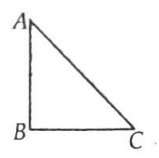# PHYSICS

1. Photoelectric emission occurs only when the incident light has more than a certain minimum
   (a) power
   (b) wavelength
   (c) intensity
   (d) frequency

2. A current carrying closed loop in the form of a right angle isosceles triangle ABC is placed in a uniform magnetic field acting along AB. If the magnetic force on the arm BC is $\vec{F}$, the force on the arm AC is
   (a) $-\sqrt{2}\,\vec{F}$
   (b) $-\vec{F}$
   (c) $\vec{F}$
   (d) $\sqrt{2}\,\vec{F}$

3. A particle moves in a circle of radius 5 cm with constant speed and time period 0.2π s. The acceleration of the particle is
   (a) 15 m/s²
   (b) 25 m/s²
   (c) 36 m/s²
   (d) 5 m/s²

4. Which of the following is not due to total internal reflection?
   (a) Working of optical fibre
   (b) Difference between apparent and real depth of a pond
   (c) Mirage on hot summer days
   (d) Brilliance of diamond

5. A missile is fired for maximum range with an initial velocity of 20 m/s. If $g = 10$ m/s², the range of the missile is
   (a) 40 m
   (b) 50 m
   (c) 60 m
   (d) 20 m

6. The wavelength of the first line of Lyman series for hydrogen atom is equal to that of the second line of Balmer series for a hydrogen like ion. The atomic number Z of hydrogen like ion is
   (a) 3
   (b) 4
   (c) 1
   (d) 2

7. The half life of a radioactive isotope X is 50 years. It decays to another element Y which is stable. The two elements X and Y were found to be in the ratio of 1 : 15 in a sample of a given rock. The age of the rock was estimated to be
   (a) 150 years
   (b) 200 years
   (c) 250 years
   (d) 100 years

8. The potential energy of a system increases if work is done
   (a) upon the system by a nonconservative force.
   (b) by the system against a conservative force.
   (c) by the system against a nonconservative force.
   (d) upon the system by a conservative force.

9. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the outward electric flux will
   (a) increase four times
   (b) be reduced to half
   (c) remain the same
   (d) be doubled

10. The power obtained in a reactor using U^{235} disintegration is 1000 kW. The mass decay of U^{235} per hour is
    (a) 10 microgram
    (b) 20 microgram
    (c) 40 microgram
    (d) 1 microgram

11. A radioactive nucleus of mass M emits a photon of frequency υ and the nucleus recoils. The recoil energy will be
    (a) $Mc^2 - h\upsilon$
    (b) $h^2\upsilon^2/2Mc^2$
    (c) zero
    (d) $h\upsilon$

12. The electric and the magnetic field, associated with an e.m wave, propagating along the +z-axis, can be represented by
    (a) $\left[\vec{E} = E_0\hat{i}, \ \vec{B} = B_0\hat{j}\right]$
    (b) $\left[\vec{E} = E_0\hat{k}, \ \vec{B} = B_0\hat{i}\right]$
    (c) $\left[\vec{E} = E_0\hat{j}, \ \vec{B} = B_0\hat{i}\right]$
    (d) $\left[\vec{E} = E_0\hat{j}, \ \vec{B} = B_0\hat{k}\right]$

13. During an isothermal expansion, a confined ideal gas does -150 J of work against its surroundings. This implies that
    (a) 150 J of heat has been removed from the gas
    (b) 300 J of heat has been added to the gas
    (c) no heat is transferred because the process is isothermal
    (d) 150 J of heat has been added to the gas

14. Two waves are represented by the equations
    $y_1 = a\sin(\omega t + kx + 0.57)$ m and
    $y_2 = a\cos(\omega t + kx)$ m,
    where x is in meter and t in sec. The phase difference between them is
    (a) 1.0 radian
    (b) 1.25 radian
    (c) 1.57 radian
    (d) 0.57 radian

15. The instantaneous angular position of a point on a rotating wheel is given by the equation $\theta(t) = 2t^3 - 6t^2$. The torque on the wheel becomes zero at
    (a) $t = 1$ s
    (b) $t = 0.5$ s
    (c) $t = 0.25$ s
    (d) $t = 2$ s

16. A boy standing at the top of a tower of 20 m height drops a stone. Assuming $g = 10$ m s⁻², the velocity with which it hits the ground is
    (a) 10.0 m/s
    (b) 20.0 m/s
    (c) 40.0 m/s
    (d) 5.0 m/s

The moment of inertia of a thin uniform rod of mass M and length L about an axis passing through its midpoint and perpendicular to its length is I_0. Its moment of inertia about an axis passing through one of its ends and perpendicular to its length is

(a) $I_0 + ML^2/2$ (b) $I_0 + ML^2/4$
(c) $I_0 + 2ML^2$ (d) $I_0 + ML^2$

A nucleus $_n^m X$ emits one α particle and two β^- particles. The resulting nucleus is

(a) $_{n-4}^{m-6} Z$ (b) $_n^{m-6} Z$
(c) $_n^{m-4} X$ (d) $_{n-2}^{m-4} Y$

A parallel plate condenser has a uniform electric field E (V/m) in the space between the plates. If the distance between the plates is d (m) and area of each plate is A (m^2) the energy (joules) stored in the condenser is

(a) $E^2 Ad/\varepsilon_0$ (b) $\dfrac{1}{2}\varepsilon_0 E^2$

(c) $\varepsilon_0 EAd$ (d) $\dfrac{1}{2}\varepsilon_0 E^2 Ad$

A planet moving along an elliptical orbit is closest to the sun at a distance r_1 and farthest away at a distance of r_2. If v_1 and v_2 are the linear velocities at these points respectively, then the ratio $\dfrac{v_1}{v_2}$ is

(a) $(r_1/r_2)^2$ (b) r_2/r_1
(c) $(r_2/r_1)^2$ (d) r_1/r_2

A body is moving with velocity 30 m/s towards east. After 10 seconds its velocity becomes 40 m/s towards north. The average acceleration of the body is

(a) 1 m/s^2 (b) 7 m/s^2
(c) $\sqrt{7}$ m/s^2 (d) 5 m/s^2

Fusion reaction takes place at high temperature because

(a) nuclei break up at high temperature
(b) atoms get ionised at high temperature
(c) kinetic energy is high enough to overcome the coulomb repulsion between nuclei
(d) molecules break up at high temperature

A body projected vertically from the earth reaches a height equal to earth's radius before returning to the earth. The power exerted by the gravitational force is greatest

(a) at the highest position of the body.
(b) at the instant just before the body hits the earth.
(c) it remains constant all through.
(d) at the instant just after the body is projected.

The dimensions of $(\mu_0\varepsilon_0)^{-1/2}$ are

(a) $[L^{1/2}T^{-1/2}]$ (b) $[L^{-1}T]$
(c) $[LT^{-1}]$ (d) $[L^{-1/2}T^{1/2}]$

An ac voltage is applied to a resistance R and an inductor L in series. If R and the inductive reactance are both equal to 3 Ω, the phase difference between the applied voltage and the current in the circuit is

(a) $\pi/6$ (b) $\pi/4$
(c) $\pi/2$ (d) zero

26. A transistor is operated in common emitter configuration at $V_C = 2$ V such that a change in the base current from 100 μA to 300 μA produces a change in the collector current from 10 mA to 20 mA. The current gain is
(a) 50 (b) 75
(c) 100 (d) 25

27. In forward biasing of the p-n junction
(a) the positive terminal of the battery is connected to p-side and the depletion region becomes thick.
(b) the positive terminal of the battery is connected to n-side and the depletion region becomes thin.
(c) the positive terminal of the battery is connected to n-side and the depletion region becomes thick.
(d) the positive terminal of the battery is connected to p-side and the depletion region becomes thin.

28. There are four light-weight-rod samples A, B, C, D separately suspended by threads. A bar magnet is slowly brought near each sample and the following observations are noted
(i) A is feebly repelled
(ii) B is feebly attracted
(iii) C is strongly attracted
(iv) D remains unaffected
Which one of the following is true?
(a) B is of a paramagnetic material
(b) C is of a diamagnetic material
(c) D is of a ferromagnetic material
(d) A is of a non-magnetic material

29. A person of mass 60 kg is inside a lift of mass 940 kg and presses the button on control panel. The lift starts moving upwards with an acceleration 1.0 m/s^2. If $g = 10$ m s^{-2}, the tension in the supporting cable is
(a) 8600 N (b) 9680 N
(c) 11000 N (d) 1200 N

30. Symbolic representation of four logic gates are shown as

(i)

(ii)

(iii)

(iv)
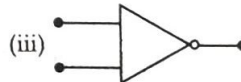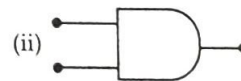
Pick out which ones are for AND, NAND and NOT gates, respectively
(a) (ii), (iii) and (iv) (b) (iii), (ii) and (i)
(c) (iii), (ii) and (iv) (d) (ii), (iv) and (iii)

31. In an ac circuit an alternating voltage $e = 200\sqrt{2} \sin 100t$ volts is connected to a capacitor of capacity 1 μF. The r.m.s. value of the current in the circuit is

(a) 10 mA
(b) 100 mA
(c) 200 mA
(d) 20 mA

32. A current of 2 A flows through a 2 Ω resistor when connected across a battery. The same battery supplies a current of 0.5 A when connected across a 9 Ω resistor. The internal resistance of the battery is
(a) 0.5 Ω
(b) 1/3 Ω
(c) 1/4 Ω
(d) 1 Ω

33. A particle of mass m is released from rest and follows a parabolic path as shown. Assuming that the displacement of the mass from the origin is small, which graph correctly depicts the position of the particle as a function of time?

(a)
(b)
(c)
(d)
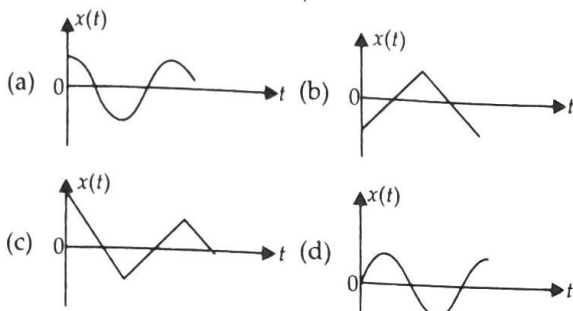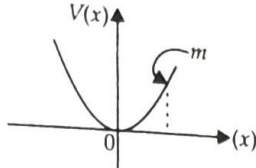
34. If power dissipated in the 9 Ω resistor in the circuit shown is 36 watt, the potential difference across the 2 Ω resistor is

(a) 4 volt
(b) 8 volt
(c) 10 volt
(d) 2 volt
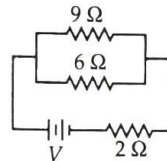
35. A biconvex lens has a radius of curvature of magnitude 20 cm. Which one of the following options describe best the image formed of an object of height 2 cm placed 30 cm from the lens?
(a) Virtual, upright, height = 1 cm
(b) Virtual, upright, height = 0.5 cm
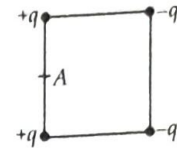(c) Real, inverted, height = 4 cm
(d) Real, inverted, height = 1 cm

36. In the Davisson and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by
(a) increasing the potential difference between the anode and filament
(b) increasing the filament current
(c) decreasing the filament current
(d) decreasing the potential difference between the anode and filament

37. The decreasing order of wavelength of infrared, microwave, ultraviolet and gamma rays is
(a) microwave, infrared, ultraviolet, gamma rays
(b) gamma rays, ultraviolet, infrared, microwaves
(c) microwaves, gamma rays, infrared, ultraviolet
(d) infrared, microwave, ultraviolet, gamma rays

38. Four electric charges $+q$, $+q$, $-q$ and $-q$ are placed at the corners of a square of side 2L (see figure). The electric potential at point A, midway between the two charges $+q$ and $+q$, is

(a) $\dfrac{1}{4\pi\varepsilon_0}\dfrac{2q}{L}\left(1+\sqrt5\right)$
(b) $\dfrac{1}{4\pi\varepsilon_0}\dfrac{2q}{L}\left(1+\dfrac{1}{\sqrt5}\right)$

(c) $\dfrac{1}{4\pi\varepsilon_0}\dfrac{2q}{L}\left(1-\dfrac{1}{\sqrt5}\right)$
(d) zero

39. When 1 kg of ice at 0°C melts to water at 0°C, the resulting change in its entropy, taking latent heat of ice to be 80 cal/°C, is
(a) 273 cal/K
(b) 8×10^4 cal/K
(c) 80 cal/K
(d) 293 cal/K

40. A uniform electric field and a uniform magnetic field are acting along the same direction in a certain region. If an electron is projected in the region such that its velocity is pointed along the direction of fields, then the electron
(a) will turn towards right of direction of motion
(b) speed will decrease
(c) speed will increase
(d) will turn towards left of direction of motion

41. Sound waves travel at 350 m/s through a warm air and at 3500 m/s through brass. The wavelength of a 700 Hz acoustic wave as it enters brass from warm air
(a) decrease by a factor 10
(b) increase by a factor 20
(c) increase by a factor 10
(d) decrease by a factor 20

42. Light of two different frequencies whose photons have energies 1 eV and 2.5 eV respectively illuminate a metallic surface whose work function is 0.5 eV successively. Ratio of maximum speeds of emitted electrons will be
(a) 1 : 4
(b) 1 : 2
(c) 1 : 1
(d) 1 : 5

43. A body of mass M hits normally a rigid wall with velocity V and bounces back with the same velocity. The impulse experienced by the body is
(a) MV
(b) $1.5MV$
(c) $2MV$
(d) zero

44. Electrons used in an electron microscope are accelerated by a voltage of 25 kV. If the voltage is increased to 100 kV then the de-Broglie wavelength associated with the electrons would
(a) increase by 2 times
(b) decrease by 2 times
(c) decrease by 4 times
(d) increase by 4 times

45. Out of the following functions representing motion of a particle which represents SHM
(1) $y = \sin\omega t - \cos\omega t$
(2) $y = \sin^3\omega t$
(3) $y = 5\cos\left(\dfrac{3\pi}{4} - 3\omega t\right)$
(4) $y = 1 + \omega t + \omega^2 t^2$

(a) Only (1)

(b) Only (4) does not represent SHM

(c) Only (1) and (3)   (d) Only (1) and (2)

In photoelectric emission process from a metal of work function 1.8 eV, the kinetic energy of most energetic electrons is 0.5 eV. The corresponding stopping potential is

(a) 1.8 V   (b) 1.3 V

(c) 0.5 V   (d) 2.3 V

The rate of increase of thermo-e.m.f. with temperature at the neutral temperature of a thermocouple

(a) is positive   (b) is zero

(c) depends upon the choice of the two materials of the thermocouple

(d) is negative

Force F on a particle moving in a straight line varies with distance d as shown in figure. The work done on the particle during its displacement of 12 m is

(a) 18 J   (b) 21 J

(c) 26 J   (d) 13 J
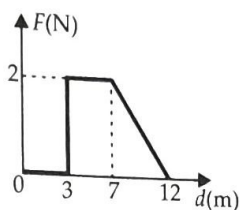
The current i in a coil varies with time as shown in the figure. The variation of induced emf with time would be
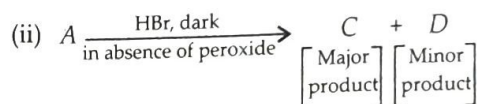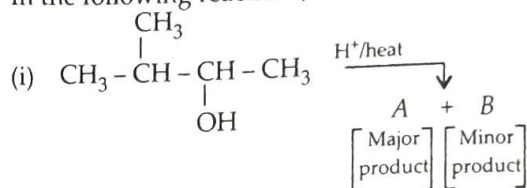

(a)

(b)

(c)

(d)
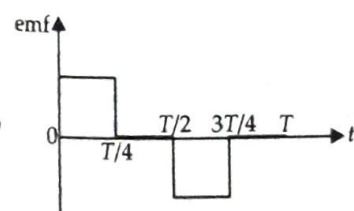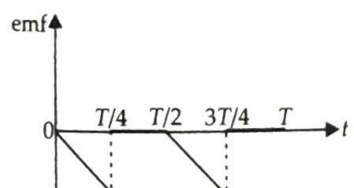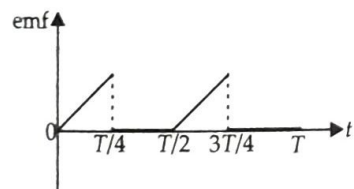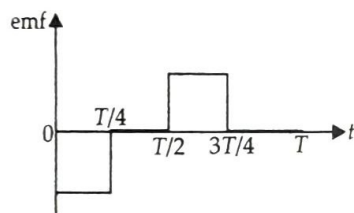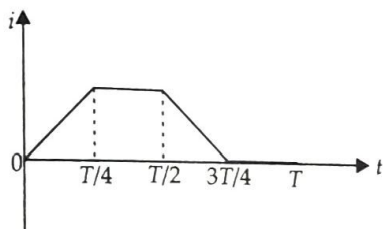
50. If a small amount of antimony is added to germanium crystal

(a) it becomes a p-type semiconductor

(b) the antimony becomes an acceptor atom

(c) there will be more free electrons than holes in the semiconductor
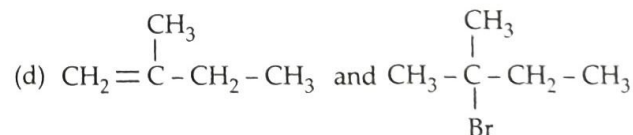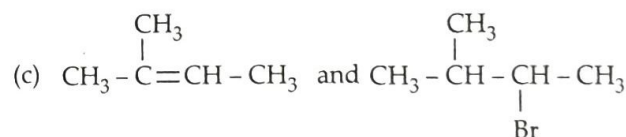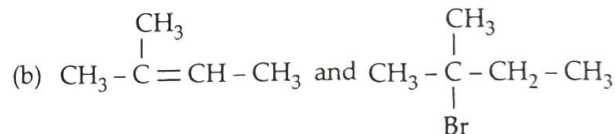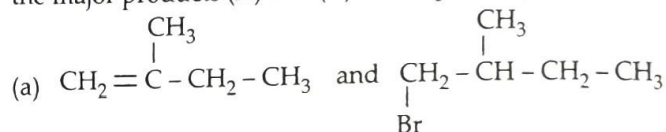
(d) its resistance is increased

CHEMISTRY

51. Considering the state of hybridization of carbon atoms, find out the molecule among the following which is linear?

(a) $CH_3 - CH = CH - CH_3$

(b) $CH_3 - C \equiv C - CH_3$

(c) $CH_2 = CH - CH_2 - C \equiv CH$

(d) $CH_3 - CH_2 - CH_2 - CH_3$

52. In the following reactions,

(i)

(ii) $A \xrightarrow[\text{in absence of peroxide}]{\text{HBr, dark}}$
$\underset{\text{product}}{\underset{\text{Major}}{C}} + \underset{\text{product}}{\underset{\text{Minor}}{D}}$

the major products (A) and (C) are respectively

(a)

(b)

(c)

(d)

53. Standard electrode potential 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 will be

(a) $Y > Z > X$ (b) $Y > X > Z$

(c) $Z > X > Y$ (d) $X > Y > Z$

54. The total number of atomic orbitals in fourth energy level of an atom is

(a) 8   (b) 16

(c) 32   (d) 4

55. Which of the following has the minimum bond length?
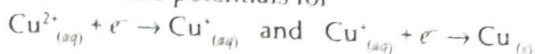
(a) O_2^+ (b) O_2^-

(c) O_2^{2-} (d) O_2

56. If x is amount of adsorbate and m is amount of adsorbent, which of the following relations is not related to adsorption process?
(a) $x/m = f(p)$ at constant T
(b) $x/m = f(T)$ at constant p
(c) $p = f(T)$ at constant (x/m)
(d) $\dfrac{x}{m} = p \times T$

57. A buffer solution is prepared in which the concentration of NH_3 is 0.30 M and the concentration of NH_4^+ is 0.20 M. If the equilibrium constant, K_b for NH_3 equals 1.8×10^{-5}, what is the pH of this solution? ($\log 2.7 = 0.43$)
(a) 9.08
(b) 9.43
(c) 11.72
(d) 8.73

58. The electrode potentials for
$$Cu^{2+}_{(aq)} + e^- \rightarrow Cu^+_{(aq)} \quad \text{and} \quad Cu^+_{(aq)} + e^- \rightarrow Cu_{(s)}$$
are + 0.15 V and + 0.50 V respectively. The value of $E^\circ_{Cu^{2+}/Cu}$ will be
(a) 0.500 V
(b) 0.325 V
(c) 0.650 V
(d) 0.150 V

59. For the four successive transition elements (Cr, Mn, Fe and Co), the stability of +2 oxidation state will be there in which of the following order?
(a) Mn > Fe > Cr > Co
(b) Fe > Mn > Co > Cr
(c) Co > Mn > Fe > Cr
(d) Cr > Mn > Co > Fe
(At. nos. Cr = 24, Mn = 25, Fe = 26, Co = 27)

60. Which one of the following statements for the order of a reaction is incorrect?
(a) Order can be determined only experimentally.
(b) Order is not influenced by stoichiometric coefficient of the reactants.
(c) Order of a reaction is sum of power to the concentration terms of reactants to express the rate of reaction.
(d) Order of reaction is always whole number.

61. Which one of the following is most reactive towards electrophilic reagent?
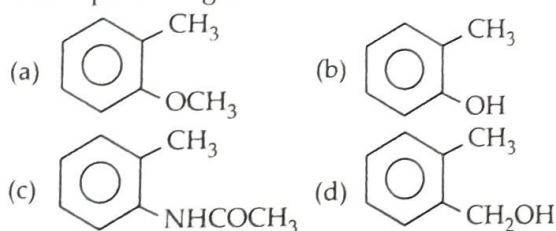
62. In a set of reactions m-bromobenzoic acid gave a product D. Identify the product D.
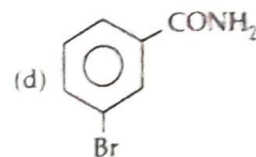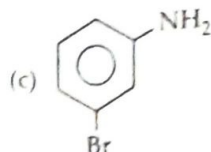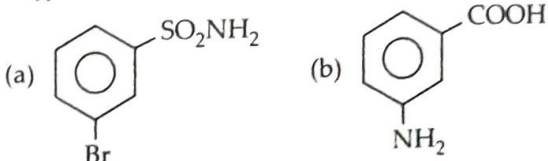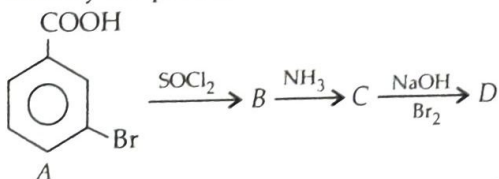
63. Which of the two ions from the list given below that have the geometry that is explained by the same hybridization orbitals, NO_2^-, NO_3^-, NH_2^-, NH_4^+, SCN^-?
(a) NO_2^- and NO_3^-
(b) NH_4^+ and NO_3^-
(c) SCN^- and NH_2^-
(d) NO_2^- and NH_2^-

64. Which of the following is least likely to behave as Lewis base?
(a) H_2O
(b) NH_3
(c) BF_3
(d) OH^-

65. Which one of the following statements is not true regarding (+) lactose?
(a) On hydrolysis (+) lactose gives equal amount of D glucose and D(+) galactose.
(b) (+) Lactose is a β-glucoside formed by the union of a molecule of D(+) glucose and a molecule of D galactose.
(c) (+) Lactose is a reducing sugar and does not exhibit mutarotation.
(d) (+) Lactose, $C_{12}H_{22}O_{11}$ contains 8-OH groups.

66. The freezing point depression constant for water is $-1.86°$ Cm^{-1}. If 5.00 g Na_2SO_4 is dissolved in 45.0 g H_2O, the freezing point is changed by $-3.82°C$. Calculate the van't Hoff factor for Na_2SO_4.
(a) 2.05
(b) 2.63
(c) 3.11
(d) 0.381

67. Of the following complex ions, which is diamagnetic in nature?
(a) $[NiCl_4]^{2-}$
(b) $[Ni(CN)_4]^{2-}$
(c) $[CuCl_4]^{2-}$
(d) $[CoF_6]^{3-}$

68. The correct IUPAC name for the compound

 is
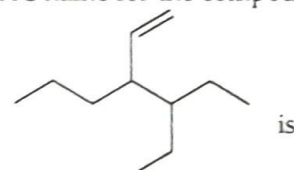
(a) 4-ethyl-3-propylhex-1-ene
(b) 3-ethyl-4-ethenylheptane
(c) 3-ethyl-4-propylhex-5-ene
(d) 3-(1-ethylpropyl)hex-1-ene

69. By what factor does the average velocity of a gaseous molecule increase when the temperature (in Kelvin) is doubled?
(a) 2.0
(b) 2.8
(c) 4.0
(d) 1.4

70. Which one of the following statement is not true?
(a) pH of drinking water should be between 5.5 – 9.5
(b) Concentration of DO below 6 ppm is good for the growth of fish.
(c) Clean water would have a BOD value of less than 5 ppm.

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

Name the two type of the structure of silicate in which one oxygen atom of $[SiO_4]^{4-}$ is shared?
(a) Linear chain silicate (b) Sheet silicate
(c) Pyrosilicate (d) Three dimensional

Two gases A and B having the same volume diffuse through porous partition in 20 and 10 seconds respectively. The molecular mass of A is 49 u. Molecular mas of B will be
(a) 50.00 u (b) 12.25 u
(c) 6.50 u (d) 25.00 u

Dumas' method of estimation of nitrogen 0.35 g of an organic compound gave 55 mL of nitrogen collected at 300 K temperature and 715 mm pressure. The percentage composition of nitrogen in the compound would be (aqueous tension at 300 K = 15 mm).
(a) 15.45 (b) 16.45
(c) 17.45 (d) 14.45

Which one of the following is employed as Antihistamine?
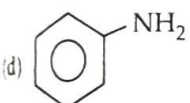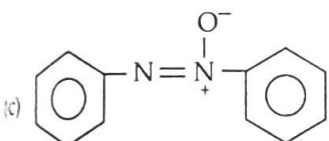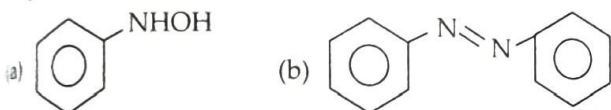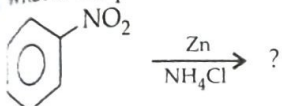(a) Chloramphenicol (b) Diphenylhydramine
(c) Norothindrone (d) Omeprazole

What is the product obtained in the following reaction?

(a) NHOH
(b) N=N
(c) O⁻ N=N⁺
(d) NH₂

Standard electrode potential for Sn^{4+}/Sn^{2+} couple is + 0.15 V and that for the Cr^{3+}/Cr couple is – 0.74 V. These two couples in their standard state are connected to make a cell. The cell potential will be
(a) + 1.19 V (b) + 0.89 V
(c) + 0.18 V (d) + 1.83 V

The van't Hoff factor i for a compound which undergoes dissociation in one solvent and association in other solvent is respectively
(a) less than one and greater than one
(b) less than one and less than one
(c) greater than one and less than one
(d) greater than one and greater than one

The Lassaigne's extract is boiled with conc. HNO_3 while testing for halogens. By doing so it
(a) decomposes Na_2S and $NaCN$, it formed
(b) helps in the precipitation of AgCl
(c) increases the solubility product of AgCl
(d) increases the concentration of NO_3^- ions

79. The energies E_1 and E_2 of two radiations are 25 eV and 50 eV respectively. The relation between their wavelengths i.e., λ_1 and λ_2 will be
(a) $\lambda_1 = \lambda_2$ (b) $\lambda_1 = 2\lambda_2$
(c) $\lambda_1 = 4\lambda_2$ (d) $\lambda_1 = \frac{1}{2}\lambda_2$

80. A gaseous mixture was prepared by taking equal mole of CO and N_2. If the total pressure of the mixture was found 1 atmosphere, the partial pressure of the nitrogen (N_2) in the mixture is
(a) 0.5 atm (b) 0.8 atm
(c) 0.9 atm (d) 1 atm

81. Mole fraction of the solute in a 1.00 molal aqueous solution is
(a) 0.1770 (b) 0.0177
(c) 0.0344 (d) 1.7700

82. Clemmensen reduction of a ketone is carried out in the presence of which of the following?
(a) Glycol with KOH (b) Zn-Hg with HCl
(c) $LiAlH_4$ (d) H_2 and Pt as catalyst

83. Acidified $K_2Cr_2O_7$ solution turns green when Na_2SO_3 is added to it. This is due to the formation of
(a) $Cr_2(SO_4)_3$ (b) CrO_4^{2-}
(c) $Cr_2(SO_3)_3$ (d) $CrSO_4$

84. Which of the following elements is present as the impurity to the maximum extent in the pig iron?
(a) Manganese (b) Carbon
(c) Silicon (d) Phosphorus

85. If the enthalpy change for the transition of liquid water to steam is 30 kJ mol⁻¹ at 27°C, the entropy change for the process would be
(a) 10 J mol⁻¹ K⁻¹ (b) 1.0 J mol⁻¹ K⁻¹
(c) 0.1 J mol⁻¹ K⁻¹ (d) 100 J mol⁻¹ K⁻¹

86. Which of the following compounds has the lowest melting point?
(a) $CaCl_2$ (b) $CaBr_2$
(c) CaI_2 (d) CaF_2

87. The complexes $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ are the examples of which type of isomerism?
(a) Linkage isomerism
(b) Ionization isomerism
(c) Coordination isomerism
(d) Geometrical isomerism

88. The complex, $[Pt(Py)(NH_3)BrCl]$ will have how many geometrical isomers?
(a) 3 (b) 4
(c) 0 (d) 2

89. Enthalpy change for the reaction,
$4H_{(g)} \rightarrow 2H_{2(g)}$ is –869.6 kJ.
The dissociation energy of H – H bond is
(a) – 434.8 kJ (b) – 869.6 kJ
(c) + 434.8 kJ (d) + 217.4 kJ

90. The d-electron configurations of Cr^{2+}, Mn^{2+}, Fe^{2+} and Co^{2+} are d^4, d^5, d^6 and d^7 respectively. Which one of the following will

exhibit minimum paramagnetic behaviour?
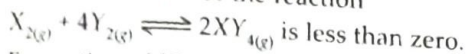
(a) $[Mn(H_2O)_6]^{2+}$
(b) $[Fe(H_2O)_6]^{2+}$
(c) $[Co(H_2O)_6]^{2+}$
(d) $[Cr(H_2O)_6]^{2+}$

(At. nos. Cr = 24, Mn = 25, Fe = 26, Co = 27)

91. Which of the following is correct option for free expansion of an ideal gas under adiabatic condition?

(a) $q = 0, \Delta T \neq 0, w = 0$
(b) $q \neq 0, \Delta T = 0, w = 0$
(c) $q = 0, \Delta T = 0, w = 0$
(d) $q = 0, \Delta T < 0, w \neq 0$

92. The value of ΔH for the reaction
$X_{2(g)} + 4Y_{2(g)} \rightleftharpoons 2XY_{4(g)}$ is less than zero. Formation of $XY_{4(g)}$ will be favoured at

(a) high temperature and high pressure
(b) low pressure and low temperature
(c) high temperature and low pressure
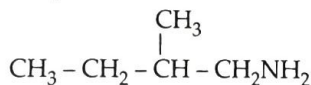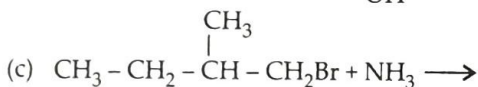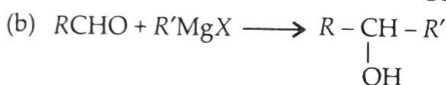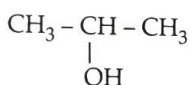(d) high pressure and low temperature

93. The correct order of increasing bond length of C – H, C – O, C – C and C = C is

(a) C – H < C = C < C – O < C – C
(b) C – C < C = C < C – O < C – H
(c) C – O < C – H < C – C < C = C
(d) C – H < C – O < C – C < C = C

94. If the E°_{cell} for a given reaction has a negative value, then which of the following gives the correct relationships for the values of ΔG° and K_{eq}?

(a) $\Delta G^{\circ} > 0 ; K_{eq} > 1$
(b) $\Delta G^{\circ} < 0 ; K_{eq} > 1$
(c) $\Delta G^{\circ} < 0 ; K_{eq} < 1$
(d) $\Delta G^{\circ} > 0 ; K_{eq} < 1$

95. Which one is a nucleophilic substitution reaction among the following?

(a) $CH_3 – CH = CH_2 + H_2O \xrightarrow{H^+}$

$$CH_3 – \underset{\overset{|}{OH}}{CH} – CH_3$$

(b) $RCHO + R'MgX \longrightarrow R – \underset{\overset{|}{OH}}{CH} – R'$

(c) $CH_3 – CH_2 – \underset{\overset{|}{CH_3}}{CH} – CH_2Br + NH_3 \longrightarrow$

$$CH_3 – CH_2 – \underset{\overset{|}{CH_3}}{CH} – CH_2NH_2$$

(d) $CH_3CHO + HCN \longrightarrow CH_3CH(OH)CN$
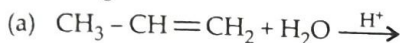
96. Which of the following pairs of metals is purified by van Arkel method?

(a) Ga and In
(b) Zr and Ti
(c) Ag and Au
(d) Ni and Fe
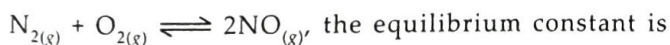
97. For the reaction,
$N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$, the equilibrium constant is K_1. The equilibrium constant is K_2 for the reaction, $2NO_{(g)} + O_{2(g)} \rightleftharpoons 2NO_{2(g)}$. What is K for the reaction, $NO_{2(g)} \rightleftharpoons \frac{1}{2} N_{2(g)} + O_{2(g)}$?
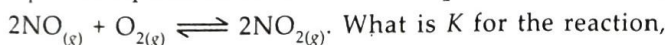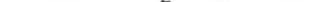
(a) $\dfrac{1}{2K_1K_2}$
(b) $\dfrac{1}{4K_1K_2}$

(c) $\left[\dfrac{1}{K_1K_2}\right]^{1/2}$
(d) $\dfrac{1}{K_1K_2}$

98. Which one of the following is present as an active ingredient in bleaching powder for bleaching action?

(a) $CaOCl_2$
(b) $Ca(OCl)_2$
(c) CaO_2Cl
(d) $CaCl_2$

99. Of the following which one is classified as polyester polymer?

(a) Terylene
(b) Backelite
(c) Melamine
(d) Nylon-66

100. If $n = 6$, the correct sequence for filling of electrons will be

(a) $ns \rightarrow (n – 2)f \rightarrow (n – 1)d \rightarrow np$
(b) $ns \rightarrow (n – 1)d \rightarrow (n – 2)f \rightarrow np$
(c) $ns \rightarrow (n – 2)f \rightarrow np \rightarrow (n – 1)d$
(d) $ns \rightarrow np(n – 1)d \rightarrow (n – 2)f$

BIOLOGY

101. What will you look for to identify the sex of the following?

(a) female *Ascaris*-sharply curved posterior end
(b) male frog- a copulatory pad on the first digit of the hind limb
(c) female cockroach-anal cerci
(d) male shark-claspers borne on pelvic fins.

102. Filiform apparatus is a characteristic feature of

(a) suspensor
(b) egg
(c) synergid
(d) zygote

103. "Jaya" and "Ratna" developed for green revolution in India are the varieties of

(a) maize
(b) rice
(c) wheat
(d) bajra

104. A prokaryotic autotrophic nitrogen fixing symbiont is found in

(a) *Alnus*
(b) *Cycas*
(c) *Cicer*
(d) *Pisum*

105. One very special feature in the earthworm *Pheretima* is that

(a) fertilization of eggs occurs inside the body
(b) the typhlosole greatly increases the effective absorption area of the digested food in the intestine
(c) the S-shaped setae embedded in the integument are the defensive weapons used against the enemies
(d) it has a long dorsal tubular heart.

106. What type of human population is represented by the following age pyramid?

Post-reproductive

Reproductive

Pre-reproductive
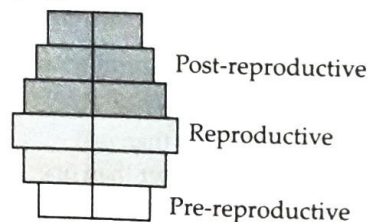
(a) vanishing population
(b) stable population
(c) declining population
(d) expanding population.

107. Mass of living matter at a trophic level in an area at any time is called

(a) standing crop   (b) detritus
(c) humus   (d) standing state

Given below is a sample of a portion of DNA strand giving the base sequence on the opposite strands. What is so special shown in it?

5'____ GAATTC' ____3'
3'____ CTTAAG ____5'

(a) replication completed
(b) deletion mutation
(c) start codon at the 5' end
(d) palindromic sequence of base pairs.

The most common substrate used in distilleries for the production of ethanol is
(a) corn meal   (b) soya meal
(c) ground gram   (d) molasses

Ground tissue includes
(a) all tissues external to endodermis
(b) all tissues except epidermis and vascular bundles
(c) epidermis and cortex
(d) all tissues internal to endodermis.

Eutrophication is often seen in
(a) deserts   (b) fresh water lakes
(c) ocean   (d) mountains

Which one of the following elements in plants is not remobilised?
(a) phosphorus   (b) calcium
(c) potassium   (d) sulphur

Where will you look for the sporozoites of the malarial parasite?
(a) saliva of infected female *Anopheles* mosquito
(b) red blood corpuscles of human suffering from malaria
(c) spleen of infected humans
(d) salivary glands of freshy moulted female *Anopheles* mosquito.

'Himgiri' developed by hybridisation and selection for disease resistance against rust pathogens is a variety of
(a) chilli   (b) maize
(c) sugarcane   (d) wheat

Of the total incident solar radiation the proportion of PAR is
(a) about 70%   (b) about 60%
(c) less than 50%   (d) more than 80%

Which one of the following is not a part of a renal pyramid?
(a) peritubular capillaries (b) convoluted tubules
(c) collecting ducts   (d) loop of Henle

Which one of the following is correct expanded form of the acronym?
(a) IPCC = International Panel for Climate Change
(b) UNEP = United Nations Environmental Policy
(c) EPA = Environmental Pollution Agency
(d) IUCN = International Union for Conservation of Nature and Natural Resources.

Which one of the following pairs of gases are the major cause of "greenhouse effect"?

(a) CO_2 and O_3 (b) CO_2 and CO
(c) CFCs and SO_2 (d) CO_2 and N_2O

119. Which one of the following conditions correctly describes the manner of determining the sex?
(a) homozygous sex chromosomes (ZZ) determine female sex in birds
(b) XO type of sex chromosomes determine male sex in grasshopper
(c) XO condition in humans as found in Turner's syndrome, determines female sex
(d) homozygous sex chromosomes (XX) produce male in *Drosophila*.

120. Nucellar polyembryony is reported in species of
(a) *Citrus*   (b) *Gossypium*
(c) *Triticum*   (d) *Brassica*

121. Important site for formation of glycoproteins and glycolipids is
(a) vacuole   (b) Golgi apparatus
(c) plastid   (d) lysosome

122. Which one of the following is not a biofertilizer?
(a) *Agrobacterium*   (b) *Rhizobium*
(c) *Nostoc*   (d) *Mycorrhiza*

123. Secondary sewage treatment is mainly a
(a) physical process   (b) mechanical process
(c) chemical process   (d) biological process

124. At which stage of HIV infection does one usually show symptoms of AIDS?
(a) when the infecting retrovirus enters host cells
(b) when viral DNA is produced by reverse transcriptase
(c) when HIV replicates rapidly in helper T-lymphocytes and damages large number of these
(d) within 15 days of sexual contact with an infected person.

125. Which one of the following pollinations is autogamous?
(a) geitonogamy   (b) xenogamy
(c) chasmogamy   (d) cleistogamy

126. The figure given below shows a small part of human lung where exchange of gases takes place. Select the option which represents labelled part (A, B, C or D) correctly identified along with its function.
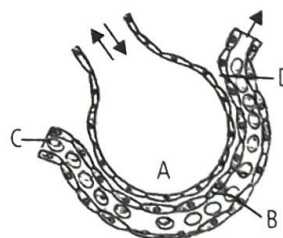
(a) C : arterial capillary - passes oxygen to tissues
(b) A : alveolar cavity - main site of exchange of respiratory gases
(c) D : capillary wall - exchange of O_2 and CO_2 takes place here
(d) B : red blood cells - transport of CO_2 mainly.

127. 'Bundle of His' is a part of which one of the following organs in humans?

(a) brain
(b) heart
(c) kidney
(d) pancreas

128. Which of the following is mainly produced by the activity of anaerobic bacteria on sewage?
(a) laughing gas
(b) propane
(c) mustard gas
(d) marsh gas

129. The "eyes" of the potato tuber are
(a) root buds
(b) flower buds
(c) shoot buds
(d) axillary buds

130. Match the source gland with its respective hormone and function and select the correct option.

	Source gland	Hormone	Function
(a)	anterior pituitary	oxytocin	contraction of uterus muscles during child birth
(b)	posterior pituitary	vasopressin	stimulates resorption of water in the distal tubules in the nephron
(c)	corpus luteum	oestrogen	supports pregnancy
(d)	thyroid	thyroxine	regulates blood calcium level

131. Which one of the following have the highest number of species in nature?
(a) fungi
(b) insects
(c) birds
(d) angiosperms

132. Which one of the following statements is correct?
(a) in tomato, fruit is a capsule
(b) seeds of orchids have oil-rich endosperm
(c) placentation in primose is basal
(d) flower of tulip is a modified shoot

133. Peptide synthesis inside a cell takes place in
(a) chloroplast
(b) mitochondria
(c) chromoplast
(d) ribosomes.

134. Which one of the following groups of animals is correctly matched with its characteristic feature without any exception?
(a) reptilia : possess 3-chambered heart with an incompletely divided ventricle.
(b) chordata : possess a mouth with an upper and a lower jaw
(c) chondrichthyes : possess cartilaginous endoskeleton.
(d) mammalia : give birth to young ones.

135. Large woody vines are more commonly found in
(a) temperate forests
(b) mangroves
(c) tropical rainforests
(d) alpine forests

136. An organism used as a biofertilizer for raising soyabean crop is
(a) *Azotobacter*
(b) *Azospirillum*
(c) *Rhizobium*
(d) *Nostoc*

137. Which one of the following plasma proteins is involved in the coagulation of blood?
(a) albumin
(b) serum amylase
(c) globulin
(d) fibrinogen

138. Ethanol is commercially produced through a particular species of
(a) *Saccharomyces*
(b) *Clostridium*
(c) *Trichoderma*
(d) *Aspergillus*

139. Which one of the following structural formulae of two organic compounds is correctly identified along with its related function?
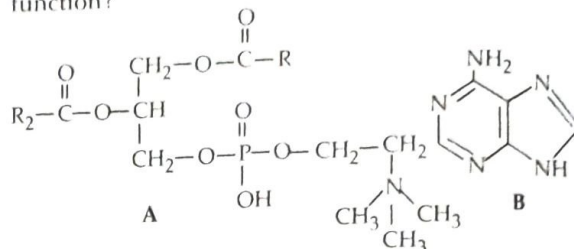
(a) B : adenine - a nucleotide that makes up nucleic acids
(b) A : triglyceride - major source of energy
(c) B : uracil - a component of DNA
(d) A : lecithin - a component of cell membrane.

140. Which one of the following organisms is not an eukaryote?
(a) *Paramecium caudatum*
(b) *Escherichia coli*
(c) *Euglena viridis*
(d) *Amoeba proteus*

141. Given below is an incomplete table on hormones, their source glands and one major effect of each on human body. Identify the option representing correct grouping of hormone its gland and effect.

Gland	Secretion	Effect on body
A	Oestrogen	Maintenance of secondary sexual characters
Alpha cells of Islets of Langerhans	B	Raises blood sugar level
Anterior pituitary	C	Over secretion leads to gigantism

	A	B	C
(a)	ovary	glucagon	growth hormone
(b)	placenta	insulin	vasopressin
(c)	ovary	insulin	calcitonin
(d)	placenta	glucagon	calcitonin

142. What are the structures called that give an appearance as 'beads-on-string' in the chromosomes when viewed under electron microscope?
(a) genes
(b) nucleotides
(c) nucleosomes
(d) base pairs

143. Nitrifying bacteria
(a) oxidize ammonia to nitrates
(b) convert free nitrogen to nitrogen compounds
(c) convert proteins into ammonia
(d) reduce nitrates to free nitrogen.

144. Archegoniophore is present in
(a) *Marchantia*
(b) *Chara*
(c) *Adiantum*
(d) *Funaria*

146. There is a restriction endonuclease called *Eco* R I. What does "co" part in it stand for?

(a) colon
(b) coelom
(c) coenzyme
(d) coli

147. A large proportion of oxygen remains unused in the human blood even after its uptake by the body tissues. This O_2

(a) acts as a reserve during muscular exercise
(b) raises the pCO_2 of blood to 75 mm of Hg.
(c) is enough to keep oxyhaemoglobin saturation at 96%
(d) helps in releasing more O_2 to the epithelial tissues.

148. In land plants, the guard cells differ from other epidermal cells in having

(a) cytoskeleton
(b) mitochondria
(c) endoplasmic reticulum
(d) chloroplasts

149. Which one of the following is the most widely accepted method of contraception in India at present?

(a) cervical caps
(b) tubectomy
(c) diaphragms
(d) IUDs (Intra Uterine Devices)

149. The ciliated columnar epithelial cells in humans are known to occur in

(a) Eustachian tube and stomach lining
(b) bronchioles and Fallopian tube
(c) bile duct and oesophagus
(d) Fallopian tube and urethra

150. Two friends are eating together on a dining table. One of them suddenly starts coughing while swallowing some food. This coughing would have been due to improper movement of

(a) epiglottis
(b) diaphragm
(c) neck
(d) tongue

151. What would be the number of chromosomes of the aleurone cells of a plant with 42 chromosomes in its root tip cells?

(a) 42
(b) 63
(c) 84
(d) 21

152. Consider the following four conditions (1 - 4) and select a correct pair of them as adaptation to environment in desert lizards.

Conditions:
1. Burrowing in soil to escape high temperature.
2. Losing heat rapidly from the body during high temperature.
3. Bask in sun when temperature is low.
4. Insulating body due to thick fatty dermis.

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

153. Maximum number of existing transgenic animals is of

(a) fish
(b) mice
(c) cow
(d) pig

154. Which one of the following statements is correct for secondary succession?

(a) it begins on a bare rock
(b) it occurs on a deforested site
(c) it follows primary succession
(d) it is similar to primary succession except that it has a relatively fast pace.

155. In eubacteria, a cellular component that resembles eukaryotic cell is

(a) plasma membrane
(b) nucleus
(c) ribosomes
(d) cell wall

156. A collection of plants and seed having diverse alleles of all the genes of a crop is called

(a) herbarium
(b) germplasm
(c) gene library
(d) genome

157. If for some reason, the vasa efferentia in the human reproductive system get blocked, the gametes will not be transported from

(a) testes to epididymis
(b) epididymis to vas deferens
(c) ovary to uterus
(d) vagina to uterus

158. Which one of the following correctly explains the function of a specific part of the human nephron?

(a) podocytes : create minute spaces (slit pores) for the filtration of blood into the Bowman's capsule
(b) Henle's loop : most reabsorption of the major substances from the glomerular filtrate
(c) distal convoluted tubule : reabsorption of K^+ ions into the surrounding blood capillaries
(d) afferent arteriole : carries the blood away from the glomerulus towards renal vein.

159. The correct floral formula of chilli is

(a) $\oplus \, \male\female \, K_{(5)} \, C_5 \, A_5 \, G_{(2)}$
(b) $\oplus \, \male\female \, K_{(5)} \, \overset{\curvearrowleft}{C_{(5)}} \, A_5 \, G_{(2)}$
(c) $\oplus \, \male\female \, K_{(5)} \, C_{(5)} \, A_{(5)} \, G_{\underline{2}}$
(d) $\oplus \, \male\female \, K_5 \, \overset{\curvearrowleft}{C_5} \, A_{(5)} \, G_{\underline{2}}$

160. Arteries are best defined as the vessels which

(a) supply oxygenated blood to the different organs
(b) carry blood away from the heart to different organs
(c) break up into capillaries which reunite to form a vein
(d) carry blood from one visceral organ to another visceral organ.

161. Which one of the following is categorised as a parasite in true sense?

(a) the female *Anopheles* bites and sucks blood from humans
(b) human foetus developing inside the uterus draws nourishment from the mother
(c) head louse living on the human scalp as well as laying eggs on human hair
(d) the cuckoo (koel) lays its eggs in crow's nest.

162. The testes in humans are situated outside the abdominal cavity inside a pouch called scrotum. The purpose served is for

(a) maintaining the scrotal temperature lower than the internal body temperature
(b) escaping any possible compression by the visceral organs
(c) providing more space for the growth of epididymis
(d) providing a secondary sexual feature for exhibiting the male sex.

163. Which one of the following statements is correct with respect to kidney function regulation?

(a) when someone drinks lot of water, ADH release is suppressed

(b) exposure to cold temperature stimulates ADH release

(c) an increase in glomerular blood flow stimulates formation of angiotensin II

(d) during summer when body loses lot of water by evaporation, the release of ADH is suppressed.

164. Agarose extracted from sea weeds is used in
(a) spectrophotometry   (b) tissue culture
(c) PCR   (d) gel electrophoresis

165. Which of the following happens in the common cockroach?
(a) Malpighian tubules are excretory organs projecting out from the colon
(b) oxygen is transported by haemoglobin in blood
(c) nitrogenous excretory product is urea
(d) the food is ground by mandibles and gizzard.

166. Which one of the following also acts as a catalyst in a bacterial cell?
(a) 5 S r RNA   (b) sn RNA
(c) hn RNA   (d) 23 S r RNA

167. Which one of the following acts as a physiological barrier to the entry of microorganisms in human body?
(a) epithelium of urogenital tract
(b) tears   (c) monocytes
(d) skin

168. The function of leghaemoglobin in the root nodules of legumes is
(a) inhibition of nitrogenase activity
(b) oxygen removal   (c) nodule differentiation
(d) expression of *nif* gene

169. The process of RNA interference (RNAi) has been used in the development of plants resistant to
(a) nematodes   (b) fungi
(c) viruses   (d) insects

170. Compared with the gametophytes of the bryophytes, the gametophytes of vascular plants tend to be
(a) smaller but to have larger sex organs
(b) larger but to have smaller sex organs
(c) larger and to have larger sex organs
(d) smaller and to have smaller sex organs.

171. The gametophyte is not an independent, free-living generation in
(a) *Polytrichum*   (b) *Adiantum*
(c) *Marchantia*   (d) *Pinus*

172. The cork cambium, cork and secondary cortex are collectively called
(a) phelloderm   (b) phellogen
(c) periderm   (d) phellem

173. Which one of the following statements for the pyramid of energy is incorrect?
(a) its base is broad
(b) it shows energy content of different trophic level organisms
(c) it is inverted in shape (d) it is upright in shape

174. Select the correct option with respect to mitosis.
(a) chromatids separate but remain in the centre of the cell in anaphase
(b) chromatids start moving towards opposite poles in telophase
(c) Golgi complex and endoplasmic reticulum are still visible at the end of prophase.
(d) chromosomes move to the spindle equator and get aligned along equatorial plate in metaphase.

175. Uricotelic mode of excreting nitrogenous wastes is found in
(a) reptiles and birds   (b) birds and annelids
(c) amphibians and reptiles
(d) insects and amphibians

176. Flowers are zygomorphic in
(a) mustard   (b) gulmohur
(c) tomato   (d) *Datura*

177. Which one of the following statements is correct regarding blood pressure.
(a) 130/90 mm Hg is considered high and requires treatment
(b) 100/55 mm Hg is considered an ideal blood pressure
(c) 105/50 mm Hg makes one very active
(d) 190/110 mm Hg may harm vital organs like brain and kidney

178. Medical Termination of Pregnancy (MTP) is considered safe up to how many weeks of pregnancy?
(a) eight weeks   (b) twelve weeks
(c) eighteen weeks   (d) six weeks

179. The ovary is half inferior in flowers of
(a) peach   (b) cucumber
(c) cotton   (d) guava

180. When two unrelated individuals or lines are crossed, the performance of F_1 hybrid is often superior to both its parents. This phenomenon is called
(a) heterosis   (b) transformation
(c) splicing   (d) metamorphosis

181. Mutations can be induced with
(a) infra red radiations   (b) IAA
(c) ethylene   (d) gamma radiations

182. Which one of the following helps in absorption of phosphorus from soil by plants?
(a) *Glomus*   (b) *Rhizobium*
(c) *Frankia*   (d) *Anabaena*

183. When a neuron is in resting state *i.e.* not conducting any impulse, the axonal membrane is
(a) comparatively more permeable to Na⁺ ions and nearly impermeable to K⁺ ions
(b) equally permeable to both Na⁺ and K⁺ ions
(c) impermeable to both Na⁺ and K⁺ ions
(d) comparatively more permeable to K⁺ ions and nearly impermeable to Na⁺ ions.

184. A patient is suspected to be suffering from Acquired Immuno Deficiency Syndrome (AIDS). Which diagnostic technique will you recommend for its detection?

(a) ELISA   (b) MRI
(c) ultra sound   (d) WIDAL

186. Continuous addition of sugars in 'fed batch' fermentation is done to
(a) produce methane   (b) obtain antibiotics
(c) purify enzymes   (d) degrade sewage

187. The purplish red pigment rhodopsin contained in the rods type of photoreceptor cells of the human eye, is a derivative of
(a) vitamin B_1 (b) vitamin C
(c) vitamin D   (d) vitamin A

188. Wind pollination is common in
(a) legumes   (b) lilies
(c) grasses   (d) orchids

189. Which one of the following is incorrectly matched?
(a) root pressure-guttation
(b) *Puccinia*-smut
(c) root-exarch protoxylem
(d) *Cassia*-imbricate aestivation

189. A drupe develops in
(a) mango   (b) wheat
(c) pea   (d) tomato

190. Which one of the following enzymes carries out the initial step in the digestion of milk in humans?
(a) pepsin   (b) rennin
(c) lipase   (d) trypsin

191. CAM helps the plants in
(a) conserving water   (b) secondary growth
(c) disease resistance   (d) reproduction.

192. Which one of the following animals is correctly matched with its particular taxonomic category?
(a) tiger-*Tigris*, species   (b) cuttlefish-mollusca, class
(c) humans-primatta, family
(d) housefly-*Musca*, order.

193. Organisms called methanogens are most abundant in a
(a) sulphur rock   (b) cattle yard
(c) polluted stream   (d) hot spring

194. What was the most significant trend in the evolution of modern man (*Homo sapiens*) from his ancestors?
(a) upright posture   (b) shortening of jaws
(c) binocular vision   (d) increasing brain capacity

**195.** In which one of the following the genus name, its two characters and its class/phylum are correctly matched?

	Genus name		Two characters	Class/ Phylum
(a)	*Ascaris*	(i)	body segmented	annelida
		(ii)	males and females distinct	
(b)	*Salamandra*	(i)	a tympanum represents ear	amphibia
		(ii)	fertilization is external	
(c)	*Pteropus*	(i)	skin possesses hair	mammalia
		(ii)	oviparous	
(d)	*Aurelia*	(i)	cnidoblasts	coelenterata
		(ii)	organ level of organization	

196. Which one of the following statements is incorrect in case of Bhopal tragedy?
(a) methyl isocyanate gas leakage took place
(b) thousands of human beings died
(c) radioactive fall out engulfed Bhopal
(d) it took place in the night of December 2/3, 1984.

197. Which one of the following shows maximum genetic diversity in India?
(a) groundnut   (b) rice
(c) maize   (d) mango

198. The figure given below depicts a diagrammatic sectional view of the human female reproductive system. Which set of three parts out of I-VI have been correctly identified?

(a) (II) endometrium, (III) infundibulum, (IV) fimbriae
(b) (III) infundibulum, (IV) fimbriae, (V) cervix
(c) (IV) oviducal funnel, (V) uterus, (VI) cervix
(d) (I) perimetrium, (II) myometrium, (III) Fallopian tube

199. A person with unknown blood group under ABO system, has suffered much blood loss in an accident and needs immediate blood transfusion. His friend who has valid certificate of his own blood type, offers for blood donation without delay. What would have been the type of blood group of the donor friend?
(a) Type B   (b) Type AB
(c) Type O   (d) Type A

200. The curve given below shows enzymatic activity in relation to three conditions (pH, temperature and substrate concentration).
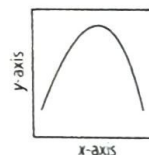
What do the two axises (x and y) represent?

	x-axis	y-axis
(a)	enzymatic activity	pH
(b)	temperature	enzyme activity
(c)	substrate concentration	enzymatic activity
(d)	enzymatic activity	temperature