NEET (UG) 2024

SAMPLE PAPER - 8

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. In a particular system, the unit of length, mass and time are chosen to be 10 cm, 10 g and 0.1 s respectively. The unit of force in this system will be equivalent to: **[4]**

   a) 100 N

   b) 10 N

   c) 1 N

   d) 0.1 N

2. A pressure of 10 dynes/cm is equivalent to: **[4]**

   a) 10^7 N/m^2

   b) 10^5 N/m^2

   c) 10^6 N/m^2

   d) 10^4 N/m^2

3. A body is thrown vertically upwards from the top A of a tower. It reaches the ground in t_1 seconds. If it is thrown vertically downwards from A with the same speed it reaches the ground in t_2 seconds. If it is allowed to fall freely from A, then the time it takes to reach the ground is given by: **[4]**

   a) $t = \frac{t_1 + t_2}{2}$

   b) $t = \sqrt{\frac{t_1}{t_2}}$

   c) $t = \sqrt{t_1 t_2}$

   d) $t = \frac{t_1 - t_2}{2}$

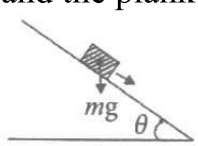
4. Let $\left|\vec{A}_1\right| = 3$, $\left|\vec{A}_2\right| = 5$ and $\left|\vec{A}_1 + \vec{A}_2\right| = 5$. The value of $\left(2\vec{A}_1 + 3\vec{A}_2\right) \cdot \left(3\vec{A}_1 - 2\vec{A}_2\right)$ is [4]

a) -118.5
b) -106.5
c) -112.5
d) -99.5

5. When a ball is thrown vertically upward it reaches upto a height of 50 cm, neglecting air resistance. If air resistance is affecting only a vertical component, it causes vertical retardation of ball equal to 12% of acceleration due to gravity. The difference in height reached by ball in both cases will be [4]

a) 6.81 cm
b) 4.93 cm
c) 7.46 cm
d) 5.36 cm

6. A plank with a box on it at one end is gradually raised about the other end. As the angle of inclination with the horizontal reaches 30, the box starts to slip and slides 4.0 m down the plank in 4.0 s. The coefficients of static and kinetic friction between the box and the plank will be, respectively [4]



a) 0.6 and 0.5
b) 0.4 and 0.3
c) 0.5 and 0.6
d) 0.6 and 0.6

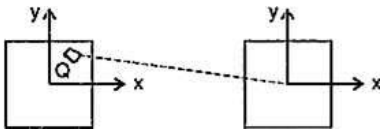
7. Two bodies, having masses in the ratio 1 : 4, have kinetic energies in the ratio 4 : 1. The ratio of their linear momentum is: [4]

a) 1 : 2
b) 2 : 1
c) 1 : 4
d) 1 : 1

8. A time dependent force F = 6t acts on a particle of mass 1 kg. If the particle starts from rest, the work done by the force during the first 1 s will be [4]

a) 9 J
b) 18 J
c) 4.5 J
d) 22 J

9. A uniform square plate has a small piece Q of an irregular shape removed and glued to the centre of the plate leaving a hole behind. [4]



The moment of inertia about the z-axis is then:

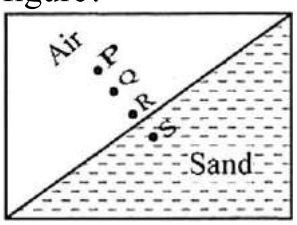
a) the same

b) decreased

c) changed in unpredicted manner

d) increased

10. Which of the points is likely position of the centre of mass of the system shown in the figure? **[4]**



a) Q

b) P

c) R

d) S

11. What will be the escape velocity on some planet which is having radius four times that of the earth and gravitational acceleration equal to the earth? **[4]**

a) Equal to escape velocity on the earth

b) One-third of escape velocity on the earth

c) Half of the escape velocity on the earth

d) Two times of escape velocity on the earth

12. The stress-strain curves are drawn for two different materials X and Y. It is observed that the ultimate strength point and the fracture point are close to each other for material X but are far apart for material Y. We can say that materials X and Y are likely to be (respectively), **[4]**

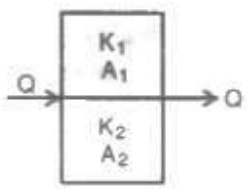
a) Brittle and ductile

b) Plastic and ductile

c) Brittle and plastic

d) Ductile and brittle

13. Two plates of same thickness, of coefficients of thermal conductivities K_1 and K_2 and areas of cross-section A_1 and A_2, are connected as shown; the common coefficient of thermal conductivity K will be: **[4]**



a) $\frac{K_1A_1}{K_2A_2}$

b) $\frac{K_1A_1+K_2A_2}{A_1+A_2}$

c) $\frac{K_1A_2+K_2A_1}{A_1+A_2}$

d) $K_1A_1 + K_2A_2$

14. 10 gm of ice at -20°C is added to 10 gm of water at 50 °C. Specific heat of water =1 cal/gm-°C, specific heat of ice = 0.5 cal/gm-°C. Latent heat of ice = 80 cal/gm. Then, resulting temperature is: **[4]**

a) 50°C

b) -20°C

c) 15°C

d) 0°C

15. Under isothermal condition, the pressure of a gas is given by $P = aV^{-3}$, where a is a constant and V is the volume of the gas. The bulk modulus at constant temperature is equal to **[4]**

a) 2 P

b) $\frac{p}{2}$

c) 3 P

d) P

16. The gas having average speed four times as that of SO_2 (molecular mass 64) is: **[4]**

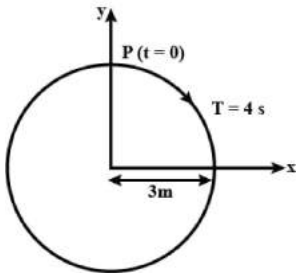
a) H_2 (molecular mass 2)

b) CH_4 (molecular mass 16)

c) He (molecular mass 4)

d) O_2 (molecular mass 32)

17. The radius of the circle, the period of revolution, initial position, and sense of revolution are indicated in fig. **[4]**



y-projection of the radius vector of rotating particle P is:

a) $y(t) = 3\cos\left(\frac{3\pi t}{2}\right)$, where y in m

b) $y(t) = 4\sin\left(\frac{\pi t}{2}\right)$, where y in m

c) $y(t) = 3\cos\left(\frac{\pi t}{2}\right)$, where y in m

d) $y(t) = -3\cos 2\pi t$, where y in m

18. The fundamental frequency of a closed organ pipe of length 20 cm is equal to the second overtone of an organ pipe open at both the ends. The length of organ pipe open at both the ends is: **[4]**

a) 120 cm

b) 80 cm

c) 140 cm

d) 100 cm

19. The frequency of a radar is 780 MHz. The frequency of the reflected wave from an aeroplane is increased by 2.6 kHz. The velocity of aeroplane is: **[4]**

a) 0.5 km/sec

b) 1 km/sec

c) 0.25 km/sec

d) 2 km/sec

20. Electric charge is uniformly distributed along a long straight wire of radius 1mm. The charge per cm length of the wire is Q coulomb. Another cylindrical surface of radius 50 cm and length 1 m symmetrically encloses the wire. The total electric flux passing through the cylindrical surface, is: **[4]**

a) $\frac{100Q}{\varepsilon_0}$

b) $\frac{Q}{\varepsilon_0}$

c) $\frac{10Q}{\pi\varepsilon_0}$

d) $\frac{100Q}{\pi\varepsilon_0}$

21. An e^- acquired an energy of 3.2×10^{-17} J. When it passes through an electric field between two plates. The potential difference between two plates is: **[4]**

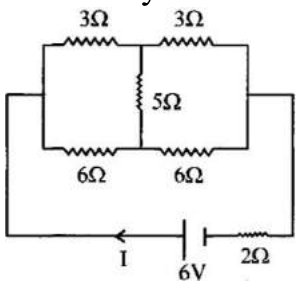
a) 400 V

b) 300 V

c) 200 V

d) 100 V

22. A battery of 6 V is connected to the circuit as shown below. The current I drawn from the battery is: **[4]**



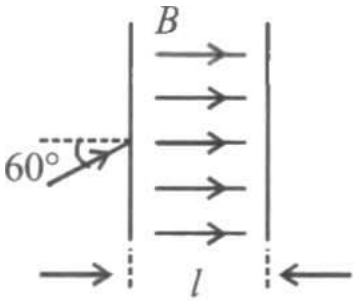
a) 1A

b) 2 A

c) $\frac{4}{3}$ A

d) $\frac{6}{11}$ A

23. The figure shows a region of length l with a uniform magnetic field of 0.3 T in it and a proton entering the region with velocity 4×10^5 ms^{-1} making an angle 60^o with the field. If the proton completes 10 revolution by the time it cross the region shown, l is close to (mass of proton = 1.67×10^{-27} kg, charge of the proton = 1.6×10^{-19} C) **[4]**



a) 0.88 m

b) 0.44 m

c) 0.11 m

d) 0.22 m

24. Two tangent galvanometer A and B are identical except in their number of turns. They are connected in series. On passing a current through them, deflections of 60^o and 30^o are produced. The ratio of the number of turns in A and B is: **[4]**

a) 1 : 2

b) 1 : 3

c) 2 : 1

d) 3 : 1

25. A tangent galvanometer has a coil with 50 turns and radius equal to 4 cm. A current of 0.1 amp is passing through it. The plane of the coil is set parallel to the earth's magnetic meridian. If the value of the earth's horizontal componeni of the magnetic field is 7×10^{-5} tesla and p $0 = 4\pi \times 10^{-7}$ weber/amp $\times$ metre, then the deflection in the galvanometer needle will be: **[4]**

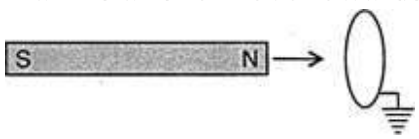
a) 48.2^o

b) 52.7^o

c) 50.7^o

d) 45^o

26. A circular ring is fixed in a gravity free space and one point of the ring is earthed. Now a magnet is placed along the axis of the ring at a distance from its centre such that the nearer pole is north pole as shown in the figure. An impulse is applied on the magnet so that it starts to move towards the ring. Then: **[4]**



a) the magnet retards and comes to a permanent rest

b) initially the magnet experiences an acceleration and then it retards to come to an instantaneous rest

c) the magnet continues to move along the axis with constant velocity

d) the magnet starts to oscillate about centre of the ring

27. The flux linked with a coil at any instant t is given by $\phi = 10\ t^2 - 50\ t + 250$. The induced emf at t = 3 sec is: **[4]**

a) 10 volt

b) -190 volt

c) 190 volt

d) -10 volt

28. In an a.c. circuit containing only capacitor, the current. **[4]**

a) leads voltage by 90°

b) remains in phase with a voltage

c) leads voltage by 180°

d) lags voltage by 90°

29. The dimensions of $\frac{E}{B}$ are same as that of: [4]

a) acceleration

b) charge

c) velocity

d) current

30. The refractive index of glass is 1.520 for red light and 1.525 for blue light. Let D_1 and D_2 be the angles of minimum deviation for red light and blue light respectively in a prism of this glass. Then: [4]

a) $D_1 < D_2$

b) $D_1 = D_2$

c) $D_1 > D_2$

d) D_1 can be less than or greater than depending upon the angle of prism

31. If the ratio of intensities of two waves causing interference be 9 : 4, then the ratio of the resultant maximum and minimum intensitiies will be: [4]

a) 9 : 4

b) 3 : 2

c) 5 : 1

d) 25 : 1

32. The value of de Broglie wavelength of an electron moving with a speed of 6.6×10^5 ms^{-1} is approximately: [4]

a) $111\ \overset{o}{A}$

b) $311\ \overset{o}{A}$

c) $211\ \overset{o}{A}$

d) $11\ \overset{o}{A}$

33. Sodium lamps are used in foggy conditions because: [4]

a) yellow light is scattered more by the fog particles

b) yellow light is unaffected during its passage through the fog

c) wavelength of yellow light is the mean of the visible part of the spectrum

d) yellow light is scattered less by the fog particles

34. The longest wavelength that a single ionised helium atom in its ground state will absorb is: **[4]**

a) $912\ A^{o}$

b) $606\ A^{o}$

c) $304\ A^{o}$

d) $1216\ A^{o}$

35. You are given that mass of $^{7}_{3}\mathrm{L} = 7.0160$ u, **[4]**

Mass of $^{4}_{2}\mathrm{He} = 4.0026$ u

and Mass of $^{1}_{1}\mathrm{H} = 1.0079$ u

When 20 g of $^{7}_{3}\mathrm{Li}$ is converted into $^{4}_{2}\mathrm{He}$ by proton capture, the energy liberated, (in kWh), is:

[Mass of nucleon = 1 GeV/c^2]

a) 4.5×10^5

b) 8×10^6

c) 1.33×10^6

d) 6.82×10^5

PHYSICS (Section-B)

Attempt any 10 questions

36. If the waterfalls from a dam into a turbine wheel 19.6 m below, then the velocity of water at the turbine is: (g = 9.8 m/s) **[4]**

a) 19.6 m/s

b) 9.8 m/s

c) 98 m/s

d) 39.2 m/s

37. A thin rod of mass m and length 2l is made to rotate about an axis passing through its centre and perpendicular to it. If its angular velocity changes from 0 to ω in time t, the torque acting on it is: **[4]**

a) $\frac{ml^2\omega}{3t}$

b) $\frac{4ml^2\omega}{3t}$

c) $\frac{ml^2\omega}{t}$

d) $\frac{ml^2\omega}{12t}$

38. Four identical particles of mass M are located at the comers of a square of side a. What should be their speed, if each of them revolves under the influence of other's gravitational field in a circular orbit circumscribing the square ? **[4]**

a) $1.16\sqrt{\frac{GM}{a}}$

b) $1.21\sqrt{\frac{GM}{a}}$

c) $1.41\sqrt{\frac{GM}{a}}$

d) $1.35\sqrt{\frac{GM}{a}}$

39. A cube of side 5 cm made of iron and having a mass of 1500 gm, is heated from 25°C to 400°C. The specific heat for iron is 0.12 cal/gm-°C and the coefficient of volume expansion is 3.5×10^{-5}/°C. The change in internal energy of the cube is: (atmospheric pressure = 10^5 N/m^2) **[4]**

a) 141 kJ

b) 423 kJ

c) 320 kJ

d) 282 kJ

40. Two strings A and B have lengths l_A and l_B and carry masses M_A and M_b at their lower ends, the upper ends being supported by rigid supports. If n_A and n_B are the frequencies of their vibrations and $n_A - 2n_B$, then: **[4]**

a) $l_A = 4l_B$, regardless of masses

b) $l_B = 4l_A$, regardless of masses

c) $M_B = 2M_A$, $l_B = 2l_A$

d) $M_A = 2M_B$, $l_A = 2l_B$

41. When a wave propagates through the medium, the constituents of the medium gets disturbed. The speed of the waves is: **[4]**

A. directly proportional to restoring force set up in the medium when it is disturbed

B. inversely proportional to the mass density of the medium

C. directly proportional to the product of the restoring force and the mass density of the medium

D. both (A) and (B)

a) Only A

b) Only D

c) Only C

d) Only B

42. A current loop consists of two identical semicircular parts each of radius R, one lying in the x, y-plane and the other in x, z-plane. If the current in the loop is i. The resultant magnetic field due to the two semicircular parts at their common centre is: **[4]**

a) $\frac{\mu_0 i}{4R}$

b) $\frac{\mu_0 i}{2R}$

c) $\frac{\mu_0 i}{2\sqrt{2}R}$

d) $\frac{\mu_0 i}{\sqrt{2}R}$

43. A toroidal winding carrying a current of 5A is bound with 300 turns/m of the wire. The wire is of iron which has a magnetic permeability of $5000\mu_0$ under the given condition. **[4]**

The H, B and M inside the core are :

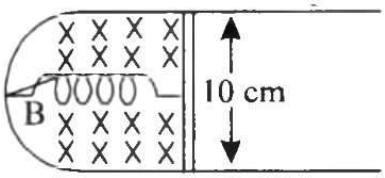
a) 5000A turns/m, 0.42 T, 7.5 10^6 Am^{-1}

b) 1000A turns/m, 9.2 T, 7.5 10^6 Am^{-1}

c) 1500A turns/m, 0.42 T, 7.5 $\times$ 10^6 Am^{-1}

d) 1500A turns/m, 9 T, 7.5 10^6 Am^{-1}

44. A thin strip 10 cm long is on a U-shaped wire of negligible resistance and it is connected to a spring of spring constant 0.5 N m^{-1} (see figure). The assembly is kept in a uniform magnetic field of 0.1 T. If the strip is pulled from its equilibrium position and released, the number of oscillations it performs before its amplitude decreases by a factor of e is N. If the mass of the strip is 50 grams, its resistance 10 Ω and air drag negligible, N will be close to: **[4]**



a) 50000

b) 1000

c) 10000

d) 5000

45. A circuit element X when connected to an a.c. supply of peak voltage 100 V gives a peak current of 5 A which is in phase with the voltage. A second element Y when connected to the same a.c. supply also gives the same value of peak current which lags behind the voltage by $\frac{\pi}{2}$. If X and Y are connected in series to the same supply, what will be the rms value of the current in ampere? **[4]**

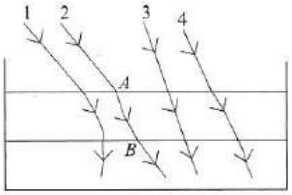
a) $\frac{5}{\sqrt{2}}$

b) $\frac{10}{\sqrt{2}}$

c) $5\sqrt{2}$

d) $\frac{5}{\sqrt{2}}$

46. The optical density of turpentine is higher than that of water while its mass density is lower. The figure shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in the figure, the path is shown is correct? **[4]**



Air Turpentine Water

a) 1

b) 3

c) 4

d) 2

47. In a calm swimming pool, a person is viewing outside objects by keeping an eye at a depth h inside water. If the critical angle for water is θ_c, if μ is the refractive index of the medium, then the value of the diameter of the circle of view for outside objects will be: **[4]**

a) $2h\mu^2$

b) $2h\ (\mu^2 - 1)^{1/2}$

c) $\dfrac{2h}{\sqrt{(\mu^2 - 1)}}$

d) $2h/\mu^2$

48. The frequency and the intensity of a beam of light falling on the surface of a photoelectric material are increased by a factor of two. This will: **[4]**

a) increase the maximum kinetic energy of the photoelectrons, as well as photoelectric current by a factor of two

b) not produce any effect on the kinetic energy of the emitted electrons but will increase the photoelectric current by a factor of two

c) increase the maximum kinetic energy of the photoelectrons by a factor of two and will have no effect on the magnitude of the photoelectric current produced

d) increase the maximum kinetic energy of the photoelectrons and would increase the photoelectric current by a factor of two

49. When an atomic gas or vapour is excited at low pressure, bypassing an electric current through it then: **[4]**

a) band spectrum is observed

b) absorption spectrum is observed

c) emission spectrum is observed

d) both absorption spectrum is observed and band spectrum is observed

50. The activity of a radioactive sample is measured as 9750 counts per minute at t = 0 and as 975 counts per minute at t = 5 minutes. The decay constant is approximately: **[4]**

a) 0.230 per minute

b) 0.461 per minute

c) 0.691 per minute

d) 0.922 per minute

CHEMISTRY (Section-A)

51. The volume of 0.1N dibasic acid sufficient to neutralize 1 g of a base that furnishes 0.04 mole of OH^- in aqueous solution is: **[4]**

a) 800mL

b) 400 mL

c) 200mL

d) 600mL

52. What is the approximate wavelength of radiation of frequency 1.5×10^{15} per sec? **[4]**

a) $4.0 \times 10^{12} A^o$

b) $4.0 \times 10^{4} A^o$

c) $2.0 \times 10^{3} A^o$

d) $3.6 \times 10^{25} A^o$

53. Using the periodic table predict the formula of compound which might be formed by the following pair of elements: silicon and bromine **[4]**

a) $Si_3Br_8^{2-}$

b) $Si_2Br_8^{4-}$

c) $SiBr_4$

d) $SiBr_2$

54. Two elements have electronegativity of 1.2 and 3.0. A bond formed between them would be: **[4]**

a) polar covalent

b) ionic

c) metallic

d) co-ordinate

55. Among the following species, which has the minimum bond length? **[4]**

a) B_2

b) $O2^-$

c) C_2

d) F_2

56. Which of the following pairs of compounds is isoelectronic and isostructural? **[4]**

a) IF_3, XeF_2

b) TeI_2, XeF_2

c) $IBr2^-$, XeF_2

d) $BeCl_2$, XeF_2

57. The Gibbs energy change in kJ/mole when liquid water boils at 1 atm and 100^oC: (Latent heat of vaporization is 2072.3 J/mole) **[4]**

a) 1.0

b) 37.3

c) 0

d) 2.072

58. The conjugate base of H_2SO_4 in the following reaction is: **[4]**

$$H_2SO_4 + H_2O \rightleftharpoons H_3O^+ + HSO4^-$$

a) $HSO4^-$

b) H_2O

c) SO_4^{2-}

d) H_3O^+

59. Bleaching action of SO_2 is due to: **[4]**

a) hydrolysis

b) reduction

c) acidic nature

d) oxidation

60. 8 g of sulphur are burnt to form SO_2 which is oxidised by Cl_2 water. The solution is treated with $BaCl_2$ solution. The mole of $BaSO_4$ precipitated is: **[4]**

a) 0.25 mol

b) 0.24 mol

c) 1 mol

d) 0.33 mol

61. Four statements are given below : **[4]**

A. B_2 solid does not exist, boron have basic building B_{12} icosahedral units made up of polyhedron having 20 faces and 12 corners.

B. In alum each metal ion is surrounded by six water molecules.

C. Graphite is used as dry lubricant in machines running at high temperature in place of oil.

D. Fullerene contains twenty, six-membered rings and twelve, five-membered rings.

The correct statements are:

a) A, B, C and D

b) A, C and D

c) A and D

d) C and D

62. Arrange in increasing order of molar masses, where X, Y and W are all boron compounds. **[4]**

i. $B_2H_6 + O_2 \rightarrow X$

ii. $B_2H_6 + H_2O \rightarrow Y$

iii. $B_2H_6 \xrightarrow{\Delta} B_5H_9(Z)$

iv. $B_2H_6 + NH_3 \xrightarrow{473K} W$

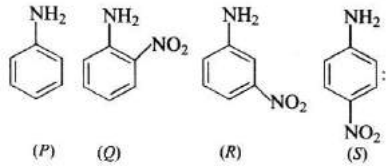
a) W < X < Z < Y

b) Z < W < X < Y

c) X < Y < Z < W

d) Y < Z < X < W

63. The decreasing order of basicity of following aniline derivatives is **[4]**



a) R > Q > P > S

b) P > Q > R > S

c) P > R > S > Q

d) S > R > Q > P

64. The IUPAC name of $CH_3 - \underset{|}{C} = \underset{|}{C} - \underset{|}{CH} - CH_2 - C \equiv CH$ is: **[4]**

$Cl \quad CH_3C_2H_5$

a) 2-chloro-4-ethyl-3-methylhept-2-en-6-yne

b) 2-chloro-4-ethyl-3-methylhept-6-yn-2-ene

c) 6-chloro-4-ethyl-5-methylhept-1-yn-5-ene

d) 6-chloro-4-ethyl-5-methylhept-5-en-1-yne

65. The kind of valency that exists in CaH_2 and C_2H_2 is: **[4]**

a) covalency in CaH_2 and electrovalency in C_2H_2

b) electrovalency in CaH_2 and covalency in C_2H_2

c) electrovalency in both

d) covalency in both

66. 15 g of a solute in 100 g of water makes a solution to freeze at -1 °C. 30 g of a solute in 100g of water will give a depression in f.pt. equal to: **[4]**

a) 0.5°C

b) 2°C

c) -2°C

d) 1°C

67. The vapour pressure of a dilute solution of glucose is 750 mm of Hg at 373 K. The mole fraction of solute is: **[4]**

a) $\frac{1}{35}$

b) $\frac{1}{10}$

c) $\frac{1}{76}$

d) $\frac{1}{7.6}$

68. 100 mL of 0.2 M HCl and 100 mL of 0.2 MNaOH are mixed at temp. T K. The resultant conductivity of mixture is 4.0×10^{-3} S cm^{-1} at TK. Then molar conductance in S cm^2 mol^{-1} at TK will be: **[4]**

a) 20

b) 80

c) 60 d) 40

69. If **a** is the initial concentration of a substance which reacts according to zero-order kinetics and K is rate constant, the time for the reaction to go to completion is: **[4]**

a) $\frac{K}{a}$ b) $\frac{2}{aK}$

c) $\frac{2K}{a}$ d) $\frac{a}{K}$

70. In the elementary reaction A + B $\rightarrow$ Products, if B is taken in excess, then the rate of reaction with respect to B is _____. **[4]**

a) zero order b) first order

c) second order d) pseudo-first order

71. Why is oxygen superior to fluorine in stabilising high oxidation states of transition metals? **[4]**

a) Because oxygen is less electronegative than fluorine.

b) Both Because oxygen is less electronegative than fluorine and Because of the ability of oxygen to form multiple bonds to metals.

c) Because of larger size of oxygen as compared to fluorine.

d) Because of the ability of oxygen to form multiple bonds to metals.

72. For an interhalogen compound XX'_3, correct statement (where X, is central atom, X is surrounding atom): **[4]**

a) Size of X is greater than size of X b) X can't be fluorine

c) Electronegativity of X is greater than X d) All of these

73. Which of the following d-block metal have $4f^{14}$ electronic configuration in their inner shell? **[4]**

i. Sc

ii. Y

iii. La

iv. None of these

a) Only (i)

b) Only (ii)

c) Only (iv)

d) Only (iii)

74. All of the following obey Sidgwick effective atomic number rule except: **[4]**

a) $K_3[Fe(CN)_6]$

b) $Fe(CO)_5$

c) $\left[V(CO)_6\right]^-$

d) $Ni(CO)_4$

75. Tetracyanoethylene has a formal C = C double bond length of X in the free ligand but in the complex $[Pt\{C_2(CN)_4\}Cl_3]^-$ the C—C bond length will be: **[4]**

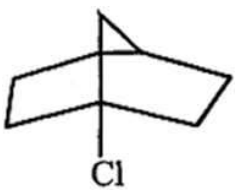
a) Less than X

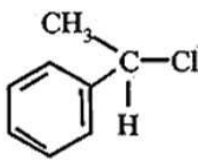
b) Not Equal to X

c) Equal to X

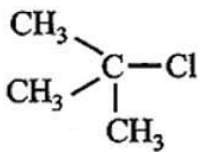
d) Greater than X

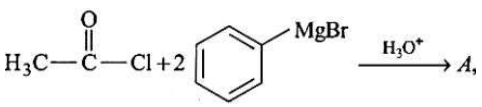
76. Which one of the following compounds is inactive towards S_N1 reaction? **[4]**

a) 

b) 

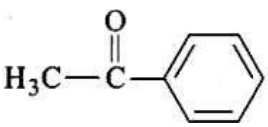
c) 

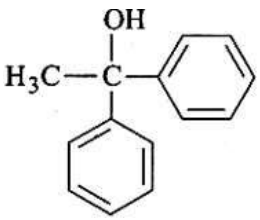
d) 

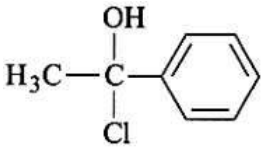
77. 

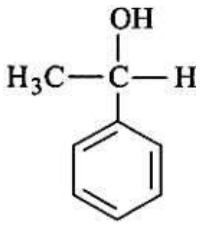
[4]

A is:

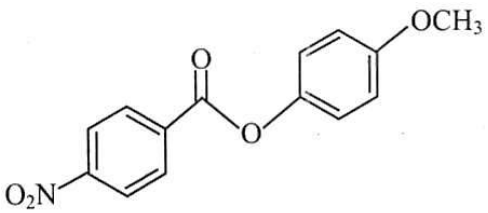
a) 

b) 

c) 

d) 

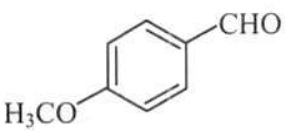
78. Predict the major product of the following reaction: **[4]**

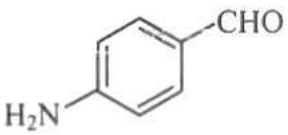


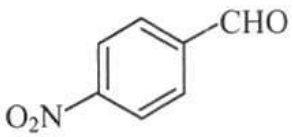
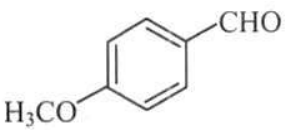
i. DIBAL - H

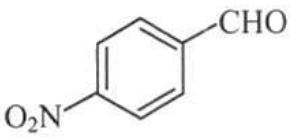
→

ii. H_2O, - 78°C

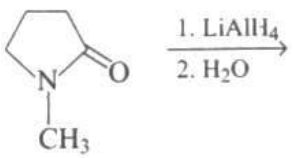
a) 

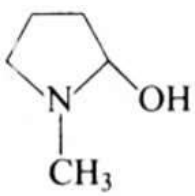
b) 

c) Both  and 

d) 

79. The product formed in the reaction is: **[4]**



a) $H_3C - N|H - (CH_2)_3 - CH_2OH$ b) 

c) $H_3C - N|H - (CH_2)_3 - \overset{O}{\overset{||}{C}} - H$

d) 

80. Deficiency of which vitamin causes osteomalacia? **[4]**

a) Vitamin D
b) Vitamin K
c) Vitamin A
d) Vitamin E

81. The number of molecules of ATP produced in the lipid metabolism of a molecule of palmitic acid is **[4]**

a) 56
b) 130
c) 86
d) 36

82. A compound X when reacted with PCl_5 and then with NH_3 given Y. When Y treated with Br_2 and KOH produced Z. Z on treatment with $NaNO_2$ + HCl at 0^oC and then boiling produced ortho-cresol. Compound X is: **[4]**

a) m-toluic acid
b) o-toluic acid
c) o-chlorotoluene
d) o-bromotoluene

83. Oxidation of oxalic acid by $KMnO_4$ in acid medium is carried out in a reversible cell. What is the logarithm of equilibrium constant of cell reaction if $E^o_{MnO_4/Mn^{2+}}$ = +1.51V and $E^{\circ}_{CO_2/\text{ oxalate}}$ = -0.49V **[4]**

a) 67.8
b) 169.49
c) 678.2
d) 338.98

84. The separation an organic compound from its aqueous solution can be achieved by **[4]**

a) Fractional distillation
b) Distillation
c) Solvent extraction
d) Steam distillation

85. Chromyl chloride test is performed for the confirmation of the presence of the following in a mixture **[4]**

a) Chromium
b) Chloride
c) Chromium and chloride
d) Sulphate

CHEMISTRY (Section-B)

Attempt any 10 questions

86. Which of the following molecules or species has different bond angles between adjacent atoms? **[4]**

a) SF_6

b) SeF_4

c) $NO2^-$

d) NCl_3

87. Hydrogen peroxide in aqueous solution decomposes on warming to give oxygen according to the equation $2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$ under conditions where one mole of gas occupies 24 dm^3, 100 cm^3 of XM solution of H_2O_2 produces 3 dm^3 of O_2. Thus X is: **[4]**

a) 0.25

b) 2.5

c) 0.5

d) 1

88. Which of the following species has four lone pairs of electrons? **[4]**

a) Cl^-

b) O

c) He

d) I

89. Which statement is wrong? **[4]**

A. Bond energy of $F_2 > Cl_2$

B. Electronegativity of F > Cl

C. F is more oxidising than Cl

D. Electron affinity of Cl > F

a) Only C

b) Only B

c) Only A

d) Only D

90. The wavelength of a microscopic particle of mass 9.1×10^{-31} kg is 182 nm, its kinetic energy in J is _____. **[4]**

a) 7.28×10^{-23}

b) 3.64×10^{-24}

c) 3.64×10^{-23}

d) 7.28×10^{-24}

91. The **INCORRECT** statement amongst the following is: **[4]**

i. $LiAlH_4$ and $NaBH_4$ act as reducing agent due to the presence of hydride ion

ii. Al — H bond is more ionic than B—H bond and hence $LiAlH_4$ can produce larger concentration of hydride ion than that of $NaBH_4$

iii. $LiAlH_4$ cannot reduce $-NO_2$ group

iv. Inspite of very small rate constant of reduction of any carbonyl function other than aldehydes and ketones, the rate of reduction with $LiAlH_4$ becomes appreciable due to large concentration of hydride ion.

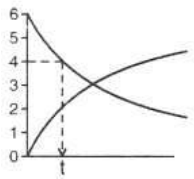
a) Only (iv)

b) Only (ii)

c) Only (i)

d) Only (iii)

92. For the unimolecular reaction A $\longrightarrow$ B, the figure given below shows that at the time t curves represents: **[4]**



Thus t is given by:

a) $\frac{1}{t_{\frac{1}{4}}}$

b) $\frac{1}{t_{\frac{1}{2}}}$

c) $\frac{1}{t_{\frac{1}{3}}}$

d) $\frac{2}{t_{\frac{1}{3}}}$

93. Standard reduction electrode potentials of three metals X, Y and Z are -1.2 V, -0.5 V and -3.0 V respectively. The reducing power of these metals are: **[4]**

a) X > Y > Z

b) Y > X > Z

c) Z > X > Y

d) Y > Z > X

94. At a given temperature, the ratio of molar conductivity to specific conductance of a 0.01 M NaCl solution is _____. **[4]**

a) $1 \times 10^2\ cm^3\ mol^{-1}$

b) $1 \times 10^3\ cm^3\ mol^{-1}$

c) $1 \times 10^6\ cm^3\ mol^{-1}$

d) $1 \times 10^5\ cm^3\ mol^{-1}$

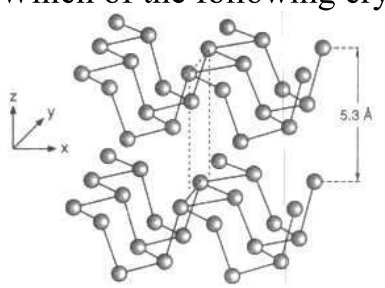
95. The given reaction, **[4]**
$2FeCl_3 + SnCl_2 \rightarrow SnCl_4 + 2FeCl_2$ is an example of:

a) fourth order reaction
b) second order reaction
c) third order reaction
d) first order reaction

96. The oxidation number of phosphorus and basicity of acid in pyrophosphoric acid respectively are **[4]**

a) +1 and 4
b) +4 and 3
c) +3 and 1
d) +5 and 4

97. Which of the following crystalline allotrope found in given arrangement of atoms? **[4]**



a) Black phosphorus
b) Red phosphorus
c) Graphite
d) Rhombic sulphur

98. Identify the only paramagnetic species: **[4]**

a) Yb^{2+}
b) Ce^{4+}
c) Nd^{3+}
d) Lu^{3+}

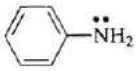
99. Cis-trans isomerism is found in square planar complexes of molecular formula (a and b are monodentate ligands): **[4]**

a) Ma_3b
b) Mab_3
c) Ma_2b_2
d) Ma_4

100. Consider the following three amines, **[4]**

i. $CH_3CH_2 - \ddot{N}H_2$

ii. $CH_2 = CH - \ddot{N}H_2$

iii. 

Arrange C-N bond length of these compounds in decreasing order:

a) i > iii > ii

b) i > ii > iii

c) ii > iii > i

d) iii > ii > i

BOTANY (Section-A)

101. All living organisms are linked to one another because : **[4]**

a) They share common genetic material but to varying degrees

b) All have common cellular organization

c) They have common genetic material of the same type

d) Both (a) and (c)

102. 5th June is celebrated as : **[4]**

a) World red cross day

b) World environment day

c) World food day

d) World forest day

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

a) Cyanobacteria form blooms in polluted water bodies.

b) Chemosynthetic autotrophic bacteria oxidise various inorganic substances and use the released energy for their ATP production.

c) Heterotrophic bacteria are the most abundant in nature. The majority are important decomposers.

d) All are these

104. In Agaricus karyogamy and meiosis takes place in: **[4]**

a) Trama

b) Basidum

c) Subhymanium

d) Ascus

105. Which of the following has both male and female sex organs in the same plant? **[4]**

a) Castor

b) Both Castor and Maize

c) Papaya

d) Maize

106. Plants in which the seeds are not covered, i.e., are naked: **[4]**

a) Gymnosperms
b) Bryophytes
c) Pteridophytes
d) Angiosperms

107. How many statements for artificial systems of classification are correct from given statements? **[4]**

i. The classification used only gross superficial morphological characters.
ii. They were based mainly on vegetative characters or on the androecium structure.
iii. Not give equal weightage to vegetative and sexual characteristics.
iv. They separated the closely related species since they were based on a few characteristics.
v. They were based on habit, colour, number and shape of leaves etc.

a) Three
b) One
c) Four
d) Five

108. In which one of the following plants water is not necessary for the act of fertilization? **[4]**

a) Vallisneria
b) Fem
c) Coconut
d) Moss

109. The fusion of polar nuclei and male gamete produces: **[4]**

a) Secondary nucleus
b) Primary endosperm nucleus (PEN)
c) Zygote
d) Central cell

110. The term polyadelphous is related to: **[4]**

a) Gynoecium
b) Calyx
c) Corolla
d) Androecium

111. How many statements are incorrect for fruit? **[4]**

i. The fruit is a ripened ovary, developed after fertilisation.

ii. If a fruit is formed without fertilisation of the ovary, it is called a parthenocarpic fruit.

iii. Fruit consists of a wall or pericarp and seeds. In coconut fruit is barry, the mesocarp is fibrous.

iv. In mango and coconut, the fruit is known as a drupe.

v. In mango, the pericarp is well differentiated into an outer thin epicarp, a middle fleshy edible mesocarp, and an inner stony hard endocarp.

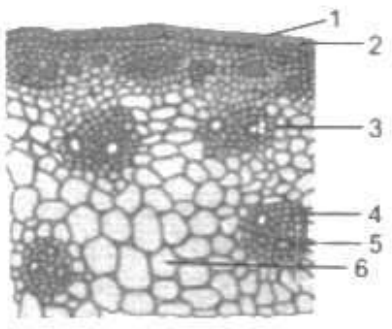
a) One

b) Three

c) Two

d) Four

112. Identify the given diagram and choose the correct answer for labelled 1, 2, 3, 4, 5, and 6 of the given diagram. **[4]**



a) Dicot stem - 1 - Epidermis, 2 - Hypodermis, 3 - Vascular bundles, 4 - Phloem, 5 - Xylem, 6 - Ground tissue

b) Monocot stem - 1 - Epidermis, 2 - Hypodermis, 3 - Vascular bundles, 5 - Xylem, 4 - Phloem, 6 - Ground tissue

c) Monocot stem - 1 - Epidermis, 2 - Hypodermis, 3 - Vascular bundles, 4 - Phloem, 5 - Xylem, 6 - Ground tissue

d) Monocot leaf - 1 - Epidermis, 2 - Hypodermis, 3 - Vascular bundles, 4 - Phloem, 5 - Xylem, 6 - Ground tissue

113. Mutation is: **[4]**

a) Non-heritable

b) Change in heritable characters

c) Change in somatic characters

d) Sudden change in morphology

114. Fruit colour in squash is an example of: **[4]**

a) Dominant epistasis

b) Recessive epistasis

c) Inhibitory genes

d) Complementary genes

115. The universal initiating codon is: **[4]**

a) AAG
b) GUG
c) GUA
d) UAG

116. If 50 heavy DNA ^{15} N are replicated two times in the medium of ^{14}N, what is obtained? **[4]**

a) 100 half heavy and half light while 100 light only
b) 200 half light only
c) 100 heavy only and 100 light only
d) 200 half heavy only

117. The main arena of various types of activities of a cells is: **[4]**

a) Plasma membrane
b) Mitochondrion
c) Cytoplasm
d) Nucleus

118. An elaborate network of filamentous proteinaceous structures present in the cytoplasm which helps in the maintenance of cells shape is called: **[4]**

a) Endoplasmic reticulum
b) Cytoskeleton
c) Thylakoid
d) Plasmolemma

119. A cell coded protein that is formed in response to infection with most animal viruses is called: **[4]**

a) Antibody
b) Histone
c) Antigen
d) Interferon

120. Morphine is extracted from the: **[4]**

a) Amazonian coca
b) Inflorescences of the plant Cannabis saliva
c) Erythroxylon coca
d) Latex of poppy plant Papaver somniferum

121. Which of the following is correct about bivalent? **[4]**

i. Bivalents are tetrads.
ii. A bivalent means 4 chromatids and 2 centromeres.
iii. One bivalent consists of 2 homologous chromosomes.
iv. Bivalents form in zygotene.

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

122. Match the following columns: **[4]**

Column I	Column II
A. Mesotherms	1. Arctic region
B. Microtherms	2. Temperature region
C. Hekistotherms	3. Sub-tropical region

a) A-l, B-3, C-2
b) A-3, B-l,C-2
c) A-3, B-2, C-l
d) A-l, B-2, C-3

123. Consider the following statements concerning food chains. **[4]**

i. Removal of 80% tigers from an area resulted in greatly increased growth of vegetation.
ii. Removal of most of the carnivores resulted in an increased population of deer.
iii. The length of food chains is generally limited to 3-4 trophic levels due to energy loss.
iv. The length of food chains may vary from 2 to 8 trophic levels.

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

124. Yogurt is produced by: **[4]**

a) Lactobacillus acidophilus
b) Lactobacillus bulgaricus
c) Both Lactobacillus bulgaricus and Streptococcus thermophilus
d) Streptococcus thermophilus

125. Write 'T' for true and 'F' for false: **[4]**

i. Edward Wilson popularized the term Biodiversity.
ii. In India, more than 50 varieties of mango and about 1000 strains of rice are examples of species diversity.
iii. For many taxonomic groups species inventories are more complete in temperate than in tropical countries.
iv. An estimate made by Robert May places the global species diversity form 20 to 50 million.

a) (i)-T, (ii)-T, (iii)-T, (iv)-F
b) (i)-T, (ii)-F, (iii)-T, (iv)-F

c) (i)-F, (ii)-F, (iii)-T, (iv)-T

d) (i)-F, (ii)-T, (iii)-F, (iv)-T

126. Which of the following statement/s is/are incorrect about IFA1927? **[4]**

a) Over a protected forest, the government doesn't have any property rights.

b) Defines the procedure to be followed for declaring an area to be a reserved forest.

c) Hunting of wild animal is prohibited.

d) It defines what is a forest offence.

127. A threatened species category includes **[4]**

a) only vulnerable species.

b) endangered, vulnerable and rare species.

c) endangered and rare species.

d) only endangered species.

128. Number of meiotic divisions required to produce 100 macrospores in angiosperm/egg is: **[4]**

a) 25

b) 100

c) 125

d) 50

129. In meiosis, how many times the nucleus divide? **[4]**

a) Does not divide

b) Once

c) Four times

d) Twice

130. Warburg effect is **[4]**

a) increased photosynthetic rate at very low O_2 concentration.

b) decreased photosynthetic rate at very high CO_2 concentration.

c) increased photosynthetic rate at very high CO_2 concentration.

d) decreased photosynthetic rate at high O_2 concentration.

131. During fixation of one molecule of CO_2 by C_3 plants: **[4]**

a) 5 ATP and 2 $NADPH_2$ are required

b) 18 ATP and 12 $NADPH_2$ are required

c) 3 ATP and 2 $NADPH_2$ are required

d) 12 ATP and 2 $NADPH_2$ are required

132. Which of the following is obtained from CO_2 during glucose manufacture? **[4]**

a) Nitrogen

b) Carbon

c) Both Oxygen and Carbon

d) Oxygen

133. The process in which water is split during photosynthesis and is essential for Photosynthesis: **[4]**

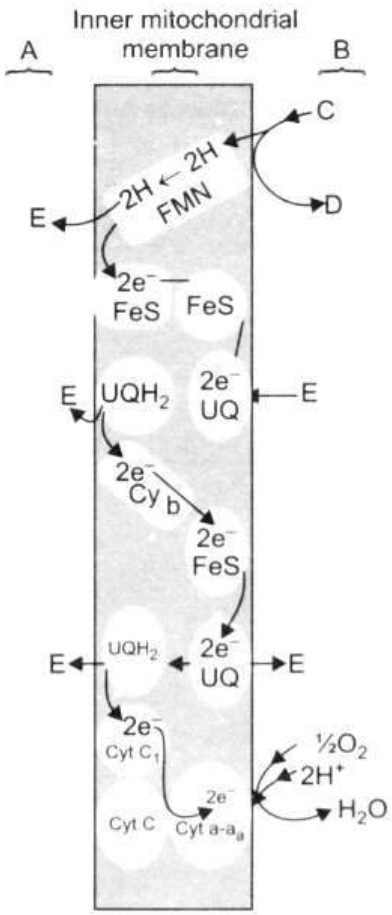
a) Plasmolysis

b) Hydrolysis

c) Haemolysis

d) Photolysis

134. The adjoining diagram refers to the mitochondrial electron chain. Identify the A, B, C, D, E. **[4]**



a) A-Outer membrane, B-Cristae; C-NAD; D-NADH + H^+ ; E-H_2

b) A-Matrix; B-Outer membrane; C-$FMNH_2$; D-$NADH_2$; E-2H

c) A-Outer chamber; B-Matrix; C-NADH H^+ ; D-NAD^+ ; E-$2H^+$

d) A-Cristae; B-Outer chamber; C-NADH + H^+ ; D-NAD^+ ; E-$2H^+$

135. The hormone which reduces transpiration rate by inducing stomatal closure is **[4]**

a) auxin

b) ABA

c) ethylene

d) gibberellin

BOTANY (Section-B)

Attempt any 10 questions

136. If two animals belong to the same kingdom but different classes, then both the animals may belong to the same **[4]**

a) orde

b) division

c) species

d) phylum

137. Mumps is a: **[4]**

a) Fungal disease

b) Protozoan disease

c) Viral disease

d) Bacterial disease

138. Coralloid roots of Cycas possess a symbiotic alga: **[4]**

a) Aulosira

b) Ulothrix

c) Anabaena

d) Spirogyra

139. The term used for transfer of pollen grains from anthers of one plant to stigma of a different plant which, during pollination, brings genetically different types of pollen grains to stigma, is **[4]**

a) Chasmogamy

b) Cleistogamy

c) Xenogamy

d) Geitonogamy

140. In Cynodon which types of stem is present? **[4]**

a) sucker

b) runner

c) stolon

d) offset

141. In a random mating population of 28,800 individuals percentage of dominant homozygous individuals is 49. Find out the percentage to heterozygous individual: **[4]**

a) 9%

b) 42%

c) 21%

d) 32%

142. In a DNA strand the nucleotides are linked together by: **[4]**

a) Hydrogen bonds

b) Phosphodiester bonds

c) Glycosidic bonds

d) Peptide bonds

143. Name chromatin for material of the nucleus was given by: **[4]**

a) Flemming

b) Robert Brown

c) Robert white

d) Strasburger

144. Three water samples namely river water, untreated sewage water and secondary effluent discharged for a sewage treatment plant were subjected to BOD test. The samples were labelled A, B, C respectively. But the laboratory attendant forget to note the BOD value of the samples. The BOD values of three samples were 200 mg/L, 8 mg/L and 400 mg/L. Can you assign BOD value to each samples. **[4]**

a) A = 8 mg/L, B = 400 mg/L. C = 200 mg/L

b) A = 400 mg/L, B = 8 mg/L, C = 200 mg/L

c) A = 200 mg/L, B = 400 mg/L, C =8 mg/L

d) A = 8 mg/L, B = 200 mg/L, C = 400 mg/L

145. Oxidative phosphorylation is the formation of: **[4]**

a) ATP in respiration

b) ATP in photosynthesis

c) $NADPH_2$ in respiration

d) $NADPH_2$ in photosynthesis

146. Which of the following organism is used in the production of beverages like wine, beer, whisky brandy or rum? **[4]**

a) Aspergillus niger

b) Saccharomyces cerevisiae

c) Penicillium notatum

d) Clostridium butylicum

147. _____ starts with green plants called producers as the first trophic level. The most appropriate choice for filling blank space is: **[4]**

a) detritus food chain

b) complex food chain

c) grazing food chain

d) normal food chain

148. A hypothetical chemical involved in the flowering of plants is or chemical agent which has an important role in flowering is: **[4]**

a) Indole acetic acid

b) Gibberellin

c) Florigen

d) Kinetin

149. Growth is maximum in the zone of: **[4]**

a) Cell elongation
b) Cell maturation
c) All of these
d) Cell division

150. Blackmann's law is related to **[4]**

a) Photosynthesis
b) Respiration
c) Transpiration
d) Root pressure

ZOOLOGY (Section-A)

151. Duck-billed platypus (Ornithorhynchus) is : **[4]**

a) A primitive egg laying reptile
b) An advance egg laying reptile
c) A primitive aquatic egg laying mammal
d) An aquatic bird

152. Given below are four statements regarding Aschelminthes. **[4]**

i. They are bilaterally symmetrical and triploblastic.
ii. They are dioecious
iii. All are plants or animal's parasites
iv. Coelomate

Mark the option that has both the correct statements.

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

153. The animals with bilateral symmetry in young stage and radial pentamerous symmetry in the adult stage, belong to the phylum: **[4]**

a) Cnidaria
b) Mollusca
c) Echinodermata
d) Annelida

154. The following are the major proteins of plasma: **[4]**

a) Globulin, bilirubin and fibrinogen
b) Haemoglobin, fibrinogen and albumin
c) Albumin, globulin and fibrinogen
d) Globulin, albumin and haemoglobin

155. Which of the following serves as a support framework for epithelium? **[4]**

a) Specialised connective tissue
b) Dense connective tissues
c) Areolar tissue
d) Adipose tissue

156. In crustacean respiration occurs through: **[4]**

a) Book lungs
b) Tracheae
c) Gills
d) Book gills

157. For proper transport of O_2 and CO_2 blood should be: **[4]**

a) Strongly acidic
b) Strongly alkaline
c) Slightly acidic
d) Slightly alkaline

158. Earthworm does not have special respiratory structures because: **[4]**

a) Haemocoel is present
b) A cylindrical shape gives high surface area to volume ratio
c) Arteries and veins are not differentiated
d) Respiratory pigment is dissolved plasma

159. Mark incorrect statement in the following. **[4]**

a) Diffusion membrane is made up of 3-major layers.
b) High cone, of hydrogen ions favours oxyhaemoglobin formation.
c) Breathing volumes are estimated by spirometer.
d) Solubility of CO_2 is higher than O_2 by 25 times.

160. Rate of breathing in an adult human is: **[4]**

a) 12-16/min
b) 10-12/min
c) 25-30/min
d) 20-25/min

161. Structure in mammals through which testes descend into the testes sacs is: **[4]**

a) Orifice
b) Inguinal canals
c) Lateral ducts
d) Bidder's canals

162. Several hormones like hCG, hPL, estrogen, progesterone are produced by: **[4]**

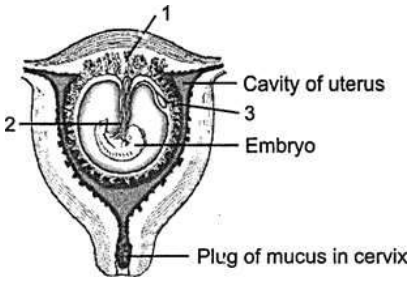
a) Pituitary

b) Ovary

c) Fallopian tube

d) Placenta

163. This is structure of human foetus within the uterus. Identify 1, 2 and 3 respectively. **[4]**



a) 1-Placental villi, 2-Umbilical cord with its vessels, 3-Allantois

b) 1-Placental villi, 2-Umbilical cord with its vessels, 3-Yolk sac

c) 1-Uterine wall, 2-Umbilical cord with its vessels, 3-Allantois

d) 1-Uterine wall, 2-Umbilical cord with its vessels, 3-Yolk sac

164. Medical Termination of Pregnancy (MTP) is considered safe up to how many weeks of pregnancy? **[4]**

a) Six weeks

b) Eight weeks

c) Twelve-weeks

d) Eighteen weeks

165. Our population which was approximately 350 million at the time of our independence reached close to the billion marks by 2000 and crossed 1 billion in May 2000. What are the probable reasons for this? **[4]**

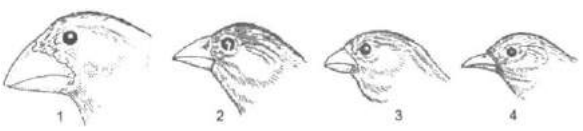
a) A rapid decline in death rate

b) A rapid decline in Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR)

c) An increase in number of people in reproducible age

d) All of these

166. Given diagrams are a variety of beaks of finches, it is used by which of the following scientist for their work? **[4]**



a) Lamarck

b) All are correct

c) Hugo de Vries

d) Darwin

167. In the Hardy-Weinberg equation, the frequency of heterozygous individual is represented by: **[4]**

a) 2pq
b) pq
c) q^2
d) p^2

168. Which one of the following characteristics is common both in humans and adult frogs? **[4]**

a) Internal fertilization
b) Nucleated RBCs
c) Four- chambered heart
d) Ureotelic mode of excretion

169. Uric acid is excreted in: **[4]**

a) Pigeon/Crow
b) Man
c) Frog
d) Rabbit

170. Which nitrogenous substance is highly toxic? **[4]**

a) Urea
b) Ammonia
c) Amino acid
d) Uric acid

171. The joint between bones of the human skull is: **[4]**

a) Hinge joint
b) Fibrous joint
c) Synovial joint
d) Cartilaginous joint

172. Which one of the following is the correct description of a certain part of a normal human skeleton? **[4]**

a) First vertebra is axis which articulates with the occipital condyles.
b) The 9th and 10th pairs of ribs are called the floating ribs.
c) Parietal bone and temporal bone of the skull are joined fibrous joint.
d) Glenoid cavity is a depression to which the thigh bone articulates.

173. Osteoporosis is a: **[4]**

A. Inflammation of joints
B. Inflammation of joints due to the accumulation of uric acid crystals
C. An age-related disorder characterised by decreased bone mass and increased chances of fractures

a) Only C

b) Only B

c) All of these

d) Only A

174. Arrange the layers of cells in retina of human eye from inside to outside. **[4]**

a) Ganglion cells → Bipolar cells → Photoreceptor cells

b) Photoreceptor cells → Ganglion cells → Bipolar cells

c) Bipolar cells → Photoreceptor cells → Ganglion cells

d) Ganglion cells → Photoreceptor cells → Bipolar cells

175. IV ventricle is found in which part of the brain? **[4]**

a) Cerebrum

b) Diencephalon

c) Olfactory lobes

d) Medulla

176. Synaptic knob is bulb-like structure which is present **[4]**

a) in the cell body.

b) at the end of axon terminal.

c) at the end of dendrites.

d) at the node of Ranvier.

177. Gigantism and dwarfism are the disease related to **[4]**

a) luteinizing hormone of pituitary gland

b) growth hormone of adenohypophysis.

c) thyroid stimulating hormone of thyroid.

d) prolactin hormone of mammary gland.

178. Graves' disease is caused due to: **[4]**

a) Hyposecretion of the adrenal gland

b) Hypersecretion of the adrenal gland

c) Hyposecretion of the thyroid gland

d) Hypersecretion of the thyroid gland

179. The T wave represents the _____ in ECG. **[4]**

a) Repolarisation of ventricles

b) Depolarisation of ventricles

c) Contraction of both the ventricles

d) Repolarisation of atria

180. Match the items given in column - I with those in column - II and select the correct option given below : **[4]**

Column - I	Column - II
(I) Tricuspid valve	(i) Between left atrium and left ventricle
(II) Bicuspid valve	(ii) Between right ventricle and pulmonary artery'
(III) Semilunar valve	(iii) Between right atrium and right ventricle

Codes:

a) (I)-(i), (II)-(iii), (III)-(ii)

b) (I)-(ii), (II)-(i), (III)-(iii)

c) (I)-(iii), (II)-(i), (III)-(ii)

d) (I)-(i), (II)-(ii), (III)-(iii)

181. In a person, both ventricles of heart totally pump 200 ml blood during one cardiac cycle. The heart rate is 77/minute. Can you calculate cardiac output of this person? **[4]**

a) 5000 ml/minute

b) 154000 ml/minute

c) 7700 ml/minute

d) 5040 ml/minute

182. Plasmid has been used as a vector because: **[4]**

a) It is circular DNA which have capacity to join to eukaryotic DNA

b) Its both ends show replication

c) It can move between prokaryotic and eukaryotic cells

d) It has antibiotic resistance gene

183. Which of the following is not required in the preparation of a recombinant DNA molecules? **[4]**

a) DNA fragments

b) Restriction endonuclease

c) E.coli

d) DNA ligase

184. With regard to insulin choose correct options. **[4]**

a. C-peptide is not present in mature insulin.

b. The insulin produced by rDNA technology has cpeptide.

c. The pro-insulin has C-peptide.

d. A-peptide and B-peptide of insulin are interconnected by disulphide bridges.

a) (a), (d) only

b) (b), (c) only

c) (b), (d) only

d) (a), (c), (d) only

185. First artificially synthesized hormone is: **[4]**

a) Renin

b) Glucagon

c) Secretin

d) Insulin

ZOOLOGY (Section-B)

Attempt any 10 questions

186. Which of the following is a true fish? **[4]**

a) Flying fish

b) All of these

c) Cuttle fish

d) Cray fish

187. Ciliated epithelium are commonly found in: **[4]**

a) Bronchioles and fallopian tubes.

b) Lining of stomach and intestine.

c) Walls of blood vessels and air sacs of lungs.

d) Ducts of glands and tubular parts of nephrons in kidneys.

188. Cardiac output is : **[4]**

a) The product of auricular and ventricular volume

b) The product of heart rate and stroke volume

c) The blood pumped in one minute

d) Both The product of heart rate and stroke volume and The blood pumped in one minute

189. At the time of inspiration, the diaphragm: **[4]**

a) Contracts

b) Relaxes

c) Does not undergo any change

d) Expands

190. Soon after implantation, the inner cell mass differentiates into outer A _____, middle D _____, and an inner C _____. **[4]**

a) A - mesoderm, B - ectoderm, C - endoderm

b) A - endoderm, B - mesoderm, C - ectoderm

c) A - mesoderm, B - endoderm, C - ectoderm

d) A - ectoderm, B - mesoderm, C - endoderm

191. Match the contraceptive methods given in column I with their modes of action given in column II in achieving contraception and select their correct matching from the four options that follow. **[4]**

Column I (Contraceptive methods)	Column II (Modes of action)
(A) Condom	(i) suppresses fertilising capacity of sperms.
(B) Pills	(ii) occurrence of semen without sperms.
(C) Copper T	(iii) prevents ovulation.
(D) Vasectomy	(iv) prevents sperms reaching cervix.

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

192. Who gave the principle that the population tends to multiply more rapidly than food supply? **[4]**

a) Haldane
b) Lamarck
c) Malthus
d) Darwin

193. Urea is directly produced in mammals from: **[4]**

a) Breakdown of ornithine
b) Ammonia released by oxidative deamination
c) Breakdown of arginine
d) Oxidative deamination of purines

194. The pectoral and pelvic girdles and the bones of limb form: **[4]**

a) Axial skeleton
b) Visceral skeleton
c) Appendicular skeleton
d) Outer skeleton

195. Twilight vision is also called **[4]**

a) scotopic vision and is the function of rods.
b) photopic vision and is the function of rods.
c) scotopic vision and is the function of cones.
d) photopic vision and is the function of cones.

196. Gonadotropin hormones are produced from: **[4]**

a) adrenal gland
b) neurohypophysis of pituitary

c) adenohypophysis of pituitary

d) posterior part of thyroid

197. Progesterone is a: **[4]**

a) protein

b) steroid

c) Vitamin

d) carbohydrate

198. Which organ of the body acts as a biological filter of blood? **[4]**

a) Heart

b) Liver

c) Spleen

d) Bone marrow

199. In insertional inactivation, the recombinant DNA is inserted within the coding sequence of **[4]**

a) restriction enzyme.

b) β-galactosidase.

c) ampicillin resistant gene.

d) tetracycline resistant gene.

200. Some of the steps involved in the production of Humulin are given below. Arrange them in the correct sequence and select the correct option. **[4]**

i. Synthesis of gene (DNA) for human insulin artificially

ii. Culturing recombinant E. coli in bioreactors

iii. Purification of Humulin

iv. Insertion of human insulin gene into plasmid

v. Introduction of recombinant plasmid into E.coli

vi. Extraction of recombinant gene product from E.coli

a) (ii), (i), (iv), (iii), (v), (vi)

b) (iii), (v), (ii), (i), (vi), (iv)

c) (i), (iv), (v), (ii), (vi), (iii)

d) (i), (iii), (v), (vi), (ii), (iv)

Solution

SAMPLE PAPER - 8

PHYSICS (Section-A)

1.

(d) 0.1 N

Explanation: Dimensional formula for force F = $[MLT^{-2}]$

F = $(10^{-2}$ kg) (10^{-1}) $(10^{-1})^{-2}$

F = 10^{-1} N

2.

(b) 10^5 N/m^2

Explanation: 10^6 dynes/ $cm^2 = \frac{10^6 \times 10^{-5} N}{10^{-4} m^2} = 10^5$ N/m^2

3.

(c) $t = \sqrt{t_1 t_2}$

Explanation: Suppose the body be projected vertically upwards from A with a speed x.

Using equation s = ut + $(\frac{1}{2})at^2$

h = $-xt_1 + (\frac{1}{2})gt_1^2$ ...(i)

For the second case: h = $xt_2 + (\frac{1}{2})gt_2^2$ ...(ii)

Subtracting eqn. (i) from eqn. (ii),

$0 = x\left(t_2 + t_1\right) + (\frac{1}{2})g\left(t_2^2 - t_1^2\right)$

or x = $(\frac{1}{2})$g$(t_1 - t_2)$ ...(iii)

Substituting for x in eqn. (ii),

$h = (\frac{1}{2})g\left(t_1 - t_2\right)t_2 + (\frac{1}{2})gt_2^2 = (\frac{1}{2})gt_1t_2$ ...(iv)

If the body falls freely for t seconds, u = 0

$\therefore$ h = 0 $\times$ t + $(\frac{1}{2})gt^2$

or h = $(\frac{1}{2})gt^2$

Combining eqn. (iv) and eqn. (v), we get;

$\frac{1}{2}gt^2 = \frac{1}{2}gt_1t_2$ or $t = \sqrt{t_1t_2}$.

4. **(a)** -118.5

Explanation: Using

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

$5^2 = 3^2 + 5^2 + 2 \times 3 \times 5\cos\theta$ or $\cos\theta = -0.3$

$$\left(2\vec{A}_1 + 3\vec{A_2}\right) \cdot \left(3\vec{A}_1 - 2\vec{A}_2\right) = 2A_1 \times 3A_1$$

$$+\left(3A_2\right)\left(3A_1\right)\cos\theta - \left(2A_1\right)\left(2A_2\right)\cos\theta - 3A_2 \times 2A_2$$

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

$$= 6A_1{}^2 - 6A_2{}^2 + 5A_1A_2\cos\theta$$

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

5.

(d) 5.36 cm

Explanation: H = 50 cm

Maximum height $\propto \frac{1}{g}$

As, retardation a is 12% of g and both g and a are acting downward,

$\Rightarrow g' = g + \frac{12}{100}g = g + 0.12\ g$

$g' = 1.12\ g$

$\therefore \frac{h'}{h} = \frac{g}{1.12\ g}$

$\therefore h' = \frac{50}{1.12}$

$h' = 44.64$

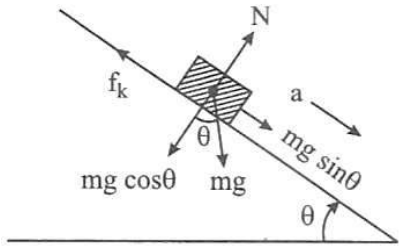
$\therefore$ h - h' = 50 - 44.64 = 5.36 cm

6. **(a)** 0.6 and 0.5

Explanation:

Let μ_s and μ_k be the coefficients of static and kinetic friction between the box and the plank respectively. When the angle of inclination θ reaches 30^o, the block just slides,

$\mu_s = \tan\theta = \tan 30^o = \frac{1}{\sqrt{3}} = 0.6$



If a is the acceleration produced in the block, then ma = mg sinθ - f_k (where f_k is force of kinetic friction)

If a is the acceleration produced in the block, then

ma = mg sinθ - f_k

ma = mg sinθ - μ_kN

ma = mg sinθ - μ_k mg cosθ

a = g(sinθ - μ_k cosθ)

g = 10 ms^{-2}, $\theta = 30^o$

a = 10(sin 30^o - μ_k cos 30^o)

If 4m is the distance travelled by the block in time 4s then

$$a = \frac{2s}{t^2}$$

$$a = \frac{2 \times 0.4}{4^2} = 0.5 \text{ ms}^{-1}$$

Using this value,

$\mu_k = 0.5$

7.

(d) 1 : 1

Explanation: 1 : 1

8.

(c) 4.5 J

Explanation: From Newton's second law, $\frac{\Delta p}{\Delta t}$ = F

$\Rightarrow \Delta p = F\Delta t$

$\therefore$ p = $\int$ dp = $\int_0^1$ F dt

$\Rightarrow$ p = $\int_0^1$6t dt = 3kg $\left(\frac{m}{s}\right)$

Also, $\Delta k = \frac{\Delta p^2}{2m} = \frac{3^2}{2 \times 1} = 4.5$

So, work done = Δk = 4.5 J

9.

(b) decreased

Explanation: According to the theorem of perpendicular axes

$I_z = I_x + I_y$

with the hole, I_x and I_y both decrease. Gluing the removed piece at the centre of square plate does not affect I_z. Hence, I_z decrease overall.

10.

(d) S

Explanation: If $m_1 > m_2$, then centre of mass of a system of two particles lies closer to the heavier particle.

Here, mass at S > mass at P

∴ point S is correct.

11.

(d) Two times of escape velocity on the earth

Explanation: Two times of escape velocity on the earth

12. **(a)** Brittle and ductile

Explanation: Ductile materials have a fracture strength lower than the ultimate Tensile strength (i.e., the points are far apart.) whereas, in brittle materials, the fracture strength is equivalent to ultimate tensile strength (i.e., the points are close.)

∴ Material X is brittle and Y is ductile in nature.

13.

(b) $\frac{K_1A_1 + K_2A_2}{A_1 + A_2}$

Explanation: $\frac{dQ}{dt} = \frac{dQ_1}{dt} + \frac{dQ_2}{dt}$

$$\frac{K(A_1 + A_2)(\theta_1 - \theta_2)}{d} = \frac{K_1A_1(\theta_1 - \theta_2)}{d} + \frac{K_2A_2(\theta_1 - \theta_2)}{d}$$

$$\therefore K = \frac{K_1A_1 + K_2A_2}{A_1 + A_2}$$

14.

(d) 0°C

Explanation: Let resulting temperature = 0°C

∴ Q_1 = heat given by water if it was to cool upto 0°C

= 10 × 1 × (50 - 0) = 500 cal

and Q_2 = heat required by ice to convert totally into water at 0°C.

= heat required to raise the temperature of ice from -20°C to 0°C + heat required to melt 10 gm of ice at 0°C into water at 0°C.

= 10 × 0.5 × 20 + 10 × 80

= 100 + 800 = 900 cal

As $Q_1 < Q_2$, hence whole of the ice cannot melt. Initially, 100 cal of heat will be used up in raising the temperature of ice to 0°C and the rest 400 cal will be available for melting of

ice. If it melts m' gm of ice, then
m' × 80 = 400, i.e., m' = 5 gm
Hence, only 5 gm of ice will melt and the remaining 5 gm of ice will remain in the mixture as ice at 0°C. The amount of water in the mixture
= 10 gm + 5 gm = 15 gm
Final temperature of mixture = 0°C

15.

(c) 3 P

Explanation: Given pressure under isothermal condition, $Pv^3 = a$
Differentiating w.r.t to pressure

$$V^3 + P3V^2\frac{dv}{dP} = 0$$

$$\Rightarrow V = -3\frac{PdV}{dP} = 0 \Rightarrow V = -3\frac{PdV}{dP}$$

$$\frac{dP \cdot V}{dV} = -3P \left[\because \text{ Bulk modulus } B = -\frac{dP}{dV/V}\right]$$

$$\therefore B = -\left(\frac{dPV}{dV}\right) = -(-3P) = 3P$$

16.

(c) He (molecular mass 4)
Explanation: He (molecular mass 4)

17.

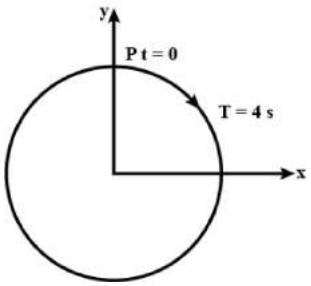
(c) $y(t) = 3\cos\left(\frac{\pi t}{2}\right)$, where y in m

Explanation: At t = 0, y displacement is maximum, so the equation will be a cosine function.
T = 4s

$$\Rightarrow \omega = \frac{2\pi}{T} = \frac{2\pi}{4} = \frac{\pi}{2} \text{ rad/s}$$

So,
$y = a\cos \omega t$

$$y = 3\cos\left(\frac{\pi t}{2}\right)$$



18. **(a)** 120 cm

Explanation: Given $L_C = 20cm$

Fundamental frequency of COP

$$v_{cop} = \frac{v}{4L_C} = \frac{v}{4 \times 20}$$

Frequency of 2nd overtone OOP.

$(V_{OOP})_{2nd\ overtone} = 3(V_{OOP})$

$$= \frac{3v}{2L_0}$$

Given that,

$$\frac{v}{4 \times 20} = 3\left(\frac{v}{2L_0}\right)$$

$\therefore\ L_0 = 120$ cm

19. **(a)** 0.5 km/sec

Explanation: $f' = \left(\frac{c + c_a}{c - v_a}\right)f$

where c is the velocity of the radio wave, an elecromagnetic wave, i.e,.c = 3 × $10^8 \frac{m}{s}$ and v_S is velocity of aeroplane.

$$f' - f = \left[\frac{c + v_a}{c - v_a} - 1\right]f$$

$$\Rightarrow \Delta f = \frac{2v_0 f}{c - v_a}$$

since approaching aeroplane cannot have a speed comparable to the speed of electromagnetic so $v_S << c$

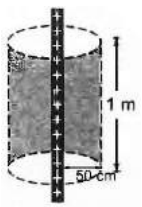
$$\triangle f = \frac{2v_a f}{c}$$

$$\Rightarrow 2.6 \times 10^3 = \frac{2V_A\left(780 \times 10^6\right)}{3 \times 10^8}$$

$$\Rightarrow V_A = 0.5 \times 10^3 \frac{m}{s}$$

$= 0.5$ km/sec

20. **(a)** $\frac{100Q}{\varepsilon_0}$

Explanation: 

Charge per metre of the wire = 100 QC

According to Gauss law, the total electric flux passing through the cylindrical surface is,

$$\phi = \frac{q_{\text{enclosed}}}{\varepsilon_0} = \frac{100Q}{\varepsilon_0}$$

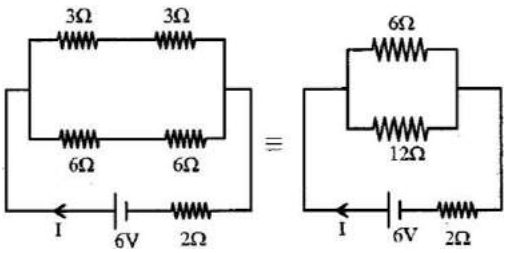
21.

(c) 200 V

Explanation: 200 V

22. **(a)** 1A

Explanation: Balanced wheat stone bridge in circuit so there is no current in 5 Ω resistor so it can be removed from the circuit.



The equivalent resistance will be

$$R_{eq} = \frac{6 \times 12}{6+12} + 2 = 6\Omega$$

Now, apply K.V.L, we have

$$I = \frac{V}{R_{eq}} = \frac{6}{6} = 1 \text{ A}$$

23.

(b) 0.44 m

Explanation: Time period of one revolution of proton, $T = \frac{2\pi m}{qB}$

Here, m = mass of proton
q = charge of proton
B = magnetic field
Linear distance travelled in one revolution,
p = T(v cos θ) (Here, v = velocity of proton)
$\therefore$ Length of region, l = 10 $\times$ (v cos θ)T

$\Rightarrow l = 10 \times v\cos 60^\circ \times \frac{2\pi m}{qB}$

$\Rightarrow l = \frac{20\pi mv}{qB} = \frac{20 \times 3.14 \times 1.67 \times 10^{-27} \times 4 \times 10^5}{1.6 \times 10^{-19} \times 0.3}$

$\Rightarrow$ l = 0.44 m

24.

(d) 3 : 1

Explanation: We know that deflection in Galvanometer (θ) and Current (I) are related as tan θ = kNI
where k = constant
N = No of turns
I = Current
Here, $\theta_1 = 60^0$ And, $\theta_2 = 30^0$

$\Rightarrow \frac{\tan 60^0}{\tan 30^0} = \frac{kN_1I}{kN_2I}$

$\Rightarrow \frac{\frac{\sqrt{3}}{1}}{\frac{1}{\sqrt{3}}} = \frac{N_1}{N_2}$

$\Rightarrow \frac{N_1}{N_2} = \frac{3}{1}$

25. **(a)** 48.2^o

Explanation: $i = \frac{2rB_H}{\mu_o n}\tan\theta$

$\tan\theta = \frac{\mu_o ni}{2rB} = \frac{4\pi \times 10^{-7} \times 50 \times 0.1}{2 \times 0.04 \times 7 \times 10^{-5}} = 1.121$

$\theta = 48.2^o$

26.

(d) the magnet starts to oscillate about centre of the ring

Explanation: As the magnet goes near the ring, the flux through the ring increases. According to Lenz law, induced current runs in the ring such that the induced flux acts opposite to the increasing flux and thus opposes the motion of the magnet.
With times, the induced current would be large enough to stop the movement of magnet.

27. **(d)** -10 volt

Explanation: $\phi = 10\ t^2 - 50\ t + 250$

Induced emf $= -\frac{d\phi}{dt} = -\frac{d}{dt}(10\ t^2 - 50\ t + 250)$

$= -(20\ t - 50)$

The induced emf at t = 3 sec

$e = -(20 \times 3 - 50) = -(60 - 50)$

$= -10$ volt

28. **(a)** leads voltage by 90°

Explanation: In an a.c. a circuit containing a capacitor C only, the current leads the voltage by a phase difference of 90^o.

29. **(c)** velocity

Explanation: The dimensions of $\frac{E}{B}$ are same as that of velocity.

30. **(a)** $D_1 < D_2$

Explanation: Angle of minimum deviation,

$D = (\mu - 1)A$

Since, $\mu_{blue} > \mu_{red}$

$\therefore\ D_2 > D_1$ or $D_1 < D_2$

31. **(d)** 25 : 1

Explanation: 25 : 1

32. **(d)** 11 $\overset{o}{A}$

Explanation: $\lambda = \frac{h}{mv} = \frac{6.6 \times 10^{-34}}{9 \times 10^{-31} \times 6.6 \times 10^5}$

$= 11 \times 10^{-10}$ m $= 11\ \overset{o}{A}$

33. **(d)** yellow light is scattered less by the fog particles

Explanation: Sodium light emits monochromatic light, i.e., it is comprised of only one wavelength (deep yellow). This color is scattered less in the foggy condition while other light sources produce light at many different discrete wavelengths and all provide some

degree of color rendering. Also, sodium lamps emit light very near to the peak sensitivity of the human eye under normal viewing conditions.

34.

(c) $304\ \overset{o}{A}$

Explanation: $\lambda = \dfrac{912\overset{o}{A}}{Z^2\left[\dfrac{1}{n_1^2} - \dfrac{1}{n_2^2}\right]}$

For singly ionised helium atom Z = 2. For the wavelength absorbed to be longest, $n_1 = 1$, $n_2 = 2$

$$\therefore \lambda = \frac{912\overset{o}{A}}{(2)^2\left[1 - \frac{1}{4}\right]} = \frac{912}{3}\overset{o}{A} = 304\ \overset{o}{A}$$

35.

(c) 1.33×10^6

Explanation: ${}^{7}_{3}\text{Li} + {}^{1}_{1}\text{H} \longrightarrow 2\left({}^{4}_{2}\text{He}\right)$

$\Delta m \rightarrow [m_{Li} + m_H] - 2[M_{He}]$

Energy released = Δmc^2

In use of 1 g Li energy released = $\dfrac{\Delta mc^2}{m_{Li}}$

In use of 20g energy released = $\dfrac{\Delta mc^2}{m_{Li}} \times 20$ g

$$= \frac{[(7.016 + 1.0079) - 2 \times 4.0026]u \times c^2}{7.016 \times 1.6 \times 10^{-24}} \times 20 \text{ g}$$

$$= \left(\frac{0.0187 \times 1.6 \times 10^{-19} \times 10^9}{7.016 \times 1.6 \times 10^{-24}} \times 20\right) = 480 \times 10^{10} \text{ J}$$

$\because$ 1 J = 2.778×10^{-7} kWh

$\therefore$ Energy released = $480 \times 10^{10} \times 2.778 \times 10^{-7}$

= 1.33×10^6 kWh

36. **(a)** 19.6 m/s

Explanation: Loss in potential energy = Gain in kinetic energy,

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

$v = \sqrt{2gh}$

$= \sqrt{2 \times 9.8 \times 19.6}$

$= 19.6$ m/s

37. **(a)** $\frac{ml^2\omega}{3t}$

Explanation: $I = \frac{m(2L)^2}{12} = \frac{mL^2}{3}$

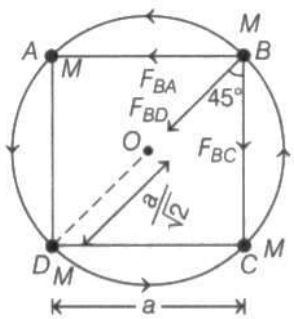
$\tau\Delta t = \Delta L = I\Delta\omega$

$\tau t = \frac{mL^2}{3}(\omega - 0) \Rightarrow \tau = \frac{mL^2\omega}{3t}$

38. **(a)** $1.16\sqrt{\frac{GM}{a}}$

Explanation:

In given configuration of masses, net gravitational force provides the necessary centripetal force for rotation.



Net force on mass M at position B towards centre of circle is

$F_{BO\ net} = F_{BD} + F_{BA} \sin 45^o + F_{BC} \cos 45^o$

$= \frac{GM^2}{(\sqrt{2}a)^2} + \frac{GM^2}{a^2}\left(\frac{1}{\sqrt{2}}\right) + \frac{GM^2}{a^2}\left(\frac{1}{\sqrt{2}}\right)$[where, diagonal length BD is $\sqrt{2}$a]

$= \frac{GM^2}{2a^2} + \frac{GM^2}{a^2}\left(\frac{2}{\sqrt{2}}\right) = \frac{GM^2}{a^2}\left(\frac{1}{2} + \sqrt{2}\right)$

This force will act as centripetal force. Distance of particle from centre of circle is $\frac{a}{\sqrt{2}}$

Here, $F_{centripetal} = \frac{Mv^2}{r} = \frac{Mv^2}{a} = \frac{\sqrt{2}Mv^2}{a}$ ($\because$ $r = \frac{a}{\sqrt{2}}$)

So, for rotation about the centre, $F_{centripetal} = F_{BO\ (net)}$

$$\Rightarrow \quad \sqrt{2}\frac{Mv^2}{a} = \frac{GM^2}{a^2}\left(\frac{1}{2} + \sqrt{2}\right)$$

$$\Rightarrow v^2 = \frac{GM}{a}\left(1 + \frac{1}{2\sqrt{2}}\right) = \frac{GM}{a}\ (1.35)$$

$$\Rightarrow \quad v = 1.16\sqrt{\frac{GM}{a}}$$

39.

(c) 320 kJ

Explanation: 320 kJ

40. **(a)** $l_A = 4l_B$, regardless of masses

Explanation: $l_A = 4l_B$, regardless of masses

41.

(b) Only D

Explanation:

i. Speed of the wave $\propto$ restoring force

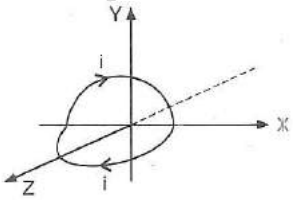
ii. Speed of the wave, $\propto \frac{1}{\text{mass density}}$

42.

(c) $\frac{\mu_0 i}{2\sqrt{2}R}$

Explanation:

The loop mentioned in the question must look like one as shown in the figure.



Magnetic field at the centre due to semicircular loop lying in X-Y plane, $B_{xy} = \frac{1}{2}\left(\frac{\mu_0 i}{2R}\right)$

negative Z-direction.

Similarly, field due to loop in X-Z plane, $B_{xz} = \frac{1}{2}\left(\frac{\mu_0 i}{2R}\right)$ in negative Y-direction.

$\therefore$ Magnitude of resultant magnetic field,

$$B = \sqrt{B_{xy}^2 + B_{xz}^2} = \sqrt{\left(\frac{\mu_0 i}{4R}\right)^2 + \left(\frac{\mu_0 i}{4R}\right)^2}$$

$$= \frac{\mu_0 i}{4R}\sqrt{2} = \frac{\mu_0 i}{2\sqrt{2}R}$$

43.

(c) 1500A turns/m, 0.42 T, 7.5×10^6 Am^{-1}

Explanation: H = nl = 3 00 × 5 = 1500A turn/m

$B = \mu H = 5000\mu_0 H$

$= 5000 \times 4\pi \times 10^{-7} \times 1500$ =0.42 Tesla

$B = \mu_0(H + M)$ or $\mu H = \mu_0(H + M)$

$5000\mu_0 H = \mu_0(H + M)$

or 5000 H = H + M

or M = 4999 × H

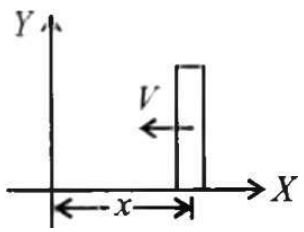
or = 4999 × 1500

44.

(d) 5000

Explanation:

Force on the strip when it is at stretched position x from mean position is



$$F = -kx - iIB = -kx - \frac{BIv}{R} \times IB$$

$$F = -kx - \frac{B^2 I^2}{R} \times v$$

Above expression shows that it is case of damped oscillation, so its amplitude can be given by

$$\Rightarrow A = A_0 e^{\frac{bt}{2m}}$$

$$\Rightarrow \frac{A_0}{e} = A_0 e^{\frac{bt}{2m}} \text{ [as per question A} = \frac{A_0}{e}]$$

$$\Rightarrow t = \frac{2m}{\left(\frac{B^2 I^2}{R}\right)} = \frac{2 \times 50 \times 10^{-3} \times 10}{0.01 \times 0.01}$$

Given, m = 50 × 10^{-3} kg
B = 0.1 T
l = 0.1 m
R = 10 Ω
k = 0.5 N

Time period, $T = 2\pi\sqrt{\frac{m}{k}} \simeq 2$ s

so, required number of oscillations,

$$N = \frac{10000}{2} = 5000$$

45. **(a)** $\frac{5}{2}$

Explanation: Element X should be resistance with R

$$= \frac{E}{I} = \frac{100}{5} = 20\ \Omega$$

Element Y should be inductive with $X_L = 20\ \Omega$

When X and Y are connected in series

$$I_0 = \frac{E_0}{Z} = \frac{E_0}{\sqrt{X_L^2 + R^2}} = \frac{100}{20\sqrt{2}} = \frac{5}{\sqrt{2}} A$$

The rms value of the current will be,

$$I_{rms} = \frac{I_0}{\sqrt{2}} = \frac{5}{2} A$$

46.

(d) 2

Explanation: $\mu_A < \mu_r < \mu r$ As incidence ray passes from air to turpentine to water it means, from rare to denser then denser to rarer so first, it bends towards normal then away from normal so the path shown is correct for ray (2).

47.

(c) $\frac{2h}{\sqrt{\left(\mu^2-1\right)}}$

Explanation: $\frac{2h}{\sqrt{\left(\mu^2-1\right)}}$

48.

(d) increase the maximum kinetic energy of the photoelectrons and would increase the photoelectric current by a factor of two

Explanation: $\left(\frac{1}{2}mv^2\right)_{\text{max}} = hv - W$.

When v is doubled (W remains same), $\left(\frac{1}{2}mv^2\right)_{\text{max}}$, i.e., $(KE)_{max.}$ is increased. The photoelectric current is directly proportional to the intensity of incident light.

49.

(c) emission spectrum is observed

Explanation: When an atomic gas or vapor is excited under low pressure by passing an electric current through it, the spectrum of the emitted radiation has specific wavelengths. It is important to note that, such a spectrum consists of bright lines on a dark background. This is an emission line spectrum.

50.

(b) 0.461 per minute

Explanation: $\frac{dN}{dt} = KN$

$9750 = KN_0$ ...(i)

$975 = KN$ ...(ii)

Dividing (i) by (ii)

$\frac{N}{N_0} = \frac{1}{10}$

$= \frac{2.303}{t}\log\frac{N_0}{N} = \frac{2.303}{5}\log 10$

$= 0.4606 = 0.461$ per minute

CHEMISTRY (Section-A)

51.

(b) 400 mL

Explanation: Applying law of equivalence

Equivalent of acid = Equivalent of base

Equivalent of acid = Normality $\times$ volume $= 0.1 \times V$

Another formula of equivalence = n factor × number of mole

∴ Equivalent of base = n factor of OH^- × moles of OH^- = 1 × 0.04

⇒ 0.1 × V = 1 × 0.04

V = 0.4 L = 0.4 × 1000 = 400 mL

52.

(c) 2.0 × $10^3 \overset{o}{A}$

Explanation: c = vλ

$$\therefore \lambda = \frac{c}{\lambda}$$

$$\therefore \lambda = \frac{3.0 \times 10^8 ms^{-}1}{1.5 \times 10^1 5s^{-}1}$$

$\lambda = 2.0 \times 10^{-7}$m = 2.0 × $10^3 \overset{o}{A}$

53.

(c) $SiBr_4$

Explanation: Br is more EN than Si and Br needs one electron to complete its octet while Si needs 4 hence the formula of compound will be $SiBr_4$.

54.

(b) ionic

Explanation: ΔE.N = 3.0 - 1.2 = 1.8 > 1.7 ⇒ Ionic bond

55.

(c) C_2

Explanation: C_2 has both bonds π

Species	B.L. (pm)
B_2	160
C_2	125
F_2	142
O_2	120
O_2^-	> 125

56.

(c) IBr_2^-, XeF_2

Explanation: IBr_2^{-1} and XeF_2 are iso-structural and both C.A. consist of same no. of valence e^-s.

57.

(c) 0

Explanation: 0

58. **(a)** HSO_4^-

Explanation: H_2SO_4 (acid) $\xrightarrow{-H^+}$ HSO_4^- (conjugate base)

59.

(b) reduction

Explanation: Sulphur dioxide and chlorine are used as bleaching agents. However Bleaching action of chlorine is based on oxidation while that of sulphur is based on reduction. Sulphour dioxide is used as bleaching agent as it removes oxygen from the coloured substances and makes it colorless (Bleaching action). But atmospheric oxygen slowly occupies removed oxygen and the material regains the color.

60.

(d) 0.33 mol

Explanation: Mass of SO_2 formed $= \frac{64 \times 8}{32} = 16$ g

Now $S^{4+} \longrightarrow S^{6+} + 2e$

mole of SO_4^{2-} formed $= \frac{16}{96} = \frac{1}{6}$

$\therefore$ mole of $BaSO_4 = \frac{1}{6} = 0.33$

61. **(a)** A, B, C and D

Explanation: All of these

62.

(d) Y < Z < X < W

Explanation:

i. $B_2H_6 + 3O_2 \rightarrow \underset{(Y)}{B_2H_6} + 2NaI + H_2$

ii. $B_2H_6 + 6H_2O \rightarrow \underset{(Y)}{2H_3BO_3} + 6H_2$

iii. $B_2H_6 + \xrightarrow{\Delta} \underset{(Z)}{B_5H_9}$

iv. $2B_2H_6 + 6NH_3 \xrightarrow{473K} \underset{(W)}{2B_3N_3H_6} + 12H_2$

$B_2O_3 = 69.6g/mol$ $H_3BO_3 = 62\ g/mol$
(X) (Y)

$B_5H_9 = 63.1g/mol$ $B_3N_3H_6 = 80.5g/mol$
(Z) (W)

63.

(c) P > R > S > Q

Explanation: P > R > S > Q

64.

(d) 6-chloro-4-ethyl-5-methylhept-5-en-1-yne

Explanation: 6-chloro-4-ethyl-5-methylhept-5-en-1-yne

65.

(b) electrovalency in CaH_2 and covalency in C_2H_2

Explanation: electrovalency in CaH_2 and covalency in C_2H_2

66.

(b) 2°C

Explanation: $\Delta T \propto w$, if other factors are constant.

Thus $\frac{\Delta T}{1} = \frac{30}{15}$

$\therefore \Delta T = 2$

67.

(c) $\frac{1}{76}$

Explanation: $\frac{1}{76}$

68.

(d) 40

Explanation: $HCl + NaOH \rightarrow NaCl + H_2O$

millimole	100 × 0.2	100 × 0.2	0	0
before mixing	=20	=20	0	0
millimole left	0	0	20	20

$[NaCl] = \frac{20}{200} = 0.1\ M$

$\Lambda_{NaCl} = \kappa_{NaCl} \times \frac{1000}{C_{NaCl}} = \frac{4 \times 10^{-3} \times 1000}{0.1}$

$= 40\ S\ cm^2\ mol^{-1}$

69.

(d) $\frac{a}{K}$

Explanation: For zero order reaction, $K = \frac{x}{t}$

If x = a (complete reactant to react); $t = \frac{a}{K}$

70. **(a)** zero order
Explanation: For elementary reaction:
Rate = k[A][B]
Rate = k [A][B]^0 (when B is in excess)
Hence, the reaction is First order with respect to [A] and zero-order with respect to [B].

71.
(d) Because of the ability of oxygen to form multiple bonds to metals.
Explanation: Because of the ability of oxygen to form multiple bonds to metals.

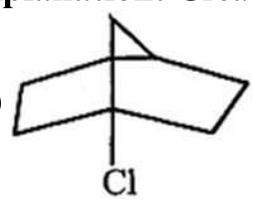
72.
(d) All of these
Explanation: All of these

73.
(c) Only (iv)
Explanation: none of these

74. **(a)** $K_3[Fe(CN)_6]$
Explanation: $K_3[Fe(CN)_6]$

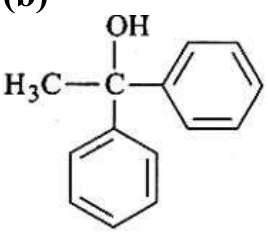
75.
(d) Greater than X
Explanation: Greater than X

76. **(a)**

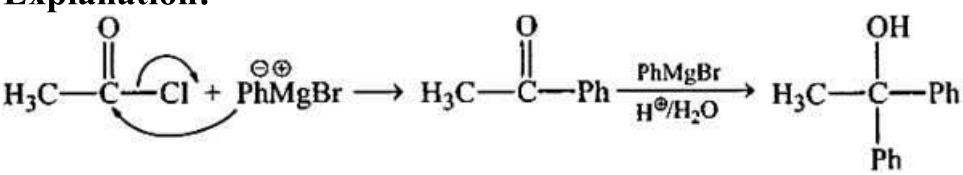


Explanation: In S_N1 reaction carbocation is formed.
The carbocation formed at Bridge head in norbomene ring is very unstable due to restricted bond angle.
So it is inactive towards S_N1.

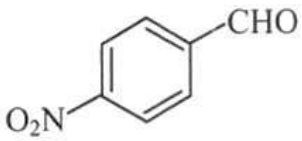
77.
(b)



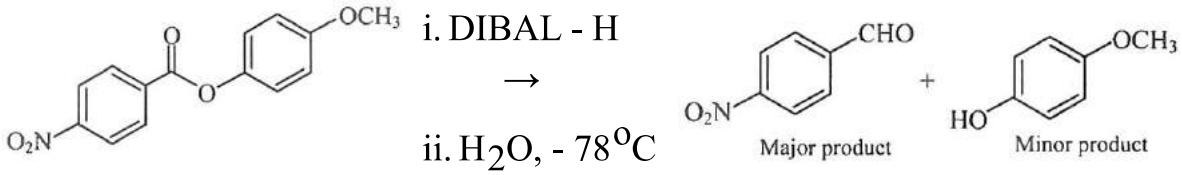
Explanation:



78.
(d)



Explanation:
DIBAL-H reduces esters to the corresponding aldehydes.



79.

(d)

Explanation:

80. **(a)** Vitamin D
Explanation: Osteomalacia (soft bones and joint pain in adults) is caused due to deficiency of vitamin D.

81.
(b) 130
Explanation: 130 molecules of ATP produced in the lipid metabolism of a molecule of palmitic acid.

82.
(b) o-toluic acid
Explanation: o-toluic acid

83.
(d) 338.98
Explanation: 338.98

84.
(c) Solvent extraction
Explanation: Solvent extraction

85.
(b) Chloride
Explanation: When a mixture containing chloride ion is heated with $K_2Cr_2O_7$ and concentrated H_2SO_4, deep orange-red fumes of chromyl choloride (CrO_2Cl_2) are formed.

$K_2Cr_2O_7 + 4NaCI + 6H_2SO_4 \rightarrow 2KHSO_4 + 4NaHSO_4 + \text{Orange-redfumes} 2CrO_2Cl_2$

$\uparrow + 3H_2O$

When chromyl chloride vapours are passed into sodium hydroxide solution, a yellow solution of sodium chromate is formed, which when treated with lead acetate gives yellow precipitate of lead chromate.

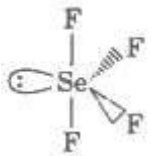
$CrO_2Cl_2 \uparrow + 2NaOH \rightarrow \underset{\text{Yellow solution}}{Na_2CrO_4} + 2HCl$

CHEMISTRY (Section-B)

86.

(b) SeF_4

Explanation:



87.

(b) 2.5

Explanation: Mole of O_2 formed $= \frac{3}{24} = \frac{1}{8}$

$\therefore$ Mole of $H_2O_2 = \frac{1}{8} \times 2 = \frac{1}{4}$

$\therefore$ $100 \times X = \frac{1}{4} \times 1000$ (m mole = m $\times$ V)

$\therefore$ $X = 2.5$

88. **(a)** Cl^-

Explanation: Outer electronic configuration of Cl = $3s^2 3p_x^2 p_y^2 p_z^1$, :Cl·

Outer electronic configuration of Cl^- = $3s^2 3p_x^2 p_y^2 p_z^2$, :Cl: i.e., 4 lone pairs of electrons.

89.

(c) Only A

Explanation: Due to greater repulsions in between non bonding electron pair (2p) of two fluorines (due to the small size of F-atom) in comparison to non-bonding electron pair (3p) in chlorine, the bond energy of F_2 is less than Cl_2.

BE (F_2) = 158.8 kJ/mole and BE(Cl_2) = 242.6 kJ/mole

90.

(d) 7.28×10^{-24}

Explanation: $\lambda = \frac{h}{\sqrt{2KE \cdot m}}$

$\therefore \lambda^2 = \frac{h^2}{2KE \cdot m}$

$$\therefore \text{ K.E.} = \frac{h^2}{2 \times m \times \lambda^2}$$

$$= \frac{\left(6.625 \times 10^{-34}\right)^2}{2 \times 9.1 \times 10^{-31} \times \left(1.82 \times 10^{-7}\right)^2}$$

$$= \frac{43.89 \times 10^{-68}}{60.287 \times 10^{-45}}$$

$= 7.28 \times 10^{-24}$ J

91. **(d)** Only (iii)

Explanation: $LiAlH_4$ can reduce— NO_2 group to —NH_2 group.

92. **(c)** $t\frac{1}{3}$

Explanation: $t\frac{1}{3}$

93. **(c)** Z > X > Y

Explanation: $E^\circ_X = -1.2$ V, $E^\circ_Y = 0.5$ V, $E^\circ_Z = -3.0$ V

$\therefore$ Z > X > Y (As higher the reduction potential, lesser the reducing power)

94. **(d)** 1×10^5 cm^3 mol^{-1}

Explanation: $\wedge_m (S\ cm^2\ mol^{-1}) = \frac{\kappa\left(Scm^{-1}\right) \times 1000\left(cm^3\ L^{-1}\right)}{C\left(molL^{-1}\right)}$

$$\frac{\wedge_m}{\kappa} = \frac{1000\left(cm^3\ L^{-1}\right)}{C\left(molL^{-1}\right)} = \frac{1000}{0.01}$$

$= 1 \times 10^5$ cm^3 mol^{-1}

95. **(c)** third order reaction

Explanation: third order reaction

96. **(d)** +5 and 4

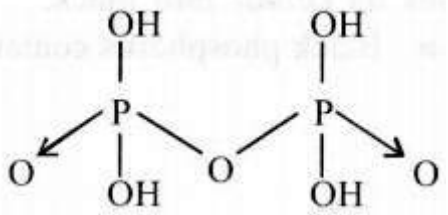
Explanation: Pyrophosphoric acid : $H_4P_2O_7$

Let Oxidation state of P be x

4 x (+1) + 2x + 7 x (-2) = 0

4 + 2x - 14 = 0

x = + 5



Basicity of acid is four.

97. **(a)** Black phosphorus

Explanation: Black phosphorus has layered structure.

98.

(c) Nd^{3+}

Explanation: Lu^{3+}, $Yb^{2+} \rightarrow 4f^{14}$; $Ce^{4+} \rightarrow 4f^{0}$; $Nd^{3+} \rightarrow 4f^{3}$

99.

(c) Ma_2b_2

Explanation: Ma_2b_2

100.

(b) i > ii > iii

Explanation: No resonance in (i). Due to resonance in (ii) (-) bond get converted into (=) bond. More resonance in (iii).

BOTANY (Section-A)

101. **(a)** They share common genetic material but to varying degrees

Explanation: All living organisms share common genetic material but to varying degrees like prokaryotes have single starnded DNA while eukaryotes have double stranded DNA. Hence, all living organisms are linked to one another.

102.

(b) World environment day

Explanation: Every year World Environment day is celebrated on 5th June to spread awareness, to encourage people to take action and to protect the environment.

103.

(d) All are these

Explanation: Heterotrophic bacteria are most abundant in nature and cyanobacteria forms blooms in polluted water bodies. Also chemosynthetic bacteria uses inorganic matter as their substrate.

104.

(b) Basidum

Explanation: The Agaricus belongs to the division Basidiomycetes (Basidiomycota). In basidiomycetes the sex organs are absent, but plasmogamy is brought about by fusion of two vegetative or somatic cells of different strains or genotypes. The resultant structure is dikaryotic which ultimately gives rise to basidium. Karyogamy and meiosis take place in

the basidium producing four basidiospores. The basidiospores are exogenously produced on the basidium. The basidia are arranged in fruiting bodies called basidiocarps.

105. **(b)** Both Castor and Maize
Explanation: Both Castor and Maize

106. **(a)** Gymnosperms
Explanation: The gymnosperms (gymnos: naked, sperma: seeds) are the plants in which the ovules are not enclosed by any ovary wall and remain exposed, both before and after fertilization. The seeds that develop post-fertilization, are not covered, i.e., are naked.

107. **(c)** Four
Explanation: Four
The earliest systems of classification used only gross superficial morphological characters such as habit, color, number, and shape of leaves, etc. They were based mainly on vegetative characters or on the androecium structure. Such systems were artificial; they separated the closely related species since they were based on a few characteristics. Also, the artificial systems gave equal weightage to vegetative and sexual characteristics; this is not acceptable since we know that often the vegetative characters are more easily affected by the environment.

108. **(c)** Coconut
Explanation: Coconut

109. **(b)** Primary endosperm nucleus (PEN)
Explanation: Primary endosperm nucleus (PEN)

110. **(d)** Androecium
Explanation: If filaments of Androecium are joined to form more than two groups but their Anthers separate, it is called **polyadelphous** E.g. Citrus.

111. **(a)** One
Explanation: Only the third statement is incorrect.
The correct statement is -"Fruit consists of a wall or pericarp and seeds. In coconut fruit is a drupe, the mesocarp is fibrous".

112. **(c)** Monocot stem - 1 - Epidermis, 2 - Hypodermis, 3 - Vascular bundles, 4 - Phloem, 5 - Xylem, 6 - Ground tissue
Explanation: The diagram is of transverse section of a Monocot stem - 1 - Epidermis, 2 - Hypodermis, 3 - Vascular bundles, 4 - Phloem, 5 - Xylem, 6 - Ground tissue.

113. **(b)** Change in heritable characters
Explanation: Change in heritable characters

114. **(a)** Dominant epistasis
Explanation: Dominant epistasis

115.

(b) GUG

Explanation: GUG

116. **(a)** 100 half heavy and half light while 100 light only

Explanation: 100 half heavy and half light while 100 light only

117.

(c) Cytoplasm

Explanation: Cytoplasm is a jelly-like substance and made up of 80% water. It is usually clear and colourless and forms the living protoplasm of a cell excluding its nucleus. It consists of proteins, nucleic acids, fats, carbohydrates, vitamins, minerals, waste metabolites, and all the organelles. It is the main area for various types of activities of a cell like respiration, nutrition, storage, etc.

118.

(b) Cytoskeleton

Explanation: Cytoskeleton is a network of filaments and tubules that extends throughout a cell, through the cytoplasm, which is all the material within a cell except for the nucleus. Cytoskeleton helps eukaryotic cells to adopt a variety of shapes and to carry out coordinated and directed movements.

119.

(d) Interferon

Explanation: Interferon

120.

(d) Latex of poppy plant Papaver somniferum

Explanation: Latex of poppy plant Papaver somniferum

121. **(a)** (i), (ii), (iii), and (iv)

Explanation: Bivalents is the association of a pair of homologous chromosomes physically held together by at least one DNA crossover. All the given statements are correct regarding bivalents.

122.

(c) A-3, B-2, C-l

Explanation: A-3, B-2, C-l

123. **(a)** (ii), (iii)

Explanation: Removal of 80% tigers (i.e., tertiary consumer) from an area resulted is decreased growth of vegetation because there will be increased numbers of secondary or primary consumers which feeds on green plant. Removal of most of the carnivores resulted in an increased population of deer on which carnivores depends. The length of food chain is generally limited to 3-4 trophic levels due to energy loss because all the food available at one level is neither eaten nor used by animals at the next level and a lot of the energy is lost in respiration to drive the organism's metabolism so less energy is left to support higher trophic level.

124.

(c) Both Lactobacillus bulgaricus and Streptococcus thermophilus

Explanation: Both Lactobacillus bulgaricus and Streptococcus thermophilus

125.

(b) (i)-T, (ii)-F, (iii)-T, (iv)-F

Explanation: (i)-T, (ii)-F, (iii)-T, (iv)-F

126. **(a)** Over a protected forest, the government doesn't have any property rights.

Explanation: Indian forest act 1927 defines the procedure to be followed for declaring an area to be reserved forest and also defines the forest offenses but this law does not say about government does not have any property rights.

127.

(b) endangered, vulnerable and rare species.

Explanation: Threatened species are species that are likely to disappear from the world sooner or later. In the Red list, all species listed under the categories critically are endangered, vulnerable and endangered are together described as threatened species.

128. **(a)** 25

Explanation: The microspore mother cell produces four pollen or microspores by one meiosis which cannot divide further. Hence, for producing 100 microspores/pollen, 100/4 = 25 meiotic divisions are required.

129.

(d) Twice

Explanation: During meiosis, one cell divides **twice** to form four daughter cells. These four daughter cells only have half the number of chromosomes of the parent cell – they are haploid.

130.

(d) decreased photosynthetic rate at high O_2 concentration.

Explanation: Warburg effect is the decrease in the rate of photosynthesis at high oxygen concentrations.

131.

(c) 3 ATP and 2 $NADPH_2$ are required

Explanation: For synthesis of one molecule of glucose molecule in C_3 cycle, 6 CO_2, 18 ATP, and 12 NADPH are requiring.

132.

(c) Both Oxygen and Carbon

Explanation: Both Oxygen and Carbon

133.

(d) Photolysis

Explanation: Photolysis of water occurs at grana i.e., lumen side of grana thylakoid membrane with the help of water splitting complex or OEC (oxygen-evolving complex). This step is associated with PS- II of the Z-scheme. Three minerals Mn^{+5}, Ca^{++}, Cl^{-} are associated with the splitting of water.

134.

(c) A-Outer chamber; B-Matrix; C-NADH H^+ ; D-NAD^+ ; E-$2H^+$

Explanation: A-Outer chamber; B-Matrix; C-NADH H^+ ; D-NAD^+ ; E-$2H^+$

135.

(b) ABA

Explanation: The hormone which reduces transpiration rate by inducing stomatal closure is ABA. ABA is a stress hormone which is synthesised by plant during drought or other stressful environmental condition. It causes rapid movement of potassium ions out of the guard cells, closes stomatal apertures, and thus reduces the rate of transpiration.

BOTANY (Section-B)

136.

(d) phylum

Explanation: Animals belonging to the same kingdom but different classes may belong to the same phylum.

137.

(c) Viral disease

Explanation: Mumps is a viral disease caused by the mumps virus.

138.

(c) Anabaena

Explanation: In some Gymnosperms like cycas, small specialized roots called coralloid roots are associated with N_2- fixing cyanobacteria. Anabaena is blue-green algae(cyanobacteria) which are associated with nitrogen fixation in coralloid roots of gymnosperms.

139.

(c) Xenogamy

Explanation: Transfer of pollen grains from the anther to the stigma of the same flower is called autogamy. Transfer of pollen grains from the anther to the stigma of another flower of the same species is called geitonogamy. Transfer of pollen grain from the anther of one flower to the stigma of the different plant is called xenogamy. This type of pollination gives a chance to bring a genetically different pollen grain to reach the stigma.

140.

(b) runner

Explanation: Underground stems of some plants such as grass and strawberry, etc. spread to new niches, and when older parts die new plants are formed. Eg-Cynodon.

141.

(b) 42%

Explanation: 42%

142.

(b) Phosphodiester bonds

Explanation: A nucleotide has three components, nitrogenous base, a pentose sugar (ribose in case of RNA and deoxyribose for DNA) and a phosphate group. A nitrogenous base is linked to the pentose sugar through a N-glycosidic linkage to form a nucleo-side. When a phosphate group is linked to 5'- OH of a nucleoside through phosphodiester linkage, a corresponding nucleotide is formed. The nucleotides are linked through 3' - 5' phosphodiester linkage to form a dinucleotide. More nucleotides are joined in the similar manner to form a polynucleotide chain.

143. **(a)** Flemming
Explanation: Name chromatin for the material of the nucleus was given by Flemming in the year 1879, the deeply staining part of the nucleus.

144.
(c) A = 200 mg/L, B = 400 mg/L, C =8 mg/L
Explanation: A = 200 mg/L, B = 400 mg/L, C =8 mg/L

145. **(a)** ATP in respiration
Explanation: ATP in respiration

146.
(b) Saccharomyces cerevisiae
Explanation: Saccharomyces cerevisiae used for bread-making and commonly called brewer's yeast, is used for fermenting malted cereals and fruit juices, to produce ethanol.

147.
(c) grazing food chain
Explanation: Grazing Food Chain (GFC) is the most common food chain. In grazing food chain (e.g. grassland ecosystem) green plants (producers) constitute the first step.

148.
(c) Florigen
Explanation: Florigen

149. **(a)** Cell elongation
Explanation: Cell elongation

150. **(a)** Photosynthesis
Explanation: Blackman proposed the law of limiting factors in 1905. According to this law, when a process depends on a number of factors, its rate is limited by the pace of the slowest factor. Blackman's law of limiting factors determines the rate of the photosynthesis.

ZOOLOGY (Section-A)

151.
(c) A primitive aquatic egg laying mammal
Explanation: The duck-billed platypus (Ornithorhynchus) is a primitive aquatic egg-laying mammal that possesses hair, milk, sweat glands.

152.
(c) (i), (ii)
Explanation: Aschelminthes are bilaterally symmetrical, triploblastic and pseudocoelomate animals. Sexes are separate hence they are dioecious, that is, males and females are distinct.

153.
(c) Echinodermata
Explanation: The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical.

154.
(c) Albumin, globulin and fibrinogen
Explanation: The three major groups of plasma proteins are albumin, globulins and

fibrinogen. Albumin is the most abundant of the plasma proteins, the second most common plasma proteins are the globulins and the least abundant plasma protein is fibrinogen.

155.

(c) Areolar tissue

Explanation: Areolar connective tissue often serves as a support framework for epithelium. It is the simplest and most widely distributed connective tissue. It is found between the skin and muscles, around blood vessels, nerves, and in the bone marrow.

156.

(c) Gills

Explanation: Special vascularised structures called gills are used by most of the aquatic arthropods and molluscs whereas vascularised bags called lungs are used by the terrestrial forms for the exchange of gases.

157.

(d) Slightly alkaline

Explanation: When carbon dioxide is in the blood, it reacts with water to form bicarbonate (HCO_3^-) and hydrogen ions (H^+). As the level of carbon dioxide in the blood increases, more H^+ is produced and the pH decreases. This increase in carbon dioxide and subsequent decrease in pH reduce the affinity of hemoglobin for oxygen. Thus, for the proper transport of O_2 and CO_2, blood should be slightly alkaline.

158.

(b) A cylindrical shape gives high surface area to volume ratio

Explanation: A cylindrical shape gives high surface area to volume ratio

159.

(b) High cone, of hydrogen ions favours oxyhaemoglobin formation.

Explanation: High cone, of hydrogen ions favours oxyhaemoglobin formation.

160. **(a)** 12-16/min

Explanation: The normal respiration rate for an adult at rest is 12 to 20 breaths per minute. A respiration rate under 12 or over 25 breaths per minute while resting is considered abnormal.

161.

(b) Inguinal canals

Explanation: Inguinal canals

162.

(d) Placenta

Explanation: Placenta

163.

(b) 1-Placental villi, 2-Umbilical cord with its vessels, 3-Yolk sac

Explanation: 1-Placental villi, 2-Umbilical cord with its vessels, 3-Yolk sac

164.

(c) Twelve-weeks

Explanation: MTPs are considered relatively safe during the first trimester, i.e., upto 12 weeks of pregnancy

165.

(d) All of these

Explanation: A rapid decline in death rate, maternal mortality rate (MMR), and infant mortality rate (IMR) as well as an increase in the number of people in reproducible age is probable reasons for the tremendous increase in population.

166.

(d) Darwin

Explanation: Darwin

167. **(a)** 2pq

Explanation: In a diploid, p and q are the frequencies of alleles A and a respectively. The frequency of AA = p^2 (i.e. the probability of an allele A with frequency p is the product of the probabilities, i.e. p^2)

The frequency of aa = q^2;The frequency of Aa =2pq

168.

(d) Ureotelic mode of excretion

Explanation: Adult frog and human exhibit ureotelism because there excretory waste product is urea.

169. **(a)** Pigeon/Crow

Explanation: Pigeon/Crow

170.

(b) Ammonia

Explanation: The ammonia is highly toxic because it has high pH, So, it must either be metabolised or expelled immediately out of body, so its concentration remains low in the blood.

171.

(b) Fibrous joint

Explanation: According to the structure, the joints can be classified into- fibrous, cartilaginous, and synovial. Fibrous connective tissue unites articulating bones without any joint cavity. Fibrous joints are mostly immovable, some slightly movable usually synarthrosis. The suture is found only in the skull. It is fibrous tissue between articulating bones in children but permanently fused in adults. Thus there is some movement in fetuses and young children but immovable in adults.

172.

(c) Parietal bone and temporal bone of the skull are joined fibrous joint.

Explanation: The bones of skulls are joined by white fibrous tissue which sustain no movement between the skull bones. This kind of joint is classified as fibrous or immovable joints. Thus parietal and temporal bone of the skull are joined by fibrous joints.

173. **(a)** Only C

Explanation: Osteoporosis: Age-related disorder characterised by decreased bone mass and increased chances of fractures. Decreased levels of estrogen is a common cause.

174. **(a)** Ganglion cells → Bipolar cells → Photoreceptor cells

Explanation: The correct sequence of the layers of cells in retina of human eye from

inside to outside is as follows:
Ganglioncells → Bipolarcells → Photoreceptor cells.

175.
(d) Medulla
Explanation: The fourth ventricle lies posterior or dorsal to the pons and medulla and the anterior or ventral to the cerebellum.

176.
(b) at the end of axon terminal.
Explanation: Synaptic knob is bulb-like structure which is present at the end of axon terminal. The function of a synaptic knob is to change the action potential that is carried by axons into a chemical message.

177.
(b) growth hormone of adenohypophysis.
Explanation: Over secretion of GH stimulates abnormal growth of the body leading to gigantism and low secretion of GH result in stunted growth resulting in dwarfism.

178.
(d) Hypersecretion of the thyroid gland
Explanation: Hypersecretion of the thyroid gland

179. **(a)** Repolarisation of ventricles
Explanation: The T-wave represents the repolarisation of ventricles, that is, the return of the ventricles from excited to a normal state.

180.
(c) (I)-(iii), (II)-(i), (III)-(ii)
Explanation: (I)-(iii), (II)-(i), (III)-(ii)

181.
(b) 154000 ml/minute
Explanation: Cardiac output is defined as the blood pumped by the left ventricle into the aorta or from the right ventricle into the pulmonary artery per minute.
Cardiac output is calculated as: Stroke volume x heart rate
The stroke volume given is 200 ml and heart rate is given 77 beats/min
Therefore, cardiac output = 200 x 77 = 15,400 ml/min.

182. **(a)** It is circular DNA which have capacity to join to eukaryotic DNA
Explanation: Plasmids is a genetic structure in a cell that can replicate independently of the chromosomes. It is typically a small circular DNA strand in the cytoplasm of a bacterium or protozoan. Plasmids are used in the laboratory for manipulation of genes.

183.
(c) E.coli
Explanation: E. coli is not required for preparation of a recombinant DNA molecule rather it may be required for the' expression of recombinant DNA-molecule.

184.
(c) (b), (d) only
Explanation: Isulin is a hormone produced by the beta cell of the Islet of Langerhans. It is synthesized as pro-insulin. It has C-peptide. In the initial stage, it comprises two polypeptides, called A-peptide and B-peptide, along with a stretch of C peptide. Later these

two polypeptides are linked by disulphide linkage by removing a stretch of C peptide. So C-peptide is not present in the mature insulin.

185.

(d) Insulin

Explanation: Insulin

ZOOLOGY (Section-B)

186. **(a)** Flying fish

Explanation: Flying fish or Exocoetus is a marine bony fish.

187. **(a)** Bronchioles and fallopian tubes.

Explanation: Ciliated columnar epithelium is composed of simple columnar epithelial cells with cilia on their surfaces. These epithelial cells are found in the lining of the fallopian tubes and parts of the respiratory system, where the beating of the cilia helps remove particulate matter.

188.

(d) Both The product of heart rate and stroke volume and The blood pumped in one minute

Explanation: Both The product of heart rate and stroke volume and The blood pumped in one minute

189. **(a)** Contracts

Explanation: Contracts

190.

(d) A - ectoderm, B - mesoderm, C - endoderm

Explanation: Immediately after implantation, the inner cell mass (embryo) differentiates into an outer layer called ectoderm and an inner layer called endoderm. A mesoderm soon appears between the ectoderm and the endoderm.

191.

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

Explanation: Condoms are barriers that prevent the ejaculated semen from entering the female reproductive tract. Copper ions released from copper T suppress sperm motility and the fertilising capacity of sperms. Pills inhibit ovulation and implantation. In vasectomy, a small part of the vas deferens is removed or tied up through a small incision on the scrotum thereby, preventing transport of sperms from testis to urethra and no sperm is present in semen.

192.

(c) Malthus

Explanation: Malthus

193.

(c) Breakdown of arginine

Explanation: Urea is manufactured in the liver is a cyclic chemical reaction called the ornithine cycle. It was once thought to be produced directly from ammonia but it is now known to be produced from ammonia by way of amino acid arginine.

194.

(c) Appendicular skeleton

Explanation: Appendicular skeleton

195. **(a)** scotopic vision and is the function of rods.
Explanation: The rods contain the rhodopsin pigment that is highly sensitive to dim light. It is responsible for scotopic (twilight) vision.

196.
(c) adenohypophysis of pituitary
Explanation: adenohypophysis of pituitary

197.
(b) steroid
Explanation: steroid

198.
(c) Spleen
Explanation: The spleen acts as a filter for the blood in case of infections and immunity.

199.
(b) β-galactosidase.
Explanation: A recombinant DNA is inserted within the coding sequence of an enzyme, β-galactosidase. This results into inactivation of the enzyme, which is referred to as insertional inactivation.

200.
(c) (i), (iv), (v), (ii), (vi), (iii)
Explanation: The correct sequence is (i), (iv), (v), (ii), (vi), (iii).