law, $7 \propto (500)^4$

$x \propto (1000)^4$

$\therefore \frac{x}{7} = 2^4$

or $x = 7 \times 2^4 = 112$ cal/(cm^2)

15.

(b) $\frac{1}{2} R \Delta T$

Explanation: Given, VT = k,(k is constant)

or $T \propto \frac{1}{V}$ ...(i)

Using ideal gas equation,

pV = nRT

$pV \propto T \Rightarrow pV \propto \frac{1}{V}$

or pV^2 = constant ...(ii)

i.e a polytropic process with x = 2

(Polytropic process means, pV^x = constant)

We know that, work done in a polytropic process is given by

$\Delta W = \frac{p_2V_2 - p_1V_1}{1-x} (\text{ for } x \neq 1)$ ...(iii)

and, $W = pV\ln\left(\frac{V_2}{V_1}\right) (\text{ for } x = 1)$

Here, x = 2,

$\therefore \Delta W = \frac{p_2V_2 - p_1V_1}{1-x} = \frac{nR\left(T_2 - T_1\right)}{1-x}$

$\Rightarrow \quad \Delta W = \frac{nR\Delta T}{1-'2} = -nR\Delta T$ ...(iv)

Now, for monoatomic gas change in internal energy is given by

$\Delta U = \frac{3}{2}R\Delta T$ ...(v)

Using first law of thermodynamics, heat absorbed by one mole gas is

$\Delta Q = \Delta W + \Delta U = \frac{3}{2}R\Delta T - R\Delta T \Rightarrow \Delta Q = \frac{1}{2}R\Delta T$

16. **(a)** $\frac{Pm}{kT}$

Explanation: The equation which related the pressure (P), volume (V) and temperature (T) of the given state of an ideal gas is known as ideal gas equation

PV = KTN, where N is the number of molecules

$P\left(\frac{Nm}{\rho}\right) = KTN \left[\therefore V = \frac{m}{\rho}\right]$

Density of gas, $\rho = \frac{pm}{KT}$

17. **(b)** 0.628 s

Explanation: Given,
Streatching in spring (X) = 5 cm
Force (F) = 10 N
Mass (m) = 2 kg
The time period of oscillation of spring

$$T = 2 \neq \sqrt{\frac{m}{k}}$$

$$\Rightarrow T = 2 \neq \sqrt{\frac{2}{k}} \text{ ...(i)}$$

From force balance equation,
KX = F

$$\Rightarrow K = \frac{F}{X}$$

$$\Rightarrow K = \frac{10}{5 \times 10^{-2}} \text{ N/m}$$

$$\Rightarrow K = 200 \text{ N/m}$$

Now, put the value of K in equation (i)

$$\Rightarrow T = 2 \neq \sqrt{\frac{2}{200}}$$

$$T = \frac{2 \neq}{10}$$

$$\Rightarrow T = \frac{2 \times 3.14}{10} \text{ s}$$

$$\Rightarrow T = \frac{6.28}{10} \text{ s}$$

$$\Rightarrow T = 0.628 \text{ s}$$

18.

(d) 0.02

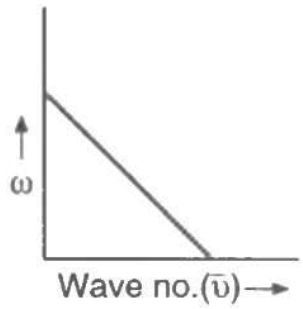
Explanation: As $v = \frac{1}{2L}\sqrt{\frac{T}{\mu}}$

$$\therefore \quad \frac{\Delta v}{v} = \frac{1}{2}\frac{\Delta T}{T}$$

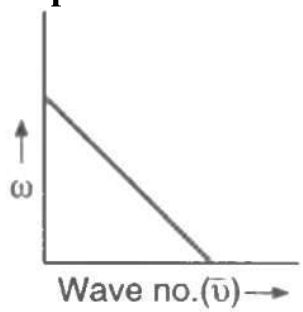
$$\frac{\Delta T}{T} = 2\frac{\Delta v}{v} = 2 \times \frac{6}{600} = 0.02$$

19.

(b)



Explanation:



20.

(c) 15 μC, 5 μC

Explanation: By using Coulomb's law,

$$F = \frac{1}{4\pi\varepsilon_0} \times \frac{q_1 q_2}{r^2}$$

$$0.075 = \frac{9 \times 10^9 \left(q_1 q_2\right)}{(3)^2}$$

$$q_1 q_2 = \frac{0.075 \times 9}{9 \times 10^9}$$

$= 75 \times 10^{-12}$ ...(i)

$\Rightarrow q_1 + q_2 = 20 \times 10^{-6}$

$\Rightarrow q_1 = 20 \times 10^{-6} - q_2$

$\Rightarrow (20 \times 10^{-6} - q_2)\, q_2 = 75 \times 10^{-12}$ ...[By using (i)]

$\Rightarrow 20 \times 10^{-6} q_2 - q_2^2 = 75 \times 10^{-12}$

$\Rightarrow q_2 = 15 \times 10^{-6}$ or $q_2 = 5 \times 10^{-6}$

$\therefore$ Two charges are 15 μC, 5 μC.

21.

(d) 25μF

Explanation: 25μF

22. **(a)** 5.5 A

Explanation: $R_{2000} = \frac{200 \times 200}{100} = 400\Omega$

So, $400 = R_0[1 + 0.005 \times 2000]$

$\therefore \quad R_0 = \frac{400}{11} = 36\Omega$

Hence, current, $I = \frac{200}{36} = 5.5$ amp

23.

(b) $\frac{\mu_0 i}{2r}\left(\frac{1}{2} + \frac{1}{2\pi}\right)$

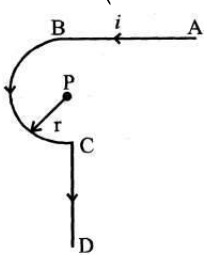
Explanation: The magnetic field at thepdnt P is $B_p = B_{AB} + B_{BC} + B_{CD}$

$B_{AB} = \frac{\mu_0 i}{4r}$

$B_{BC} = \frac{\mu_0 i}{4\pi r} \times \pi = \frac{\mu_0 i}{4r}$

$B_{CD} = 0$

$B_P = \left(\frac{\mu_0 i}{4r} + \frac{\mu_0 i}{4\pi r}\right) = = \frac{\mu_0 i}{2r}\left(\frac{1}{2} + \frac{1}{2\pi}\right)$



24.

(c) increases by 36%

Explanation: increases by 36%

25.

(d) 0.5χ

Explanation: According to Curie's law, $\chi_m = \frac{\mu_0 C}{T}$

where, C is Curie constant and T = Temperature

$\therefore \chi_m \propto \frac{1}{T}$

$$\frac{\chi_{m_1}}{\chi_{m_2}} = \frac{T_2}{T_1} = \frac{273+333}{273+30} = \frac{606}{303} = 2$$

$$\therefore \chi_{m_2} = \frac{\chi_{m_1}}{2} = 0.5\chi_{m_1} = 0.5\chi$$

26. **(a)** 46rad/s and 54 rad/s

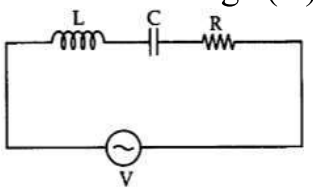
Explanation: Given,

Inductance of inductor (L) = 5.0 H

Capacitance of capacitor (C) =80 μF

Resistance of resistor (R) = 40 Ω

Terminal voltage (V) = 230 V



Resonance frequency

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$\Rightarrow \omega_0 = \frac{1}{\sqrt{5.0 \times 80 \times 10^{-6}}}$$

$$\Rightarrow \omega_0 = \frac{1}{20 \times 10^{-3}} \text{rad/s}$$

$$\Rightarrow \omega_0 = 50 \text{ rad/s}$$

As per question,

Half power frequencies are given as

$$\omega = \omega_0 \pm \frac{R}{2L}$$

$$\omega_L = 50 - \frac{40}{2 \times 5}$$

$$\Rightarrow \omega_L = (50 - 4) \text{ rad/s}$$

$$\Rightarrow \omega_L = 50 + \frac{40}{2 \times 5}$$

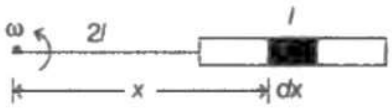
$$= 50 + 40$$

$$= 54 \text{ rad/s}$$

27. **(a)** $\frac{5B\omega l^2}{2}$

Explanation: $e = \int_{2l}^{3l}(\omega x)Bdx = B\omega\frac{\left[(3l)^2-(2l)^2\right]}{2}$

$= \frac{5Bl^2\omega}{2}$



28.

(c) V = 100 volt, I = 2 amp

Explanation: Here, $V_L = V_C$. They are in the opposite phase. Hence, they will cancel each other. Now, a resultant potential difference

= applied potential difference = 100 volt

$Z = R$ ($\because$ $X_L = X_C$)

$\therefore \quad I_{rms} = \frac{V_{rms}}{Z} = \frac{V_{rms}}{R} = \frac{100}{50} = 2$ amp

29.

(d) $0.27\overset{o}{A}$

Explanation: $\frac{1}{\lambda_\alpha} = (Z - b)^2 R\left[\frac{1}{1^2} - \frac{1}{2^2}\right]$

$\frac{1}{\lambda_\beta} = (z - b)^2 R\left[\frac{1}{1^2} - \frac{1}{3^2}\right]$

$\therefore \frac{\lambda_\beta}{\lambda_\alpha} = \frac{1-\frac{1}{4}}{1-\frac{1}{9}} = \frac{27}{32}$

$\lambda_\beta = \frac{27}{32}\lambda_\alpha = \frac{27}{32} \times 0.32\overset{o}{A} = 0.27\overset{o}{A}$

30.

(d) 20 cm below flat surface

Explanation: Given, radius of hemispherical glass R = 10 cm

$\therefore$ Focal length $f = \frac{10}{2} = -5$ cm

u = (10 - 6) = -4 cm

By using mirror formula,

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v} + \frac{1}{-4} = \frac{1}{-5} \Rightarrow$ v = 20 cm

Apparent height, $h_a = h_r \frac{\mu_1}{\mu_2} = 30 \times \frac{1}{1.5} = 20$ cm below flat surface.

31.

(d) it reduces the light intensity to half on account of polarisation

Explanation: Intensity is reduced due to polarisation.

32.

(b) 1.5×10^{20}

Explanation: Here, P = 200W, $\lambda = 0.6\mu m = 0.6 \times 10^{-6}$

Energy converted to light = 25%

Energy of one photon of yellow light $= \frac{hc}{\lambda}$

$= \frac{\left(6.6 \times 10^{-34}\right) \times \left(3 \times 10^{8}\right)}{0.6 \times 10^{-6}} = 33 \times 10^{-20} J$

Energy radiated per second as yellow light

$= 200 \times \frac{25}{100} = 50$ watt

Number of photons of yellow light emitted per second $= \frac{50}{33 \times 10^{-20}} = 1.7 \times 10^{20}$

The closest value is 1.5×10^{20}

33.

(c) Singly ionized neon atom (Ne^{+})

Explanation: Singly ionized neon has electron count more than one. Bohr's model is valid for atoms with single electron.

34. **(a)** Doubly ionized lithium

Explanation: Given the energy level of the first orbit (n) = 1. We know from Bohr's atomic model that the radius of the first orbit

$r = 4\pi\varepsilon_0 \frac{h^2}{4\pi^2 me^4 Z} \propto \frac{1}{Z}$

We also know that atomic numbers of the hydrogen atom ($_1H^1$), deuterium atom ($_1H^2$), singly ionized helium (He^{+}), and doubly ionized lithium (Li^{++}) are 1, 1, 2 and 3 respectively. Since the atomic number of doubly ionized lithium is maximum, therefore the radius of the first orbit of doubly ionized lithium will be minimum.

35. **(a)** Cu^{64} is radioactive, decaying to Zn^{64} through β-decay

Explanation: In beta decay, atomic number increases by 1 whereas the mass number remains the same.

Therefore, following equation can be possible

$$^{64}_{29}Cu \rightarrow ^{64}_{30}Zn + ^{0}_{-1}e$$

PHYSICS (Section-B)

36. **(a)** 5.17 kJ

Explanation: Friction is not considered. The gravitational field is a conservative field. Hence, work done is independent of the path. The object is moved to the height h = s sin θ, s is the length of the inclined plane.

Thus, work done = change in potential energy

Work = mgh

Work = mg (sin θ)

On substituting the values in above equation,

$$\text{Work} = 2 \times 1000 \times \sin 15^{o} \times 10 = 5.17 \text{ kJ}$$

37.

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

Explanation: Moment of inertia of a straight thin rod of mass M, length L about an axis perpendicular to its length and passing through its centre is,

$$I_c = \frac{ML^2}{12}$$

Hence, moment of inertia about an axis passing through its one end is

$$I_{\text{end}} = I_c + M\left(\frac{L}{2}\right)^2 = \frac{ML^2}{12} + \frac{ML^2}{4}$$

$$= \frac{ML^2}{3}$$ (according to theorem of parallel axes).

38.

(d) cannot be zero at any point

Explanation: Acceleration due to gravity g = 0, at the centre if we assume the Earth as a sphere of uniform density, then it can be treated as point mass placed at its centre. But on the surface of the Earth, the acceleration due to gravity cannot be zero at any point.

39.

(b) 0.024

Explanation: Thermal conductivity of the air is of the order of 0.024

40.

(b) 15.7 cm

Explanation: Wave number, $K = \frac{2\pi}{\lambda} = 0.6 \text{ cm}^{-1}$

$\therefore \frac{\lambda}{2} = \frac{\pi}{0.6}$ cm

$\therefore l = \frac{3\lambda}{2} = 3\left(\frac{\pi}{0.6}\right)$ cm = 15.7 cm

41. **(b)** $\pi/3$

Explanation: $x = a \sin\left(\omega t + \frac{\pi}{6}\right)$

$x' = a\cos\omega t = a\sin\left(\omega t + \frac{\pi}{2}\right)$

$\therefore$ Phase difference = $(\pi/2) - (\pi/6) = (\pi/3)$

42. **(a)** 3.2

Explanation: $\frac{F}{l} = \frac{\mu_0}{2\pi} \cdot \frac{i_1 i_2}{d}$

or $d = \frac{\left(2 \times 10^{-7}\right)(96)(24)}{144 \times 10^{-3}}$

$= 32 \times 10^{-4}$ m = 3.2 mm

43. **(a)** 0.8×10^7 erg

Explanation: $W = MB(\cos\theta_1 - \cos\theta_2)$

When the magnet is rotated from 0° to 60°, then work done is 0.8 J.

$0.8 = MB(\cos 0° - \cos 60°) = \frac{MB}{2}$

$\therefore$ MB = 1.6 N -m

In order to rotate the magnet through an angle of 30°, i.e. from 60° to 90°, the work done is,

$W' = MB(\cos 60° - \cos 90°) = MB\left(\frac{1}{2} - 0\right)$

$= \frac{MB}{2} = \frac{1.6}{2} = 0.8$ J $= 0.8 \times 10^7$ erg.

44. **(b)** twice per revolution

Explanation: The direction of induced emf changes after every half revolution i.e., twice per revolution.

45. **(b)** more than I_V

Explanation: By introducing the slab, C will increase. Therefore, $\frac{X}{C}$ will decrease or I will increase.

46.

(c) 5 cm

Explanation: From the formula for convex lens,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$v = \frac{fu}{4 - f} = \frac{200 \times 200 \times 10^3}{\left(200 \times 10^3 - 200\right)}$$

$$= \frac{200 \times 10^3}{999}$$

Also, magnification,

$$m = = \left|\frac{v}{u}\right| = \left|\frac{I}{O}\right|$$

$$= \frac{200 \times 10^3}{999 \times 200 \times 10^3} = \frac{I}{50 \times 100}$$

$$\therefore \quad I = \frac{5000}{999} = 5 \text{ cm}$$

47.

(d) 30^o

Explanation: Since the velocity of a light wave is inversely proportional to the refractive index of the medium. So the refractive index of the second medium is half of the medium 1.

$n_1 = 2n_2$

For total internal reflection, the incident rays from a denser medium should be greater than critical angle,

$$n_1 \sin\theta_c = n_2 = \frac{\eta_1}{2}$$

So $\sin\theta_c = 0.5$

So $\theta_c = 30^o$

48.

(b) 4133 $\overset{o}{A}$

Explanation: As we know,

$$\lambda_0 = \frac{12375}{W_0(\text{eV})} = \frac{12375}{3} = 4125\overset{o}{A}$$

49.

(d) $\frac{e}{\sqrt{4\pi\epsilon_0 a_0 m}}$

Explanation: $\frac{mv^2}{a_0} = \frac{1}{4\pi\epsilon_0}\frac{e^2}{a_0^2}$

$$\therefore \quad v = \frac{e}{\sqrt{\left(4\pi\epsilon_0 a_0 m\right)}}$$

50.

(b) binding energy per nucleon will be more

Explanation: The binding energy of a nucleus is the energy required to take its nucleons away from one another. It is generally expressed as binding energy per nucleon. It is a measure of the stability of the nucleus. Higher is the binding energy per nucleon, the more stable the nucleus.

CHEMISTRY (Section-A)

51.

(d) 36.13×10^{23}

Explanation: 22.4 L of ozone

$= 6.022 \times 10^{23}$ molecules of ozone

$\therefore$ 44.8 L of ozone

$$= \frac{6.022 \times 10^{23} \times 44.8}{22.4}$$

$= 12.044 \times 10^{23}$ molecules of ozone

Hence, number of oxygen atoms in ozone (O_3)

$= 3 \times 12.044 \times 10^{23}$

$= 36.13 \times 10^{23}$ atoms

52.

(b) E_n for $A^{+(z-1)} = Z^2 \times E_n$ for H

Explanation: $E_{He^+} = E_H \times 2^2; E_{Li^{2+}} = E_H \times 3^2$

53.

(d) proton

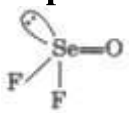
Explanation: Hydrogen atom when ionized it loses its only electron thus, it is left with

only proton in the nucleus and thus, the species H^+ is also called proton which does not have any electron.

54.

(d) Both ClO_3^- and XeO_3

Explanation:



55.

(b) Butane, C_4H_{10}

Explanation: Weaker the I.M.F, greater is the V.P.

56.

(d) four sulphur-oxygen bonds and one oxygenoxygen bond

Explanation: $H-O-O-\underset{\underset{O}{||}}{\overset{\overset{O}{||}}{S}}-O^{\Theta}$

57.

(c) -4 RT

Explanation: $C_7H_{16}(l) + 11O_2(g) \xrightarrow{\Delta} 7CO_2(g) + 8H_2O(l)$

$\Delta H - \Delta U = \Delta n_g RT$

Δn_g = no. of moles of product in gaseous state - no. of moles of reactant in gaseous state.

$\therefore \Delta n_g = -4$

$\therefore \Delta H - \Delta U = -4RT$

58.

(c) $\frac{1}{4}A_2B_{4(g)} \rightleftharpoons \frac{1}{2}AB_{2(g)}$

Explanation: (A) $K_c = 10.9$; (B) $K_c = 1.4 \times 10^4$

(C) $K_c = 1.82$; (D) $K_c = 118.6$

59. **(a)** orthophosphorus and pyrophosphorus acids

Explanation: orthophosphorus acid, H_3PO_3 : $HO-\overset{\overset{O}{||}}{P}|H-OH$

$\overset{x}{H_3PO_3} = 3 + x + 3(-2) = 0$ or $x = +3$

Pyrophosphorus acids, $H_4P_2O_5$: $HO-\overset{\overset{O}{||}}{P}|H-O-\overset{\overset{O}{||}}{P}|H-OH$

$\overset{x}{H_4P_2O_5} = 4 + 2x + 5(-2) = 0$

$4 + 2x - 10 = 0$

$x = +3$

60. **(a)** $A_3(BC_4)_2$

Explanation: The sum of oxidation number is zero.

61.

(d) sp^2, sp^3

Explanation: The state of hybridization of boron and oxygen atom in boric acid (H_3BO_3) is sp^2, sp^3 respectively.

Boric acid $OH - \overset{OH}{\underset{|}{B}} - OH$; has a network structure in which boron is trigonal having sp^2 and each oxygen atom is tetrahedral having sp^3 - hybridization with two lone pair of electrons on oxygen.

62.

(c) sharing of two oxygen atoms of each SiO_4^{-4} tetrahedral unit with two other tetrahedral units.

Explanation: sharing of two oxygen atoms of each SiO_4^{-4} tetrahedral unit with two other tetrahedral units.

63.

(c) Resonance structure should have equal energy.

Explanation: Resonance structure should have equal energy.

64.

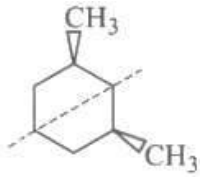
(b) 5

Explanation:

Total 5 α - H

65. **(a)** iii only

Explanation:



Plane of symmetry

66.

(b) 296 g/mol

Explanation: $\Delta T_f = i \cdot mK_f$

$$\frac{0.128}{5.12 \times 0.1} = i$$

$\therefore$ $i = 0.25$

$$i = \frac{\text{Calculated molar mass}}{\text{Observed molar mass}}$$

$$\text{Observed molar mass} = \frac{74}{0.25} = 296 \text{ g/mol}$$

67.

(c) 0.56 M

Explanation: 0.56 M

68. **(a)** $\frac{RT}{6F}$

Explanation: $\frac{RT}{6F}$

69. **(a)** $2K_2[NO_2]^2 - 2K_1[N_2O_4]$

K_0

Explanation: $N_2O_4 \rightleftharpoons K_2\ 2NO_2$

for reversible reaction $r = r_f - r_b$ (forward) (backward)

K_2

for disappearance of $NO_2 \rightarrow 2NO_2 \rightleftharpoons K_1\ N_2O_4$

$r_f = K_2[NO_2]^2$

$r_b = K_1[N_2O_4]$

$r = K_2[NO_2]^2 - K_1[N_2O_4]$

For disappearance of NO_2

$$\left[-\frac{d\left(NO_2\right)}{dt}\right]$$

$$r = (-)\frac{1}{2}\frac{d\left(NO_2\right)}{dt}$$

$$2r = \frac{-d\left(NO_2\right)}{dt}$$

$$\frac{-d\left(NO_2\right)}{dt} = 2[K_2[NO_2]^2 - K_1[N_2O_4]]$$

70. **(a)** 4×10^5 sec

Explanation: 4×10^5 sec

71.

(b) $AgNO_3$

Explanation: $AgNO_3$

72.

(c) pyramidal

Explanation: pyramidal

73.

(d) lesser energy difference between 5f and 6d orbitals than that between 4f and 5d orbitals.

Explanation: The 5f-orbitals extend into space beyond the 6s and 6p-orbitals and participate in bonding. This is in direct contrast to the lanthanides where the 4f-orbitals are buried deep inside in the atom, totally shielded by outer orbitals and thus unable to take part in bonding.

74.

(c) Tetraethyl lead

Explanation: $(Et)_4$ Pb has σ-bond only.

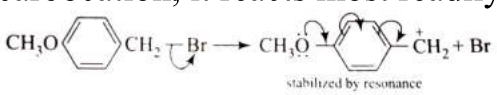
75. **(a)** two, tetrahedral

Explanation: two, tetrahedral

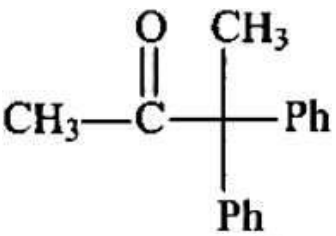
76.

(b) p-methoxybenzyl bromide

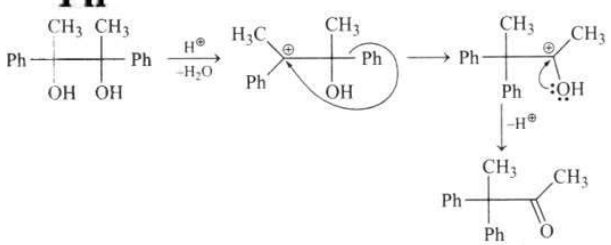
Explanation: Here ethanol reacts as a nucleophile attacking the carbocation generated by the heterolysis of the halide. Since p-methoxybenzyl bromide yields the most stable carbocation, it reacts most readily with ethanol.



77.

(b) 

Explanation:



78. **(a)** F_3CCOOH

Explanation: For a stronger acid (lower pKa), the negative charge must be more stabilized. TFA (CF_3COOH) is stronger than the other given options because its conjugate base can better stabilize the negative charge. It can stabilize the negative charge via resonance in the carboxylate functional group. However, TFA also has three highly

electronegative fluorine atoms which withdraw electron density "through the single bonds" via induction.

As stated above, the $-CF_3-$ moiety is an electron-withdrawing group, by the inductive effect. So our negative charge (rather, the electron density it represents) will be slightly drawn through the bonds toward the fluorines, thus it is further delocalized and thus more stable.

79.

(d) 1 = sp^3, 2 = sp^3, 3 = sp^2

Explanation: 1 = sp^3, 2 = sp^3, 3 = sp^2

80.

(c) 5 carbon atoms and one oxygen atom

Explanation:

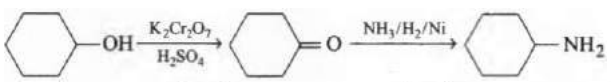
Pyranose

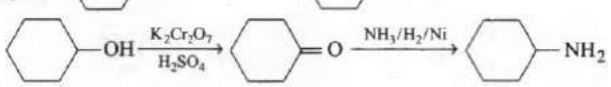
81.

(b) A-T, G-C

Explanation: A-T, G-C

82.

(d) 

Explanation: 

83.

(b) $CuSO_4$ can be stored in silver vessel.

Explanation: From the values of standard electrode potential, the order of reducing power is Al > Cu > Ag > Hg

84. **(a)** steam distillation

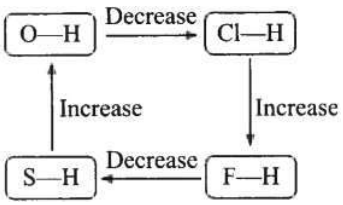
Explanation: steam distillation

85.

(c) carboxylic acid and 1^o amine

Explanation: carboxylic acid and 1^o amine

CHEMISTRY (Section-B)

86. **(a)** 

Explanation: E.N. = F > O > Cl > S

87.

(d) $2CuBr \rightarrow CuBr_2 + Cu$

$$\overset{+}{Cu}\overset{0}{Br} \longrightarrow \overset{0}{Cu} + \overset{2+}{Cu}Br_2$$

Explanation: It is an example of disproportionation reaction, as Cu undergoes both oxidation and reduction.

88.

(c) passing steam through a red hot coke bed

Explanation: H_2O Steam $+ C$ Red hot $\rightarrow H_2 + CO$

Water gas

89.

(c) A and C only

Explanation: A and C only

90.

(c) 2.0×10^{-20} J

Explanation: Energy absorbed by each molecule = Bond energy per molecule + Kinetic energy per molecule, 4.4×10^{-19} J = 4.0×10^{-19} J + Kinetic energy per molecule

0.4×10^{-19} = Kinetic energy per molecule

Now,

$$\text{Kinetic energy per atom} = \frac{Kinetic\ \ energy\ \ per\ \ molecule}{2}$$

$$= \frac{0.4 \times 10^{-19}}{2} = 0.2 \times 10^{-19}$$

$= 2.0 \times 10^{-20}$ J.

91. **(a)** A mixture of Al_2O_3 and carbon in dry Cl_2 gas

Explanation: Al_2O_3 can be converted into anhydrous $AlCl_3$ by heating a mixture of Al_2O_3 and carbon in dry chlorine.

$AI_2O_3 + 3C + 3Cl2 \rightarrow 2AICl_3 Anhy.AICI_3 dry + 3CO$

92.

(c) $1.6 \times 10^{6}\ s^{-1}$

Explanation: From Arrhenius equation,

$$\ln\frac{k_2}{k_1} = \frac{-E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

Since $E_a = 0$,

$$\ln\frac{k_2}{k_1} = 0$$

$\therefore$ $k_2 = k_1$

Hence, rate constant at 400 K = $1.6 \times 10^6\ s^{-1}$

93.

(c) $S_2O_8^{2-}$

Explanation: The strongest oxidizing agent will have a higher positive value of standard reduction potential.

94.

(d) -4.311×10^{-4} V/degree

Explanation: -4.311×10^{-4} V/degree

95.

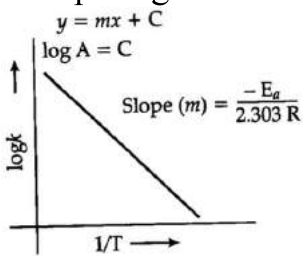
(d) log k vs $\frac{1}{T}$

Explanation: Arrhenius equation $k = Ae^{\frac{-Ea}{RT}}$

or $\log k = \log A \frac{E_a}{2.303RT}$

(E_a = energy of activation)

Comparing it with equation of straight line i.e.,

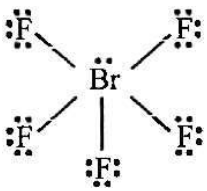


96.

(b) BrF_5 : trigonal bipyramid

Explanation:

The molecular geometry of BrF_5 is square pyramidal with asymmetric charge distribution on the central atom.



97.

(b) All of these

Explanation: $RbF + XeF_6 \rightarrow Rb + XeF_7^-$

$XeF_6 + 3H_2O \rightarrow XeO_3 + 6HF$

$2XeF_6 + SiO_2 \rightarrow 2XeOF_4 + SiF_4$

98.

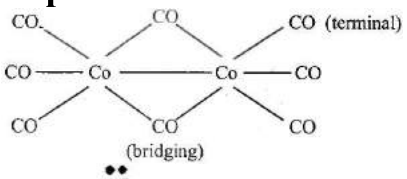
(c) K_2MnO_4

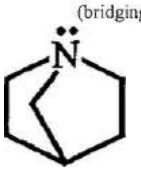
Explanation: Highest O.N. of Mn is +7 which is not present in K_2MnO_4 (Mn = +6).

99.

(c) one Co-Co bond, six terminal CO and two bridging CO

Explanation:



100. **(a)** 

Explanation: 

It is most basic due to no amine inversion at N atom.

BOTANY (Section-A)

101.

(b) Only human

Explanation: A human being is the only organism who is aware of himself, i.e., has self-consciousness.

102.

(c) Felidae

Explanation: Felidae is a family of carnivorous animals which includes lions, tigers, leopards, and cats.

103.

(c) Eubacteria are also called false bacteria

Explanation: Eubacteria are also called true bacteria. Eu stands for true.

104.

(b) Archaea have some novel features that are absent in other prokaryotes and eukaryotes.

Explanation: Archae have primitive forms with histones, no organized nucleus, membrane bound organelles are absent and proteinaceous and non-cellulosic carbohydrate nature of cell wall.

105.

(c) Two

Explanation: In 60 percent of angiosperms, mostly dicots, pollen grains are shed at the 2-celled stage.

106.

(c) Isogamous

Explanation: During sexual reproduction Ulothrix produces flagellated (motile), morphologically similar gametes and Spirogyra produces non-flagellated(non-motile) but morphologically dissimilar gametes. The fusion of morphologically similar gametes is known as isogamous sexual reproduction.

107.

(c) Brown algae

Explanation: Brown algae possess chlorophyll a, c, carotenoids, and xanthophylls. They vary in colour from olive green to various shades of brown depending upon the amount of the xanthophyll pigment, fucoxanthin present in them.

108.

(c) self-pollinated

Explanation: Cleistogamous flowers do not open at all and their anthers and stigma lie close to each other. When anthers dehisce in the flower buds, pollen grains come in contact with the stigmato effectpollination. Thus, cleistogamous flowers are self-pollinated as there is no chance of cross-pollen landing on the stigma.

109.

(d) Absent

Explanation: Absent

110.

(d) Alstonia

Explanation: Whorled, simple leaves with reticulate venation are present in Alstonia. In Alstonia, five or more leaves arise from each node, so it shows whorled phyllotaxy. These leaves are leathery, sessile, and simple and also elliptical or ovate or wedge-shaped at the base. It is used in traditional medicines.

111.

(b) Lamina

Explanation: In the pitcher plant (Nepenthes) the leaf becomes modified into a pitcher. There is a slender stalk that coils like a tendril holding the pitcher vertical and the basal portion is flattened like a leaf. The pitcher is provided with a lid that covers the mouth. The function of the pitcher is to capture and digest insects. The lamina is modified into a pitcher.

112.

(c) (i) and (ii)

Explanation: (i) and (ii)

The incorrect statements are the following:

i. The cells of cambium cut off towards pith, mature into secondary phloem, and the cells cut off towards periphery mature into secondary xylem.

ii. The vascular cambium is generally more active on the outer side than on the inner.

113.

(c) 22 + XXY male

Explanation: The karyotype of a male 22 + XXY represents one extra X chromosome which is an aneuploidy.

114.

(c) Klinefelter's syndrome and Turner's syndrome

Explanation: The union of a sperm with 22A + XY and normal egg with 22A + X results in the formation of zygote with 44A + XXY which will develop into male affected with Klinefelter's syndrome. The union of a sperm with 22A + X0 and normal egg with 22A + X

results in the formation of zygote with 44A + X0 which will develop into a female affected with Tuner's syndrome.

115. **(b)** Essential amino acids
Explanation: Essential amino acids

116. **(b)** Nirenberg and Matthaei
Explanation: Nirenberg and Matthaei

117. **(b)** Lysosomes
Explanation: Lysosomes is enclosed by a single membrane. Lysosome contains hydrolytic enzymes which include phosphatase, proteases, peptidases, nucleases, etc.

118. **(d)** Mitochondria
Explanation: Mitochondria

119. **(d)** amphetamines
Explanation: Certain drugs such as amphetamine, ephedrine, tyramine cause release of adrenaline and noradrenaline from its storage vesicles in the sympathetic nerve endings. The released adrenaline and noradrenaline in turn causes the sympathetic effects. These drugs are structurally very similar to adrenaline and noradrenaline and taken by athletes to increase athletic performance. These drugs are also used in the treatment of obesity because they directly inhibit feeding centre of the brain.

120. **(a)** accumulates excess of fats.
Explanation: In alcoholism liver gets damaged as it accumulates excess of fats.

121. **(c)** the force of repulsion between the divided kinetochores.
Explanation: The separation of two chromatids of each chromosome at early anaphase is initiated by the force of repulsion between the divided kinetochores.

122. **(c)** (i) and (ii) are correct
Explanation: (i) and (ii) are correct

123. **(d)** Food chain
Explanation: Food chain

124. **(d)** A, B, C and D
Explanation: Cheese is one of the oldest milk products prepared with the help of microbes. The curd is separated from liquid part or whey to form cheese. Dosa, Upma and Idli are fermented preparation of rice and black gram.

125. **(b)** Deforestation
Explanation: Deforestation

126.

(c) By creating biosphere reserve

Explanation: Creating biosphere reserve is the most effective approach to conserve the plant diversity in an area. A biosphere reserve is an ecosystem with plants and animals of unusual scientific and natural interest.

127.

(d) Core zone

Explanation: Core zone or Natural zone area of a Biosphere reserve is undisturbed and legally protected ecosystem. No human activity is allowed in this zone. Little human activity is allowed in the buffer zone whereas in transition zone, an active cooperation is present between reserve management and local people for activities like settlements, cropping, etc. Restoration region is degraded area which is selected for restoration to near natural form.

128.

(b) Gametes

Explanation: Genes do not occur in pairs in gametes. Gametes are haploid in nature as they undergo meiosis and reduces ploidy levels into half. Male and female gametes which are haploid in nature fuse to form a zygote and thus, the zygote is diploid in nature.

129.

(c) G_1

Explanation: G_1 phase decide weather the cell growth and cell division occurs end of the G_1 or not. The G_1 phase, or growth 1/gap 1 phase, is the first of four phases of the cell cycle that takes place in eukaryotic cell division. In this part of interphase, the cell grows in size and synthesizes mRNA and proteins in preparation for subsequent steps leading to mitosis. G_1 phase ends when the cell moves into the S phase of interphase.

130. **(a)** Manganese and Chlorine

Explanation: Photolysis of water during photosynthesis evolve nascent oxygen in the presence of manganese, calcium and chloride ions.

131.

(b) 1, 4, 2, 3, 5

Explanation: 1, 4, 2, 3, 5

132. **(a)** Both Cyclic photophosphorylation and Non - cyclic photophosphorylation

Explanation: Z scheme of light reaction is non-cyclic fow of electron from PSII through quinone, cyt b6b6 f complex and plastocyanin to NADPH via PSI; it does not return to PSII. NADP reductase enzyme is located on stromal side of PSI; Z scheme includes both PSI and PSII. Absence of PS-II leads to cyclic photophosphorylation in which electrons are passed from PS-I, via electron transfer chain, to back to PS-I with formation of ATP. Cyclic photophosphorylation does not pass electrons to NADP; rather electrons are passed back to PSI. PS I is involved in both cyclic and non-cyclic photophosphorylation.

133. **(a)** Both 680 nm ↑ and 680 nm ↓

Explanation: Both 680 nm ↑ and 680 nm ↓

134. **(a)** Organic acid

Explanation: Usually carbohydrates are oxidised to release energy, but proteins, fats and

even organic acids can be used as respiratory substances in some plants, under certain condition.

135.

(b) Auxin accumulates on the shaded side, stimulating greater cell elongation there

Explanation: Auxins induce cell elongation. In a differentially illuminated plant, they accumulate in the shaded part, causing elongation of the cells in the shaded part. This unequal elongation on two sides causes the plant to curve or bend towards the light source, i.e., phototropic curvature

BOTANY (Section-B)

136.

(c) Taxon

Explanation: Each unit or category of classification is termed as a taxon which represents a rank. All the organism belonging to a similar taxon share similar traits.

137. **(a)** vascular tissues

Explanation: Pteridophytes differ from bryophytes and thallophytes in having well-developed vascular tissue system. Vascular tissues play an important role in conducting water and food materials to the plants. Whereas they are absent in bryophytes and thallophytes.

138.

(d) Chlorella

Explanation: Chlorella a unicellular alga rich in proteins is used as food supplement even by space travelers.

139.

(d) Entomophily

Explanation: Fragrant flowers with well-developed nectaries are an adaptation for entomophily in which insects are the pollinating agents. Bees are the most common insect which acts as pollinating agents. Other insect pollinators are butterflies, flies, beetles, wasps, ants, moths.

140.

(c) Brassica campestris

Explanation: Brassica campestris

141.

(d) 50%

Explanation: The man's father being colourblind has a normal vision as he has Y chromosome from his father and X from his mother. His wife's mother was colour blind and father was normal, so she must be a carrier of the trait.

Their cross will produce

Normal carrier female X^CX × Normal eyed male XY

♀ \ ♂	X	Y
X^C	X^CX	X^CY
X	X^CX	XY

50% of male children will be colourblind.

142.

(b) G 17%, A 33%, T 33%

Explanation: According to Charagaff's rule, A = T and G = C and A + G + C + T = 100%. As Cytosine always pairs with Guanine. So Guanine would also be 17%, G + C = 34% therefore A + T = 66%. As A = T therefore A = 33% and T = 33%

143. **(a)** Safranin
Explanation: Safranin is used as a counter-stain in Gram staining and endospore staining. It can also be used for detection of cartilage, mucin and mast cell granule. Carmine is the basic dye and used to stain nucleic acid and chromosomes, and gives chromosomes a pink colour thus, differentiating from other cellular organelles. Basic Fuchsin is involved in staining of human chromosomes, elastic fibres, cardiac or skeletal muscle tissue. Methylene blue is used to stain nuclei, Golgi bodies, and pectic substances.

144. **(a)** Nostoc
Explanation: Nostoc

145.
(d) Mitochondria
Explanation: Mitochondria are the sites of cellular respiration, oxidative phosphorylation, synthesis of haem protein, cytochrome, myoglobin, etc.

146.
(d) (i)-(C), (ii)-(D), (iii)-(B), (iv)-(A)
Explanation: (i)-(C), (ii)-(D), (iii)-(B), (iv)-(A)

147. **(a)** (ii) and (iii)
Explanation: (ii) and (iii)

148. **(a)** gibberellin
Explanation: Vernalisation involves the cold treatment of certain plants to induce flowering. Vernalisation treatment of biennial plants for flowering can be replaced by gibberellin.

149. **(a)** axillary buds are activated.
Explanation: Decapitating a growing plant means removing shoot apex of the plant. Auxin, a growth promoting phytohormone present in apex inhibits the growth of axillary buds so that only the apex continues to grow. When the apex containing auxin is removed or decapitation is done, then axillary buds show their growth, this is because the apical dominance is removed. This practice of removal of apical dominance is applied in tea gardens, hedges, rose gardens etc.

150. **(a)** 3 carbon atoms
Explanation: 3 carbon atoms

ZOOLOGY (Section-A)

151.
(d) Arthropoda : Body divided into head, thorax and abdomen and respires by tracheae.
Explanation: Arthropoda, the largest phylum of kingdom animalia, characteristically possesses an outer body layer - the cuticle. The body is composed of segments usually forming distinct specialized body regions, i.e., head, thorax, and abdomen. Respiratory organs consist of book gills or gills in the aquatic and semiaquatic arthropods and book lungs or tracheae in the terrestrial forms.

152.
(c) Catla- Bony fish

Explanation: The given image represents Catla which is a bony fish.

153. **(d)** Snake and lizard
Explanation: Squamata is the largest order of reptiles, comprising lizards and snakes.

154. **(a)** Cerebrum
Explanation: The cerebrum is the thinking part of the brain which controls your voluntary muscles.

155. **(b)** Intermediate Junctions
Explanation: These usually occur just below tight junctions. The intercellular space at these places contain a clear, low electron density fluid. They probably serve anchoring functions.

156. **(a)** 3000-4500 ml
Explanation: 3000-4500 ml

157. **(b)** Asbestosis
Explanation: Asbestosis is a lung disease resulting from the inhalation of asbestos particles.

158. **(b)** RBCs and plasma
Explanation: RBCs and plasma

159. **(d)** 20-25 times more readily than oxygen
Explanation: 20-25 times more readily than oxygen

160. **(d)** Nasal cavity → Pharynx → Larynx → Trachea → Bronchi Bronchiole → Alveoli
Explanation: Nasal cavity → Pharynx → Larynx → Trachea → Bronchi Bronchiole → Alveoli

161. **(d)** luteal phase and lasts for 13 days.
Explanation: The luteal phase is the final phase of the ovarian cycle and it corresponds to the secretory phase of the uterine cycle. During the luteal phase, the pituitary hormones, FSH and LH cause the remaining parts of the dominant follicle to transform into the corpus luteum, which produces progesterone. It occurs from fifteenth to twenty-eighth day of the menstrual cycle.

162. **(a)** Abdominal cavity
Explanation: Abdominal cavity

163. **(b)** Sperm before fertilization
Explanation: Sperm before fertilization

164. **(d)** All of these
Explanation: All of these

165.

(b) (i) and (iv)

Explanation: Rapid increase in population over a relatively short period of time is called population explosion. Increased health facilities, better living conditions and a rapid decline in death rate, maternal mortality rate (MMR) and infant mortality rate (lMR) as well as an increase in number of people in reproducible age are the probable reasons for population explosion.

166. **(a)** (i) Dryopithecus, (ii) Ramapithecus, (iii) Australopithecus (iv) Homo habilis

Explanation: (i) Dryopithecus, (ii) Ramapithecus, (iii) Australopithecus (iv) Homo habilis

167.

(d) Oparin and Haldane

Explanation: Oparin and Haldane proposed that the first form of life come from pre-existing non-living molecules, e.g., RNA, protein, etc. and the formation of life was preceded by chemical evolution, i.e., formation of diverse organic molecule from inorganic molecules.

168.

(b) running parallel to loop of Henle.

Explanation: Vasa recta are the blood vessels running parallel to loop of Henle forming a counter-current system in juxta-medullary nephron.

169.

(c) Hydrogen ions are actively secreted into the filtrate

Explanation: An adult human excretes, on average, 1 to 1.5 liters of urine per day. The urine formed is a light yellow colored watery fluid which is slightly acidic (pH-6.0). Human urine is usually acidic because hydrogen ions are actively secreted into the filtrate. So, the correct answer is 'Hydrogen ions are actively secreted into the filtrate'.

170. **(a)** afferent arteriole, efferent arteriole

Explanation: Glomerulus is a tuft of capillaries formed by (afferent arteriole) a fine branch of renal artery. Blood from the glomerulus is carried away by an (efferent arteriole).

171. **(a)** 14

Explanation: 14

172.

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

Explanation: Ca^{2+} ions bind to the troponin and unmask the tropomyosin sites for attaching ATP so that, the contraction takes place during the muscle contraction. A band never shortens. It is the light band, which slides over the I-band and causes the shortening of sarcomere. In relaxed state, Ca^{2+} is pumped back into sarcoplasmic reticulum and this causes the troponin confirmation changes that lead troponin to occupy the active site of actin filament.

173.

(c) sarcomere

Explanation: Z-lines divide the myofibrils into sarcomere. A sarcomere is the basic unit of striated muscle tissue. It is the repeating unit between two Z lines.

174.

(d) Dura mater

Explanation: Dura mater

175.

(c) No impulse is transmitted from receptor

Explanation: No impulse is transmitted from receptor

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

Explanation: Axon hillock is a specialized part of the cell body (or soma) of a neuron that connects to the axon. The axon hillock is the last site in the soma where membrane potentials propagated from synaptic inputs are summated before being transmitted to the axon. Efferent Neurons (also known as efferent nerve fibres) are conducting cells that carry information from the central nervous system (the brain and spinal cord) to muscles and organs throughout the body. These neurons carry electrical impulses that tell organs and muscles what to do.

177.

(d) Only A

Explanation: Progesterone-corpus-luteum, stimulation of growth and activities of female secondary sex organs

178.

(b) Sympathetic nervous system is activated releasing epinephrine and norepinephrine from adrenal medulla.

Explanation: The adrenal medulla secretes epinephrine and norepinephrine. These hormones increase alertness, pupillary dilation, piloerection, sweating, and heartbeat, strength of heart contraction, rate of respiration, glycogenolysis, lipolysis, and proteolysis.

179. **(a)** Fibrinogen

Explanation: Fibrinogens are needed for clotting or coagulation of blood.

180.

(b) B

Explanation: The blood group B contains antigen B and antibody A in their plasma.

181. **(a)** Sudden closure of AV valves

Explanation: The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves.

182.

(c) Genetic engineering

Explanation: Genetic engineering

183.

(c) with a piece of foreign DNA.

Explanation: After cutting the source DNA and the vector DNA with a specific restriction enzyme, the cut out 'gene of interest' from the source DNA and the cut vector with space are mixed and ligase enzyme is added. This results in the formation of rDNA or hybrid PNA or chimeric DNA.

184.

(d) Human insulin

Explanation: Human insulin

185.

(c) Bacillus thuringiensis

Explanation: Bacillus thuringiensis

ZOOLOGY (Section-B)

186. **(a)** (b), (c) and (e) are correct.

Explanation: Echinoderms are triploblastic and coelomates with true coelom. Roundworms have an organ-system level of body organization. The water vascular system is a characteristic of Echinoderms. The above three statements are correct.

187. **(a)** Dense regular connective tissue

Explanation: In the dense regular connective tissues, the collagen fibres are present in rows between many parallel bundles of fibres. Tendons, which attach skeletal muscles to bones and ligaments which attach one bone to another are examples of dense regular connective tissue.

188.

(d) They carry blood from an organ towards the heart.

Explanation: Veins are blood vessels that carry blood towards the heart. Most veins carry deoxygenated blood from the tissues back to the heart; exceptions are the pulmonary and umbilical veins, both of which carry oxygenated blood to the heart.

189.

(c) Increase of CO_2 content in inhaled air.

Explanation: Ventilation rate of lungs is the process that mixes fresh inspired gas with alveolar gas. Increase of CO_2 content in inhaled air is responsible for increase in ventilation rate of lungs. If there is no ventilation at all, there will be no replenishment of oxygen and no removal of CO_2. PO_2 will fall and pCO_2 will rise towards the venous O_2 and CO_2 tensions.

190.

(b) FSH and LH

Explanation: Both LH and FSH attain a peak level in the middle of the menstrual cycle (about the 14th day). Rapid secretion of LH leading to its maximum level during the mid-cycle called LH surge induces rupture of Graafian follicle and thereby the release of an ovum (ovulation).

191.

(b) ZIFT and IUT

Explanation: ZIFT- Zygote intrafallopian transfer, is an infertility treatment used when a blockage in the fallopian tubes prevents the normal binding of sperm to the egg. Egg cells are removed from a woman's ovaries, and in vitro fertilized. The resulting zygote is placed into the fallopian tube by the use of laparoscopy.

IUT- is the technique in which an embryo of more than 8 blastomeres is transferred into the uterus.

192.

(c) Only d

Explanation: Items - Plasmodium, Cuscuta, Trypanosoma, Category - Protozoan parasites, Exception - Cuscuta

193.

(b) Loop of Henle's

Explanation: Henle's Loop Reabsorption in this segment is minimum. However, this region plays a significant role in the maintenance of high osmolarity of medullary interstitial fluid. The descending limb of Henle is permeable to water but almost impermeable to electrolytes. This concentrates the filtrate as it moves down. The ascending limb is impermeable to water but allows transport of electrolytes actively or passively.

194.

(d) thigh is striated and voluntary.

Explanation: Striated (or skeletal) muscles are found in the limbs and body walls. These muscles are voluntary (under the control of animal's will) and show dark and light bands thus are striated.

195.

(c) 100 metre per second

Explanation: 100 metre per second

196. **(a)** cytoplasmic receptors

Explanation: Oestrogen and testosterone being steroid hormones are soluble in lipids, therefore they can cross the plasma membrane and bind to the cytoplasmic receptors to trigger their action.

197.

(c) Duodenum and jejunum

Explanation: Duodenum and jejunum

198.

(c) Ca

Explanation: Ca

199.

(b) Escherichia coli and Agrobacterium tumifaciens

Explanation: Escherichia coli and Agrobacterium tumifaciens

200.

(b) Both sense and anti-sense RNA

Explanation: Tobacco plants resistant to a nematode have been developed by the introduction of DNA that produces (in the host cells) both sense and anti-sense RNA.