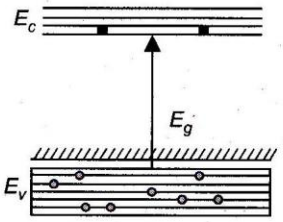
1. In radioactive decay process, the negatively charged emitted β-particles are
   (a) the electrons present inside the nucleus
   (b) the electrons produced as a result of the decay of neutrons inside the nucleus
   (c) the electrons produced as a result of collisions between atoms
   (d) the electrons orbiting around the nucleus

2. The resistance of an ammeter is 13Ω and its scale is graduated for a current upto 100 A. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750 A by this meter. The value of shunt resistance is
   (a) 20Ω (b) 2Ω
   (c) 0.2Ω (d) 2 kΩ

3. The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flux f linked with the primary coil is given by $\phi = \phi_0 + 4t$, where ϕ is in weber, t is time in second and ϕ_0 is a constant, the output voltage across the secondary coil is
   (a) 90 V (b) 120 V
   (c) 220 V (d) 30 V

4. In the energy band diagram of a material shown below, the open circles and filled circles denote holes and electrons respectively. The material is a/an



   (a) p–type semiconductor
   (b) insulator
   (c) metal
   (d) n–type semiconductor

5. Two radioactive substances A and B have decay constants 5λ and λ respectively. At $t = 0$ they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be $\left(\frac{1}{e}\right)^2$ after a time interval
   (a) $\frac{1}{4\lambda}$ (b) 4λ
   (c) 2λ (d) $\frac{1}{2\lambda}$

6. A charged particle (charge q) is moving in a circle of radius R with uniform speed v. The associated magnetic moment μ is given by
   (a) $\frac{qvR}{2}$ (b) qvR^2
   (c) $\frac{qvR^2}{2}$ (d) qvR

7. A common emitter amplifier has a voltage gain of 50, an input impedance of 100Ω and an output impedance of 200Ω. The power gain of the amplifier is
   (a) 500 (b) 1000
   (c) 1250 (d) 100

8. Specific rotation of sugar solution is 0.01 SI units. 200 kg-m^{-3} of impure sugar solution is taken in a polarimeter tube of length 0.25 m and an optical rotation of 0.4 rad is observed. The percentage of purity of sugar in the sample is
   (a) 11% (b) 20%
   (c) 80% (d) 89%

9. A beam of parallel rays is brought to focus by a plano–convex lens. A thin concave lens of the same focal length is joined to the first lens. The effect of this is

(a) the focus shifts to infinity

(b) the focal point shifts towards the lens by a small distance

(c) the focal point shifts away from the lens by a small distance

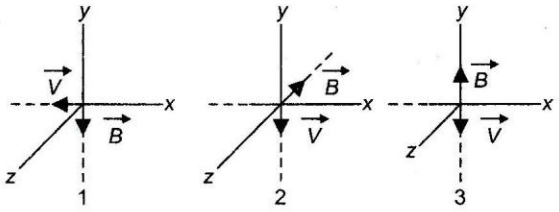
(d) the focus remains undisturbed

10. A ray of light is incident on the surface of a glass plate of thickness t. If the angle of incidence θ is small, the emerging ray would be displaced side ways by an amount [Take n = refractive index of glass)

(a) $t\,\theta\,n/(n+1)$ (b) $t\,\theta\,(n-1)/n$

(c) $t\,\theta\,n/(n-1)$ (d) $t\,\theta\,(n+1)/n$

11. The figure shows three situations when an electron with velocity $\vec{v}$ travels through a uniform magnetic field $\vec{B}$. In each case, what is the direction of magnetic force on the electron?



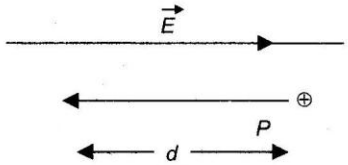
(a) +ve z-axis, –ve x-axis, +ve y-axis

(b) –ve z-axis, –ve x-axis and zero

(c) +ve z-axis, +ve y-axis and zero

(d) –ve z-axis, +ve x-axis and zero

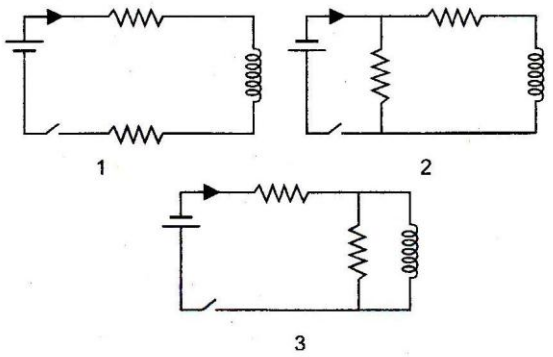
12. In the figure, a proton moves a distance d in a uniform electric $\vec{E}$ as shown in the figure. Does the electric field do a positive or negative work on the proton? Does the electric potential energy of the proton increase or decrease?



(a) Negative, increase (b) Positive, decrease

(c) Negative, decrease (d) Positive, increase

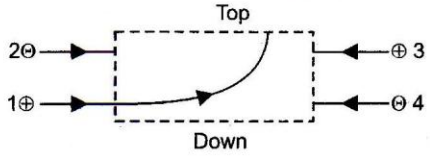
13. The figure shows three circuits with identical batteries, inductors and resistance. Rank the circuits according to the currents through the battery just after the switch is closed, greatest first.



(a) $i_2 > i_3 > i_1$ (b) $i_2 > i_1 > i_3$

(c) $i_1 > i_2 > i_3$ (d) $i_1 > i_3 > i_2$

14. The figure shows the path of a positively charged particle 1 through a rectangular region of uniform electric field as shown in the figure. What is the direction of electric field and the direction of deflection of particles 2, 3 and 4?



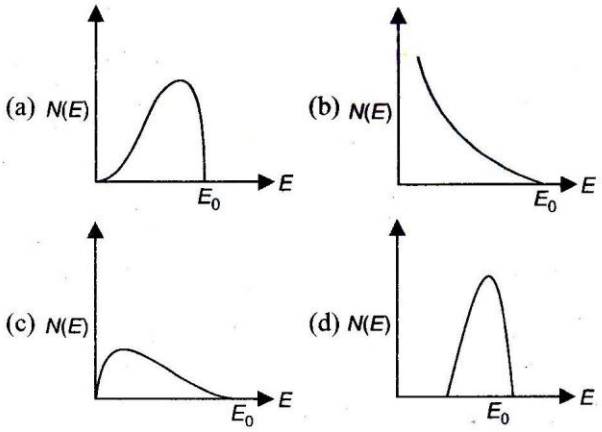
(a) Top; down, top, down

(b) Top; down, **down**, top

(c) Down; top, **top**, down

(d) Down; top, **down**, down

15. The energy spectrum of β–particles [number $N(E)$ as a function of β–energy E] emitted from a radioactive source is

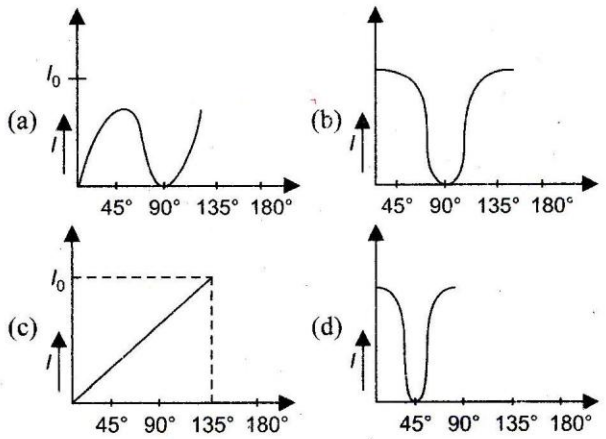


16. In a detector, output circuit consists of $R = 10\ k\Omega$ and $C = 100\ \mu F$. The frequency of carrier signal it can detect is

(a) >> 1 MHz (b) 0.1 kHz

(c) > > 1 GHz (d) 10^3 Hz

17. The graph showing the dependence of intensity of transmitted light on the angle between polariser and analyser, is



18. Energy from the sun is received on earth at the rate of 2 cal per cm^2 per min. If average wavelength of solar light be taken at 5500 A then how many photons are received on the earth per cm^2 per min?

($h = 6.6 \times 10^{-34}$ J-s, 1 cal = 4.2 J)

(a) 1.5×10^{13} (b) 2.9×10^{13}

(c) 2.3×10^{19} (d) 1.75×10^{19}

19. A beam of 35.0 keV electrons strikes a molybdenum target, generating the X-rays. What is the cutoff wavelength?

(a) 35.5 pm (b) 40.0 pm

(c) 15.95 pm (d) 18.2 pm

20. We have seen that a gamma–ray dose of 3 Gy is lethal to half the people exposed to it. If the equivalent energy were absorbed as heat, what rise in body temperature would result?

(a) 300 μK (b) 700 μK

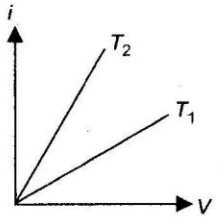
(c) 455 μK (d) 390 μK

21. Mass spectrometric analysis of potassium and argon atoms in a Moon rock sample shows that the ratio of the number of (stable) ^{40}Ar atoms present to the number of (radioactive) ^{40}K atoms is 10.3. Assume that all the argon atoms were produced by the decay of potassium atoms, with a half–life of 1.25×10^9 yr. How old is the rock?

(a) 2.95×10^{11} yr (b) 2.95×10^9 yr

(c) 4.37×10^9 yr (d) 4.37×10^{11} yr

22. The current i and voltage V graphs for a given metallic wire at two different temperatures T_1 and T_2 are shown in the figure. It is concluded that



(a) $T_1 > T_2$ (b) $T_1 < T_2$

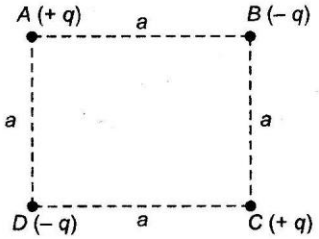
(c) $T_1 = T_2$ (d) $T_1 = 2T_2$

23. An electric bulb marked 40 W and 200 V, is used in a circuit of supply voltage 100 V. Now, its power is

(a) 10 W (b) 20 W

(c) 40 W (d) 100 W

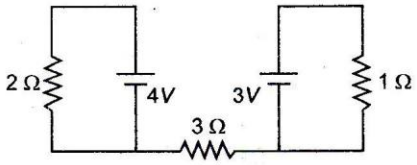
24. There are four point charges $+q$, $-q$, $+q$ and $-q$ are placed at the corners A, B, C, and D respectively of a square of side a. The potential energy of the system is $\frac{1}{4\pi\varepsilon_0}$ times



(a) $\frac{q^2}{a}(-4+\sqrt{2})$ (b) $\frac{q^2}{2a}(-4+\sqrt{2})$

(c) $\frac{4q^2}{a}$ (d) $\frac{-4\sqrt{2}\,q^2}{a}$

25. The potential difference across the 3 resistor shown in figure is



(a) zero (b) 1 V

(c) 3.5 V (d) 7 V

26. There are N cells in the circuit of figure. The emf and internal resistance of each cell is E and r respectively. The points A and B in the circuit divide the circuit into n and $(N-n)$ cells. The current in the circuit is

(a) E/r (b) nE/r

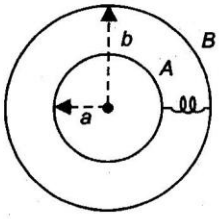
(c) NE/nr (d) zero

27. The earth's magnetic field at a certain place has a horizontal component of 0.3 G and total strength 0.5 G. Find angle of dip in $\tan^{-1}$.

(a) $\delta = \tan^{-1}\frac{4}{3}$ (b) $\delta = \tan^{-1}\frac{3}{4}$

(c) $\delta = \tan^{-1}\frac{5}{3}$ (d) $\delta = \tan^{-1}\frac{3}{5}$

28. Two spherical conductors A and B of radii a and b ($b > a$) are placed concentrically in air. The two arc connected by a copper wire as shown in figure. The equivalent capacitance of the system is



(a) $\frac{4\pi\varepsilon_0 ab}{b-a}$ (b) $4\pi\varepsilon_0 (a+b)$

(c) $4\pi\varepsilon_0 b$ (d) $4\pi\varepsilon_0 a$

29. The magnetic flux linked with the coil varies with time as $\phi = 3t^2 + 4t + 9$. The magnitude of the induced emf of 2 s is

(a) 9 V (b) 16 V

(c) 3 V (d) 4 V

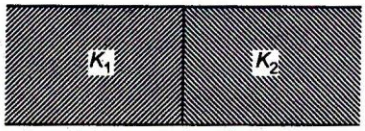
30. A concave mirror having the focal length 15 cm, forms an image having twice of the linear dimensions of the object. If the image is virtual, then the position of the object will be

(a) 7.5 cm (b) 22.5 cm

(c) 40 cm (d) 30 cm

31. Two material having the dielectric constants K_1 and K_2 are filled between two parallel plates of a capacitor.

Where area of each plate is A and the distance between the plates is d.



The capacity of the capacitor is:

(a) $\frac{A\varepsilon_0 (K_1 \times K_2)}{d(K_1 + K_2)}$ (b) $\frac{A\varepsilon_0 (K_1 - K_2)}{d}$

(c) $\frac{A\varepsilon_0 K_1 K_2}{(K_1 + K_2)}$ (d) $\frac{A\varepsilon_0 (K_1 + K_2)}{d}$

32. A closely wound flat circular coil of 25 turns of wire has diameter of 10 cm which carries current of 4 A, the flux density at the centre of a coil will be

(a) 1.256×10^{-3} T (b) 1.679×10^{-5} T

(c) 1.512×10^{-5} T (d) 2.28×10^{-4} T

33. Four lenses having the focal length of + 15 cm, 20 cm, + 150 cm, and + 250 cm respectively are provided to make an astronomical telescope. The focal length of the eyepiece to produce the largest magnification, should be

(a) + 250 cm (b) + 150 cm

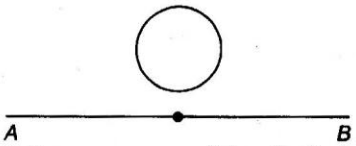
(c) + 20 cm (d) + 15 cm

34. The point charges Q and $-2Q$ are placed at some distance apart. If the electric field at the location of Q is E, the electric field at the location of $-2Q$ will be

(a) $-\frac{3E}{2}$ (b) $-E$

(c) $-\frac{E}{2}$ (d) $-2E$

35. The current flows from A to B as shown in figure, then the direction of the induced current in the loop will be :



(a) straight line (b) anti–clockwise

(c) clockwise (d) none of the above

36. The cell has an emf of 2 V and the internal resistance of this cell is 0.1 Ω, it is connected to resistance of 3.9 Ω, the voltage across the cell will be

(a) 1.95 V (b) 1.5 V

(c) 2 V (d) 1.8 V

37. In a circuit, the current lags behind the voltage by a phase difference of $\pi/2$, the circuit will contain which of the following?

(a) only R (b) only C

(c) R and C (d) only L

38. The current gain for a transistor working a common–base amplifier is 0.96. If the emitter current is 7.2 mA, the base current will be

(a) 0.42 mA (b) 0.49 mA

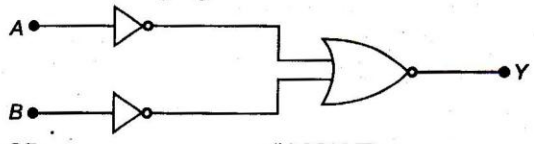
(c) 0.29 mA (d) 0.35 mA

39. When a wire is stretched and its radius becomes $r/2$ then its resistance will be

(a) zero (b) 2 R

(c) 8 R (d) 16 R

40. Which logic gate is represented by the following combination of logic gates?



(a) OR (b) NAND

(c) AND (d) NOR

Directions for Q. 41 to Q. 45: In each of the following questions a statement of Assertion is followed by a corresponding statement of Reason. Mark the correct answer as:

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of assertion.

(c) If assertion is true but reason is false.

(d) If both assertion and reason are false.

41. **Assertion:** Light emitting diode (LED) emits spontaneous radiation.

    Reason: LED are forward biased *p-n* junctions.

42. **Assertion:** The pattern and position of fringes always remain same even after the introduction of transparent medium in a path of one of the slits.

    Reason: The central fringe is bright or dark does not depend upon the initial phase difference between the two coherence sources.

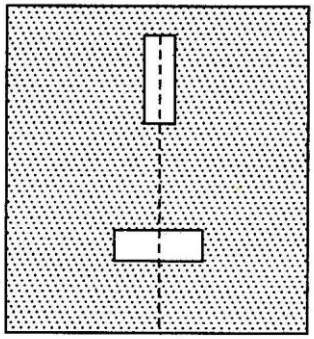
43. **Assertion:** A biconvex lens of focal length 10 cm is split into two equal parts by a plane parallel to its principal axis. The focal length of the each part will be 20 cm.

    Reason: Focal length does not depend on the radii of curvature of two surfaces.

44. **Assertion:** The lightning conductor at the top of high building has sharp pointed ends.

    Reason: The surface density of charge at sharp points is very high resulting in setting up of electric wind.

45. **Assertion:** Two short magnets are placed on a cork which floats on water. The magnets are placed such that the axis of one produced bisects the axis of other at right angles. Then the cork has neither translational nor rotational motion.



Reason: Net force on the cork is zero.

SECTION 2 - CHEMISTRY

46. Among the following pairs of ions, the lower oxidation state in aqueous solution is more stable than the other, in :

(a) Ti^{+}, Ti^{3+} (b) Cu^{+}, Cu^{2+}

(c) Cr^{2+}, Cr^{3+} (d) V^{2+}, VO^{2+}

47. If NaCl is doped with 10^{-4} mol % of $SrCl_2$, the concentration of cation vacancies will be ($N_A = 6.02 \times 10^{23} mol^{-1}$)

(a) $6.02 \times 10^{16} mol^{-1}$ (b) $6.02 \times 10^{17} mol^{-1}$

(c) $6.02 \times 10^{14} mol^{-1}$ (d) $6.02 \times 10^{15} mol^{-1}$

48. Which of the following isomerism is exhibited by $CH_3 - O - C_3H_7$ and $C_2H_5OC_2H_5$

(a) optical isomerism

(b) chain isomerism

(c) metamerism

(d) position isomerism

49. Which of the following statements, about the advantage of roasting of sulphide ore before reduction is not true?

(a) The ΔG_f^o of the sulphide is greater than those for CS_2 and H_2S.

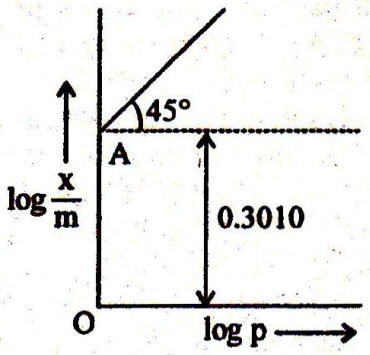
(b) The ΔG_f^o is negative for roasting of sulphide ore to oxide.

(c) Roasting of the sulphide to the oxide is thermodynamically feasible.

(d) Carbon and hydrogen are suitable reducing agents for metal sulphides.

50. Graph between $\log\left(\frac{x}{m}\right)$ and log p is a straight line at angle 45° with intercept OA as shown.

Hence, $\left(\frac{x}{m}\right)$ at a pressure of 0.2 atm is



(a) 0.2 (b) 0.4

(c) 0.6 (d) 0.8

51. The correct order of increasing $[H_3O^+]$ in the following aqueous solutions is

(a) 0.01 M H_2S < 0.01M H_2SO_4 < 0.01 M NaCl < 0.01M $NaNO_2$

(b) 0.01 M NaCl < 0.01 M $NaNO_2$ < 0.01 M H_2S < 0.01M H_2SO_4

(c) 0.01 M $NaNO_2$ < 0.01 M NaCl < 0.01 M H_2S < 0.01 M H_2SO_4

(d) 0.01 M H_2S < 0.01 M $NaNO_2$ < 0.01 M NaCl < 0.01 M H_2SO_4

52. Pollution in large cities can be checked only by

(a) Shifting of factories out of the residential area

(b) Less use of insecticides

(c) Proper disposal of organic wastes, sewage and industrial effluents

(d) All the above

53. All form ideal solution except

(a) C_6H_6 and $C_6H_5CH_3$

(b) C_2H_6 and C_2H_5I

(c) C_6H_5Cl and C_6H_5Br

(d) C_2H_5I and C_2H_5OH.

54. Which of the following metal ions will form complexes with the same magnetic moment and geometry irrespective of the nature of ligands?

(a) Ni^{2+} (b) Fe^{2+}

(c) Cu^{2+} (d) Co^{2+}

55. A straight chain hydrocarbon has the molecular formula C_8H_{10}. The hybridization of the carbon atoms from one end of the chain to the other are respectively sp^3, sp^2, sp^2, sp^3, sp^2, sp and sp. The structural formula of the hydrocarbon would be :
(a) $CH_3C \equiv CCH_2-CH=CHCH=CH_2$
(b) $CH_3CH_2-CH=CHCH=CHC \equiv CH$
(c) $CH_3CH=CHCH_2-C \equiv CCH=CH_2$
(d) $CH_3CH=CHCH_2-CH-CH-C \equiv CH$.

56. Enthalpy and entropy change for a chemical reaction are -2.5×10^3 cals and 7.4 cals deg^{-1} respectively. At 25°C the reaction is
(a) Reversible (b) Irreversible
(c) Spontaneous (d) Non spontaneous

57. Which of the following has correct increasing basic strength ?
(a) $MgO < BeO < CaO < BaO$
(b) $BeO < MgO < CaO < BaO$
(c) $BaO < CaO < MgO < BeO$
(d) $CaO < BaO < BeO < MgO$

58. One litre of 1 M $CuSO_4$ solution is electrolysed. After passing 2 F of electricity, molarity of $CuSO_4$ solution will be
(a) $\frac{M}{2}$ (b) $\frac{M}{4}$
(c) M (d) 0

59. Which of the following is commercially known as oxone ?
(a) $Na_2O_2 + HCl$ (b) $Na_2O + HCl$
(c) $Na_2O_2 + Na_2O$ (d) none of these

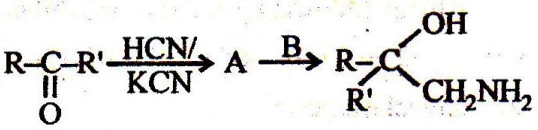
60. $M(OH)_x$ has $K_{sp} = 4 \times 10^{-4}$ M. Hence, x is
(a) 1 (b) 2
(c) 3 (d) 4

61. Which is not correct regarding the adsorption of a gas on surface of solid?
(a) On increasing temperature, adsorption increases contineuously
(b) Enthalpy and entropy changes are –ve
(c) Adsorption is more for some specific substance
(d) This Phenomenon is reversible

62. At its melting point ice is lighter than water because
(a) H_2O molecules are more closely packed in solid state
(b) Ice crystals have hollow hexagonal arrangement of H_2O molecules.
(c) On melting of ice the H_2O molecule shrinks in size
(d) Ice froms mostly heavy water on first melting.

63. The most suitable method for separtion of a 1 : 1 mixture of ortho and para nitrophenols is
(a) Sublimation (b) Chromatography
(c) Crystallization (d) Steam distillation

64. A and B in the following reactions are



(a) A = RR'C(CN)(OH), B = $LiAlH_4$
(b) A = RR'C(OH)(COOH), B = NH_3
(c) A = RR'C(CN)(OH), B = $H_3O^{\oplus}$
(d) A = $RR'CH_2CN$, B = NaOH

65. On adding 0.1 M solution each of $[Ag^+]$, $[Ba^{2+}]$, $[Ca^{2+}]$ in a Na_2SO_4 solution, species first precipitated is
[K_{sp} $BaSO_4 = 10^{-11}$, K_{sp} $CaSO_4 = 10^{-6}$, K_{sp} $Ag_2SO_4 = 10^{-5}$]
(a) Ag_2SO_4 (b) $BaSO_4$
(c) $CaSO_4$ (d) All of these

66. Which one of the following statements concerning lanthanide elements is false?
(a) Lanthanides are separated from one another by ion exchange method
(b) The ionic radii of trivalent lanthanides steadily increase with increase in atomic number
(c) All lanthanides are highly dense metals
(d) Most characteristic oxidation state of lanthanides is +3

67. The fraction of total volume occupied by the atoms present in a simple cube is

(a) $\frac{\pi}{3\sqrt{2}}$ (b) $\frac{\pi}{4\sqrt{2}}$

(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

68. The hypothetical complex chlorodiaquotri-ammine cobalt (III) chloride can be represented as

(a) $[CoCl(NH_3)_3(H_2O)_2]Cl_2$
(b) $[Co(NH_3)_3(H_2O)Cl_3]$
(c) $[Co(NH_2)_3(H_2O)_2Cl]$
(d) $[Co(NH_3)_3(H_2O)_3]Cl_3$

69. Which of the following may be considered to be an organometallic compound?

(a) Nickel tetracarbonyl
(b) Chlorophyll
(c) $K_3[Fe(C_2O_4)_3]$
(d) $[Co(en)_3]Cl_3$

70. If K_1 and K_2 are respective equilibrium constants for the two reactions

$XeF_6(g) + H_2O(g) \rightleftharpoons XeOF_4(g) + 2HF(g)$

$XeO_4(g) + XeF_6(g) \rightleftharpoons XeOF_4(g) + XeO_3F_2(g)$

the equilibrium constant for the reaction

$XeO_4(g) + 2HF(g) \rightleftharpoons XeO_3F_2(g) + H_2O(g)$

will be

(a) $\frac{K_1}{K_2^2}$ (b) $K_1.K_2$

(c) $\frac{K_1}{K_2}$ (d) $\frac{K_2}{K_1}$

71. Alkyl halide on heating with dry Ag_2O produces

(a) ether (b) ester
(c) ketone (d) hydrocarbon

72. In the following reaction 'A' is

$$C_2H_5MgBr + H_2C\underset{O}{\diagdown\diagup}CH_2 \xrightarrow{H_2O} A$$

(a) $C_2H_5CH_2CHO$ (b) $C_2H_5CH_2CH_2OH$
(c) $C_2H_5CH_2OH$ (d) C_2H_5CHO

73. The standard electrode potentials of four elements A, B, C and D are –3.05, –1.66, –0.40 and +0.80. The highest chemical reactivity will be exhibited by :

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

74. Causticisation is a process in which

(a) soap is prepared by treating vegetable oils with caustic soda
(b) paper is formed
(c) petroleum is treated with caustic soda before fractional distillation
(d) caustic soda is manufactured by treating sodium carbonate with lime.

75. Which of the following statements is incorrect regarding benzyl chloride?

(a) It gives white precipitate with alcoholic $AgNO_3$
(b) It is an aromatic compound with substitution in the side chain
(c) It undergoes nucleophilic substitution reaction
(d) It is less reactive than vinyl chloride

76. One mole of an ideal gas is allowed to expand reversibly and adiabatically from a temperature of 27°C. If the work done during the process is 3 kJ, then final temperature of the gas is ($C_v = 20$ J/K)

(a) 100 K (b) 150 K
(c) 195 K (d) 255 K

77. Chemically borax is

(a) Sodium metaborate
(b) Sodium orthoborate
(c) Sodium tetraborate
(d) Sodium tetraborate decahydrate

78. Acetylenic hydrogens are acidic because

(a) Sigma electron density of C – H bond in acetylene is nearer to carbon, which has 50% s-character
(b) Acetylene has only open hydrogen in each carbon
(c) Acetylene contains least number of hydrogens among the possible hydrocarbons having two carbons
(d) Acetylene belongs to the class of alkynes with molecular formula, C_nH_{2n-2}.

79. $H_2S(g) \longrightarrow HS^-(g) + H^+(g)$, $\Delta H^\circ = x_1$

$\Delta H_f^\circ[H_2S(g)] = x_2$, $\Delta H_f^\circ[H(g)] = x_3$

hence, $\Delta H_f^\circ[HS]^-$ is

(a) $x_1 + x_2 - x_3$ (b) $x_3 - x_1 - x_2$

(c) $x_1 - x_2 - x_3$ (d) $x_3 - x_1 + x_2$

80. In qualitative analysis, the metals of Group I can be separated from other ions by precipitating them as chloride salts. A solution initially contains Ag^+ and Pb^{2+} at a concentration of 0.10 M. Aqueous HCl is added to this solution until the Cl^- concentration is 0.10 M. What will the concentrations of Ag^+ and Pb^{2+} be at equilibrium?

(K_{sp} for $AgCl = 1.8 \times 10^{-10}$,

K_{sp} for $PbCl_2 = 1.7 \times 10^{-5}$)

(a) $[Ag^+] = 1.8 \times 10^{-7}\,M$; $[Pb^{2+}] = 1.7 \times 10^{-6}\,M$

(b) $[Ag^+] = 1.8 \times 10^{-11}\,M$; $[Pb^{2+}] = 8.5 \times 10^{-5}\,M$

(c) $[Ag^+] = 1.8 \times 10^{-9}\,M$; $[Pb^{2+}] = 1.7 \times 10^{-3}\,M$

(d) $[Ag^+] = 1.8 \times 10^{-11}\,M$; $[Pb^{2+}] = 8.5 \times 10^{-4}\,M$

81. Carbon and CO gas are used to reduce which of the following pairs of metal oxides for extraction of metals ?

(a) FeO, SnO (b) SnO, ZnO

(c) BaO, Na_2O_2 (d) FeO, ZnO

82. Which one of the alkaline earth metals shows some anomalous behaviour and has same electronegativity as aluminium?

(a) Sr (b) Ca

(c) Ba (d) Be

83. Identify the correct order of electron affinity for O^-, O, F^- and Na^+.

(a) $Na^+ < F^- < O^- < O$

(b) $O < O^- < F^- < Na^+$

(c) $O^- < O << F^- < Na^+$

(d) $F^- < Na^+ < O^- < O$

84. For the reaction, $2Cl(g) \longrightarrow Cl_2(g)$, the signs of ΔH and ΔS respectively, are:

(a) +, – (b) +, +

(c) –, – (d) –, +

85. Which of the following can not be isoelectronic?

(a) two different cations

(b) two different anions

(c) cation and anion

(d) two different atoms

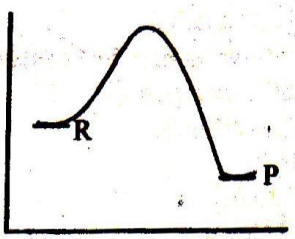
86. When CH_3Cl and $AlCl_3$ are used in Friedel-Crafts reaction, the electrophile is

(a) Cl^+ (b) $AlCl_4^-$

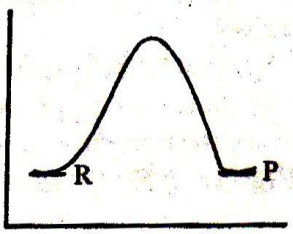
(c) CH_3^+ (d) $AlCl_2^+$

87. An endothermic reaction with high activation energy for the forward reaction is given by the diagram :

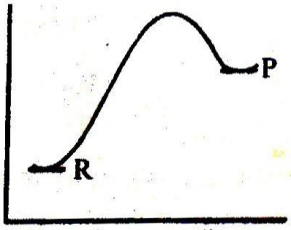
(a)



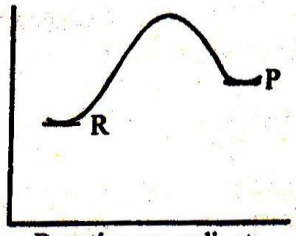
(b)



(c)

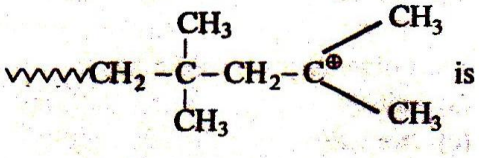


(d)

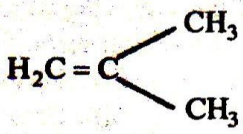


88. The alkaline earth metals Ba, Sr, Ca and Mg may be arranged in the order of their decreasing first ionisation potential as
(a) Mg, Ca, Sr, Ba (b) Ca, Sr, Ba, Mg
(c) Sr, Ba, Mg, Ca (d) Ba, Mg, Ca, Sr

89. The monomer of the polymer;



is

(a) 

(b) $CH_3CH{=}CHCH_3$
(c) $CH_3CH=CH_2$
(d) $(CH_3)_2C=C(CH_3)_2$

90. Two electrolytic cells, one containing acidified ferrous chloride and another acidified ferric chloride, are connected in series. The ratio of iron deposited at cathodes in the two cells will be :
(a) 3 : 1 (b) 2 : 1
(c) 1 : 1 (d) 3 : 2

SECTION 3 - BOTANY

91. The living organisms can be unexceptionally distinguished from the non-living things on the basis of their ability for
(a) interaction with the environment and progressive evolution
(b) reproduction
(c) growth and movement
(d) responsiveness to touch.

92. The largest flower found is known as
(a) *Rafflesia* (b) *Tecoma*
(c) *Musa* (d) Cauliflower

93. Pulses are belong to the family
(a) fabaceae (b) asteraceae
(c) poaceae (d) solanaceae

94. People recovering from long illness are often advised to include the alga *Spirulina* in their diet because it
(a) makes the food easy to digest.
(b) is rich in proteins.
(c) has antibiotic properties.
(d) restores the intestinal microflora.

95. In a cereal grain the single cotyledon of embryo is represented by
(a) scutellum (b) prophyll
(c) coleoptile (d) coleorrhiza

96. The chief water conducting elements of xylem in gymnosperms are :
(a) vessels (b) fibres
(c) transfusion tissue (d) tracheids

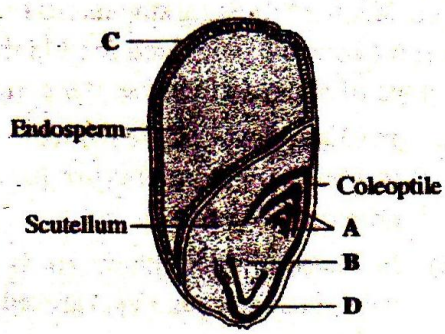
97. Consider the following statements regarding the major pigments and stored food in the different groups of algae and choose the correct option.
(i) In Chlorophyceae, the stored food material is starch and the major pigments are chlorophyll-*a* and *d*.
(ii) In Phaeophyceae, laminarin is the stored food and major pigments are chlorophyll-*a* and *b*.
(iii) In Rhodophyceae, floridean starch is the stored food and the major pigments are chlorophyll-*a*, *d* and phycoerythrin.
(a) (i) is correct, but (ii) and (iii) are wrong.
(b) (i) and (ii) are correct, but (iii) is wrong.
(c) (i) and (iii) are correct, but (ii) is wrong.
(d) (iii) is correct, but (i) and (ii) are wrong.

98. Chromosome duplication without nuclear division refers to
(a) Meiosis (b) Mitosis
(c) Androgenesis (d) Endomitosis

99. During which stages (or prophase I substages) of meiosis do you expect to find the bivalents and DNA replication respectively?
(a) Pachytene and interphase (between two meiotic divisions)
(b) Pachytene and interphase (just prior to prophase I)
(c) Pachytene and S phase (of interphase just prior to prophase I)
(d) Zygotene and S phase (of interphase prior to prophase I)

100. Perisperm is
(a) remnant of endosperm
(b) persistant nucellus
(c) remnant of embryo
(d) part of endosperm

101. Identified A, B, C and D of a seed.



(a) A – Plumule; B – Radicle; C – Pericarp; D – Coleorhiza
(b) A – Radicle; B – Plumule; C – Pericarp; D – Coleorhiza
(c) A – Radicle; B – Plumule; C – Coleorhiza; D – Pericarp
(d) A – Radicle; B – Coleorhiza; C – Plumule; D – Pericarp

102. One of the most resistant biological material is
(a) lignin (b) hemicellulose
(c) lignocellulose (d) sporopollenin

103. Which of the following is a pollution related occupational health hazard disease ?
(a) Pneumoconiosis (b) Asthma
(c) Flurosis (d) Silicosis

104. A population of genetically identical individuals, obtained from asexual reproduction is
(a) Callus (b) Clone
(c) Deme (d) Aggregate

105. The polyembryony commonly occurs in
(a) citrus (b) turmeric
(c) tomato (d) potato

106. In which one of the following habitats does the diurnal temperature of soil surface vary most?
(a) Shrub land (b) Forest
(c) Desert (d) Grassland

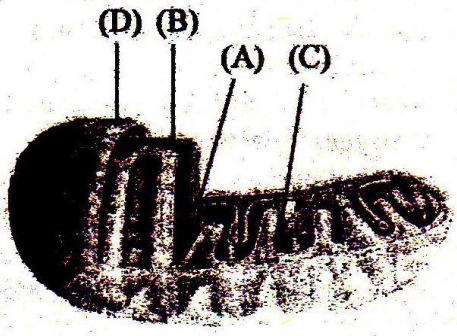
107. In increasing order of organizational complexity, which one of the following is the correct sequence?
(a) Population, species, community, ecosystem
(b) Population, variety, species, ecosystem
(c) Population, ecosystem, species, community
(d) Species, variety, ecosystem, community

108. In dicot embryo the radicle is formed by
(a) epibasal tier of embryo
(b) hypobasal tier of embryo
(c) hypophysis of suspensor
(d) terminal cell of suspensor

109. Osmosis means movement of
(a) solute from lower concentration to higher concentration.
(b) solute from higher concentration to lower concentration.
(c) solvent from lower concentration of solution to higher concentration of solution.
(d) solvent from higher concentration of solution to lower concentration of solution.

110. Solution outside a cell has higher concentration than cytoplasm, then the solution is
(a) isotonic (b) acidic
(c) hypotonic (d) hypertonic

111. The figure below shows the structure of a mitochondrion with its four parts labelled (A), (B), (C) and (D).



Select the part correctly matched with its function.

(a) Part (D): Outer membrane – gives rise to inner membrane by splitting
(b) Part (B): Inner membrane – forms infoldings called cristae
(c) Part (C): Cristae – possess single circular DNA molecule and ribosomes
(d) Part (A): Matrix – major site for respiratory chain enzymes

112. Which of the following is correct set of micronutrient for plants?
(a) Mg, Si, Fe, Cu, Ca
(b) Cu, Fe, Zn, B, Mn
(c) Mg, Fe, Zn, B, Mn
(d) Mo, Zn, Cl, Mg, Ca

113. During $Na^+ - K^+$ pump
(a) $3Na^+$ and $2K^+$ are transported
(b) $1Na^+$ and $2K^+$ are transported
(c) $3Na^+$ and $3K^+$ are transported
(d) Depends on requirement of cell

114. The technique of obtaining large number of plantlets by tissue culture method is called
(a) Plantlet culture
(b) Organ culture
(c) Micropropagation
(d) Macropropagation

115. Extranuclear inheritance occurs in
(a) peroxisome and ribosome
(b) chloroplast and mitochondria
(c) mitochondria and ribosome
(d) chloroplast and lysosome

116. Which one of the following pairs, is not correctly matched?
(a) Gibberellic acid - Leaf fall
(b) Cytokinin - Cell wall elongation
(c) IAA - Cell wall elongation
(d) Abscissic acid - Stomatal closure.

117. Test cross involves
(a) crossing between two F_1 hybrids
(b) crossing the F_1 hybrid with a double recessive genotype
(c) crossing between two genotypes with dominant trait
(d) crossing between two genotypes with recessive trait

118. What base is responsible for hot spots for spontaneous point mutations?
(a) Adenine (b) 5-bromouracil
(c) 5-methylcytosine (d) Guanine

119. When one gene controls two or more different characters simultaneously, the phenomenon is called
(a) apomixis (b) pleiotropy
(c) polyploidy (d) polyteny

120. Pneumatophores are characteristic of plants growing in
(a) saline soils
(b) sandy soils
(c) marshy places and salt lakes
(d) dryland regions

121. What is antisense technology ?
(a) A cell displaying a foreign antigen used for synthesis of antigens
(b) Production of somaclonal variants in tissue cultures
(c) When a piece of RNA that is complementary in sequence is used to stop expression of a specific gene
(d) RNA polymerase producing DNA

122. An enzyme brings about
(a) decrease in reaction time
(b) increase in reaction time
(c) increase in activation energy
(d) reduction in activation energy

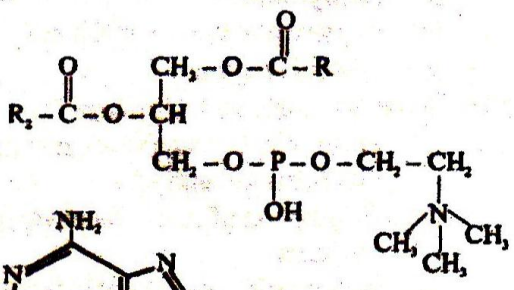
123. The enzymes hexokinase which catalyses glucose to glucose-6-phosphate in glycolysis is inhibited by glucose-6-phosphate. This is an example of
(a) competitive inhibition
(b) non-competitive inhibition
(c) feedback allosteric inhibition
(d) positive feedback

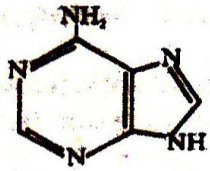
124. Apical dominance in plants is caused by
(a) high concentration of auxins in the terminal bud.
(b) high concentration of gibberellins in the apical bud.
(c) high concentration of auxins in the lateral bud.
(d) absence of auxins and gibberellins in apical bud.

125. Primary precursor of IAA is
(a) phenylalanine (b) tyrosine
(c) tryptophan (d) leucine

126. In a plant growing under dark condition, the leaves turn light coloured, internodes become much elongated and it is termed as
(a) vernalization (b) etiolation
(c) phyllotaxy (d) chlorosis

127. Which one of the following structural formulae of two organic compounds is correctly identified along with its related function ?

A. 

B. 

(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

128. Silencing of mRNA has been used in producing transgenic plants resistant to:
(a) bollworms (b) nematodes
(c) white rusts (d) bacterial blights

129. The enzyme, which helps to cut one strand of DNA duplex to release tension of coiling of two strands is
(a) DNA ligase
(b) DNA polymerase I
(c) topo-isomerase
(d) swielases (helicase or unwindases)

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

131. Cell elongation in internodal regions of the green plants takes place due to
(a) indole acetic acid (b) cytokinins
(c) gibberellins (d) ethylene

132. The 'Earth Summit' held at Rio de Janerio in 1992 resulted into
(a) Compilation of Red list
(b) Establishment of Biosphere Reserves
(c) Convention on Biodiversity
(d) Development of Hot Spots of Biodiversity

133. Tobacco plants resistant to a nematode have been developed by the introduction of DNA that produced (in the host cells)
(a) both sense and anti-sense RNA
(b) a particular hormone
(c) an antifeedant
(d) a toxic protein

134. Chloramphenicol and erythromycin (broad spectrum antibiotics) are produced by
(a) *Streptomyces* (b) *Nitrobacter*
(c) *Rhizobium* (d) *Penicillium*

135. For biogas production besides dung an extensive use of which weed is recommended in our country–
(a) *Mangifera indica*
(b) *Hydrilla*
(c) *Eicchornia crassipes*
(d) *Solanum*

SECTION 4 - ZOOLOGY

136. Which one of the following statements about Mycoplasma is wrong ?
(a) They are pleomorphic.
(b) They are sensitive to penicillin.
(c) They cause diseases in plants.
(d) They are also called (Pleuro pneumonia like organisms) PPLO.

137. Housefly possesses
(a) two pairs of wings
(b) one pair of wings
(c) three pairs of wings
(d) four pair of wings

138. The longest cells in human body are
(a) nerve cells (b) bone cells
(c) leg muscle cells (d) heart-muscle cells

139. Major inorganic component of vertebrate bone is
(a) calcium carbonate
(b) calcium phosphate
(c) sodium hydroxide
(d) potassium hydroxide

140. Histamine is secreted by
(a) mast cells (b) fibroblast
(c) histiocytes (d) melanocytes

141. Which of the following is not a granulocyte?
(a) Lymphocyte (b) Neutrophil
(c) Basophil (d) Eosinophil

142. The largest gland of human body is
(a) thyroid (b) pituitary
(c) pancreas (d) liver

143. Which one of the following statements is correct with respect to salt water balance inside the body of living organisms?
(a) When water is not available, camels do not produce urine but store urea in tissues.
(b) Salmon fish excretes lot of stored salt through gill membrane in fresh water.
(c) *Paramecium* discharges concentrated salt solution by contractile vacuoles.
(d) The body fluids of fresh water animals are generally hypotonic to surrounding water.

144. Identify A to E.

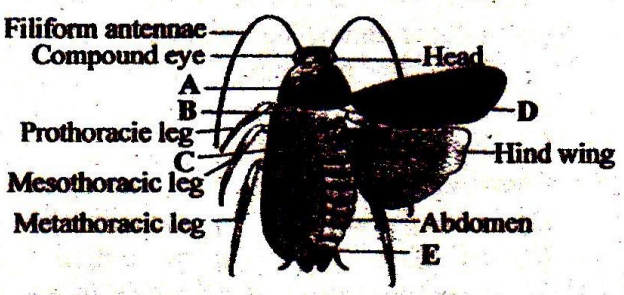


Figure - External features of cockroach

(a) A- Pronotum, B- Mesothorax, C- Metathorax, D- Tegmina, E- Pleura
(b) A-Pronotum, B-Mesothorax, C-Metathorax, D-Tegmina, E- Sterna
(c) A-Pronotum, B-Mesothorax, C-Metathorax, D- Tegmina, E-Anal cerci
(d) A-Pronotum,B-Mesothorax, C- Metathorax, D-Tegmina, D- Anal style.

145. Tying up or removing a small part of fallopian duct is called
(a) Vasectomy (b) Ductus arteriosus
(c) Archidectomy (d) Tubectomy

146. The technique called gamete intrafallopian transfer (GIFT) is recommended for those females:
(a) who cannot produce an ovum
(b) who cannot retain the foetus inside uterus.
(c) whose cervical canal is too narrow to allow passage for the sperms
(d) who cannot provide suitable environment for fertilisation

147. Fertilization occurs in, human, rabbit and other placental mammals in –
(a) Ovary (b) Uterus
(c) Fallopian tubes (d) Vagina

148. Sertoli cells are found in
(a) ovaries and secrete progesterone
(b) adrenal cortex and secrete adrenaline
(c) seminiferous tubules and provide nutrition to germ cells
(d) pancreas and secrete cholecystokinin

149. Birth control pills check ovulation in female by inhibiting the secretion of –
(a) follicle stimulating hormone
(b) luteinizing hormone
(c) Both (a) and (b)
(d) None of the above

150. Cessation of menstrual cycle in women is called
(a) menopause (b) lactation
(c) ovulation (d) parturition

151. What happens during fertilisation in humans after many sperms reach close to the ovum?
(a) Cells of corona radiata trap all the sperms except one
(b) Only two sperms nearest the ovum penetrate zona pellucida
(c) Secretions of acrosome helps one sperm enter cytoplasm of ovum through zona pellucida
(d) All sperms except the one nearest to the ovum lose their tails

152. Coronary artery disease (CAD) is often referred to as
(a) Heart failure (b) Cardiac arrest
(c) Atherosclerosis (d) Thrombosis

153. Antidiuretic hormone
(a) Secretion is determined by plasma osmolarity
(b) Increases permeability of renal collecting duct cells to water
(c) Is secreted by nerve cells with their cell bodies in hypothalamus
(d) All the above

154. Which one of the following is a matching pair of a substrate and its particular digestive enzyme?
(a) Starch — maltase
(b) Lactose — rennin
(c) Maltose — steapsin
(d) Casein — chymotrypsin

155. Which one of the following pairs of the cells with their secretion is correctly matched?
(a) Oxyntic cells - A secretion with pH between 2.0 and 3.0.
(b) Alpha cells of Islets of Langerhans - Secretion that decreases blood sugar level.
(c) Kupffer cells - A digestive enzyme that hydrolysis nucleic acids.
(d) Sebaceous glands - A digestive enzyme that hydrolysis nucleic acids

156. Bulk of carbon dioxide (CO_2) released from body tissues into the blood is present as
(a) bicarbonate in blood plasma and RBCs
(b) free CO_2 in blood plasma
(c) 70% carbamino- haemoglobin and 30% as bicarbonate
(d) carbamino-haemoglobin in RBCs

157. 'Bundle of His' is a part of which one of the following organs in humans?
(a) Brain (b) Heart
(c) Kidney (d) Pancreas

158. In mammals, the urinary bladder opens into
(a) Uterus (b) Urethra
(c) Vestibule (d) Ureter

159. Barr body in mammals represents
(a) all the heterochromatin in female cells
(b) Y-chromosomes in somatic cells of male
(c) all heterochromatin in male and female cells
(d) one of the two X-chromosomes in somatic cells of females

160. Genetic drift is change of
(a) gene frequency in same generation
(b) appearance of recessive genes
(c) gene frequency from one generation to next
(d) None of the above

161. Two different species can not live for long duration in the same niche or habitat. This law is
(a) Allen's law
(b) Gause's hypothesis
(c) Dollo's rule
(d) Weisman's theory

162. Which one of the following statements is correct in relation to honey bees?
(a) *Apis indica* is the largest wild honey bee in India
(b) Honey is predominantly sucrose and arabinose
(c) Beewax is a waste product of honey bees
(d) Communication in honey bees was discovered by Karl Von Frisch

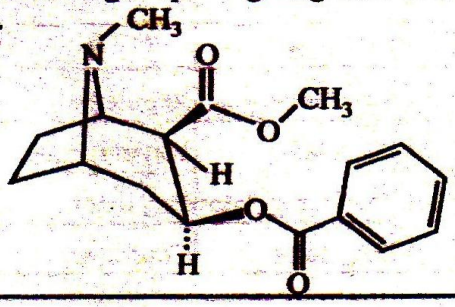
163. Select the **incorrect** statement from the following:
(a) Galactosemia is an inborn error of metabolism
(b) Small population size results in random genetic drift in a population
(c) Baldness is a sex-limited trait
(d) Linkage is an exception to the principle of independent assortment in heredity

164. Biometric genetics deals with :
(a) the biochemical explanations of various genetical phenomena
(b) the effect of environment on genetic set up organisms
(c) the genetical radiations on the living organisms
(d) the inheritance of quantitative traits

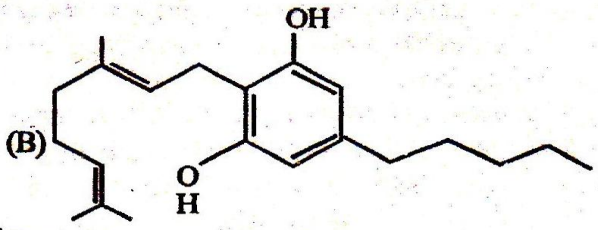
165. Murrah, Mehsana, Jaffarbadi are breeds of
(a) Buffalo (b) Cow
(c) Cattle (d) Horse

166. Identify the molecules (A) and (B) shown below and select the right option giving their source and use.

(A)



(B)



Options

	Molecule	Source	Use
(a)	(A) Cocaine	*Erythroxylum coca*	Accelerates the transport of dopamine
(b)	(B) Heroin	*Cannabis sativa*	Depressant and slows down body functions
(c)	(C) Cannabinoid	*Atropa belladona*	Produces hallucinations
(d)	(A) Morphine	*Papaver somniferum*	Sedative and pain killer

167. The technique used for estimation of minute amounts of hormones and drugs is called
(a) electrophoresis
(b) electroencephalogram
(c) fractionation
(d) radioimmunoassay

168. Which of the following is the contractile protein of a muscle?
(a) Myosin (b) Tropomyosin
(c) Actin (d) Tubulin

169. During oxygen transport the oxyhaemoglobin at the tissue level liberates oxygen to the cells because in tissue
(a) O_2 concentration is high and CO_2 is low
(b) O_2 concentration is low and CO_2 is high
(c) O_2 tension is high and CO_2 tension is low
(d) O_2 tension is low and CO_2 tension is high

170. Select the correct statement regarding the specific disorder of muscular or skeletal system :
(a) *Myasthenia gravis* - Autoimmune disorder which inhibits sliding of myosin filaments.
(b) *Gout* - inflammation of joints due to extra deposition of calcium.
(c) *Muscular dystrophy* - age related shortening of muscles.
(d) *Osteoporosis* - decrease in bone mass and higher chances of fractures with advancing age.

171. Which one of the following pairs is incorrectly matched?
(a) Glucagon - Beta cells (source)
(b) Somatostatin - Delta cells (source)
(c) Corpus luteum - Relaxin (secretion)
(d) Insulin - Diabetes mellitus (disease)

172. Melanocyte stimulating hormone (MSH) is produced by
(a) parathyroid
(b) pars intermedia of pituitary
(c) anterior pituitary
(d) posterior pituitary

173. Nicotine acts as a stimulant, because it mimics the effect of
(a) thyroxine (b) acetylcholine
(c) testosterone (d) dopamine

174. A major component of gobar gas is –
(a) Butane (b) Ammonia
(c) Methane (d) Ethane

175. Rennin used in cheese industry is –
(a) Antibiotic (b) Enzyme
(c) Alkaloid (d) Inhibitor

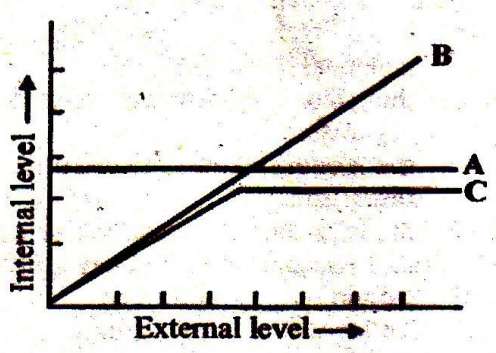
176. The polymerase chain reaction (PCR) technology was discovered by
(a) Karry Mullis (b) Saiki *et al*
(c) Craig Venter (d) Maxam and Gilbert

177. Antibodies in our body are complex
(a) steroids (b) prostaglandins
(c) glycoproteins (d) lipoproteins

178. A person likely to develop tetanus is immunised by administering
(a) preformed antibodies
(b) wide spectrum antibiotics
(c) weakened germs
(d) dead germs

179. cDNA probes are copied from the messenger RNA molecules with the help of –
(a) Restriction enzymes
(b) Reverse transcriptase
(c) DNA polymerase
(d) Adenosine deaminase

180. The figure given below is a diagrammatic representation of response of organisms to abiotic factors. What do A, B and C represent respectively?



	A	B	C
(a)	Conformer	Regulator	Partial regulator
(b)	Regulator	Partial regulator	Conformer
(c)	Partial regulator	Regulator	Conformer
(d)	Regulator	Conformer	Partial regulator