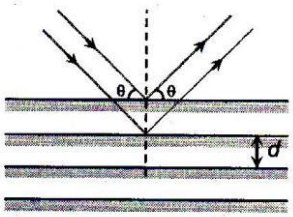
01. A current flows in a conductor from east to west. The direction of the magnetic field at a point above the conductor is ... **[2007]**

(a) towards north (b) towards south
(c) towards east (d) towards west

02. A beam with wavelength λ falls on a stack of partially reflecting planes with separation d. The angle θ that the beam should make with the planes so that the beams reflected from successive planes may interfere constructively is (where $n = 1, 2, \ldots\ldots$)



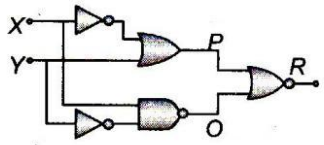
(a) $\sin^{-1}\left(\frac{n\lambda}{d}\right)$ (b) $\tan^{-1}\left(\frac{n\lambda}{d}\right)$

(c) $\sin^{-1}\left(\frac{n\lambda}{2d}\right)$ (d) $\cos^{-1}\left(\frac{n\lambda}{2d}\right)$

03. In a YDSE bi-chromatic light of wavelengths 400 nm and 560 nm are used. The distance between the slits is 0.1 mm and the distance between the plane of the slits and the screen is 1 m. The minimum distance between two successive regions of complete darkness is

(a) 4 mm (b) 5.6 mm
(c) 14 mm (d) 28 mm

04. Figure gives a system of logic gates. From the study of truth table it can be found that to produce a high output (1) at R, we must have



(a) $X = 0, Y = 1$ (b) $X = 1, Y = 1$
(c) $X = 1, Y = 0$ (d) $X = 0, Y = 0$

05. What would be the energy required to dissociate completely 1 gram of Ca-40 into its constituent particles?

Mass of proton = 1.007277 amu

Mass of neutron = 1.00866 amu

Mass of Ca-40 = 39.97545 amu

(Take one amu = 931 MeV)

(a) 4.813×10^{24} MeV (b) 4.813×10^{24} eV
(c) 4.813×10^{23} MeV (d) none of these

06. The half-life period of a radioactive substance is 5 min. The amount of substance decayed in 20 min will be

(a) 93.75% (b) 75%
(c) 25% (d) 6.25%

07. α-particles of energy 400 KeV are bombarded on nucleus of $_{82}$Pb. In scattering of α-particles, its minimum distance from nucleus will be

(a) 0.59 nm (b) 0.59 Å
(c) 5.9 pm (d) 0.59 pm

08. If in Rutherford's experiment, the number of particles scattered at 90° angle are 28 per min, then number of scattered particles at an angle 60° and 120° will be

(a) 112/min, 12.5/min (b) 100/min, 200/min
(c) 50/min, 12.5/min (d) 117/min, 25/min

09. Which state of triply ionised Beryllium (Be^{+++}) has the same orbital radius as that of the ground state of hydrogen?

(a) $n = 4$ (b) $n = 3$
(c) $n = 2$ (d) $n = 1$

10. The potential energy of a particle of mass m is given by

$$U(x) = \begin{cases} E_0 : 0 \le x \le 1 \\ 0; \quad x > 1 \end{cases}$$

λ_1 and λ_2 are the de-Broglie wavelengths of the particle, when $0 \le x \le 1$ and $x > 1$ respectively. If the total energy of particle is $2E_0$, the ratio $\frac{\lambda_1}{\lambda_2}$ will be

(a) 2 (b) 1
(c) $\sqrt{2}$ (d) $\frac{1}{\sqrt{2}}$

11. A silver ball of radius 4.8 cm is suspended by a thread in the vacuum chamber. UV light of wavelength 200 nm is incident on the ball for some times during which a total energy of 1×10^{-7} J falls on the surface. Assuming on an average one out of 103 photons incident is able to eject electron. The potential on sphere will be

(a) 1 V (b) 2 V
(c) 3 V (d) Zero

12. A lens forms a virtual, diminished image of an object placed at 2 m from it. The size of image is half of the object. Which one of the following statements is correct regarding the nature and focal length of the lens?

(a) Concave $|f| = 1$ m (b) Convex, $|f| = 1$

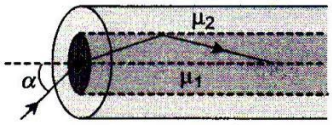
(c) Concave, $|f| = 2$ m (d) Convex, $|f| = 2$ m

13. A combination of two thin lenses with focal lengths f_1 and f_2 respectively forms an image of distant object at distance 60 cm when lenses are in contact. The position of this image shifts by 30 cm towards the combination when two lenses are separated by 10 cm. The corresponding values of f_1 and f_2 are **[2010]**

(a) 30 cm, –60 cm (b) 20 cm, –30 cm

(c) 15 cm, –20 cm (d) 20 cm, –15 cm

14. An optical fibre consists of core of μ_1 surrounded by a cladding of $\mu_2 < \mu_1$. A beam of light enters from air at an angle α with axis of fibre. The highest α for which ray can be travelled through fibre is **[2005]**



(a) $\cos^{-1}\sqrt{\mu_2^2 - \mu_1^2}$ (b) $\sin^{-1}\sqrt{\mu_1^2 - \mu_2^2}$

(c) $\tan{-1}\sqrt{\mu_1^2 - \mu_2^2}$ (d) $\sec^{-1}\sqrt{\mu_1^2 - \mu_2^2}$

15. A short linear object of length l lies along the axis of a concave mirror of focal length f at a distance u from the pole of the mirror. The size of the image is approximately equal to **[2004]**

(a) $l\left(\frac{u-f}{f}\right)^{1/2}$ (b) $l\left(\frac{u-f}{f}\right)^{2}$

(c) $l\left(\frac{f}{u-f}\right)^{1/2}$ (d) $l\left(\frac{f}{u-f}\right)^{2}$

16. The instantaneous values of alternating current and voltages in a circuit are given as **[2012]**

$$i = \frac{1}{\sqrt{2}}\sin(100\,\pi t) \text{ ampere}$$

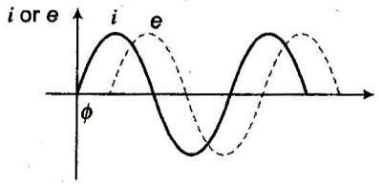
$$e = \frac{1}{\sqrt{2}}\sin(100\,\pi t + \pi/3) \text{ volt}$$

The average power in watts consumed in the circuit is

(a) $\frac{1}{4}$ (b) $\frac{\sqrt{3}}{4}$

(c) $\frac{1}{2}$ (d) $\frac{1}{8}$

17. When an AC source of e.m.f. $e = E_0 \sin(100t)$ is connected across a circuit, the phase difference between the e.m.f. e and the current i in the circuit is observed to be $\pi/4$, as shown in the diagram. If the circuit consists possibly only of RC or LC in series, find the relationship between the two elements



(a) $R = 1k\Omega, C = 10\,\mu F$ (b) $R = 1k\Omega, C = 1\,\mu F$

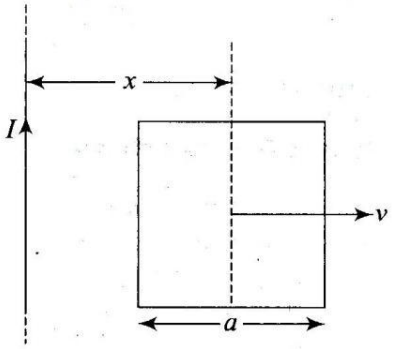
(c) $R = 1k\Omega, L = 10H$ (d) $R = 1k\Omega, L = 1H$

18. A coil having n turns and resistance $R\ \Omega$ is connected with a galvanometer of resistance $4R\Omega$. This combination is moved in time t seconds from a magnetic field W_1 weber to W_2 weber. The induced current in the circuit is

(a) $-\frac{W_2 - W_1}{5\,Rnt}$ (b) $-\frac{n(W_2 - W_1)}{5\,Rt}$

(c) $-\frac{(W_2 - W_1)}{Rnt}$ (d) $-\frac{n(W_2 - W_1)}{Rt}$

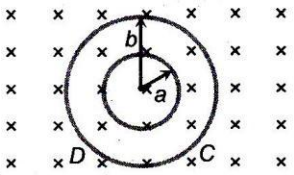
19. A conducting square frame of side a and a long straight wire carrying current I are located in the same plane as shown in the figure. The frame moves to the right with a constant velocity V. The emf induced in the frame will be proportional to **[2015]**



(a) $\frac{1}{x^2}$ (b) $\frac{1}{(2x-a)^2}$

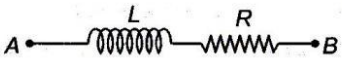
(c) $\frac{1}{(2x+a)^2}$ (d) $\frac{1}{(2x-a)(2x+a)}$

20. Plane figures made of thin wires of resistance R = 50 *milliohm*/metre are located in a uniform magnetic field perpendicular into the plane of the figures and which decrease at the rate dB/dt = 0.1 m *T*/*s*. Then currents in the inner and outer boundary are. (The inner radius a = 10 cm and outer radius b = 20 cm)



(a) 10^{-4} *A* (Clockwise), 2×10^{-4} *A* (Clockwise)
(b) 10^{-4} *A* (Anticlockwise), 2×10^{-4} *A* (Clockwise)
(c) 2×10^{-4} *A* (clockwise), 10^{-4} *A* (Anticlockwise)
(d) 2×10^{-4} *A* (Anticlockwise), 10^{-4} *A* (Anticlockwise)

21. In an AC sub circuit, the resistance R = 0.2 Ω. At a certain instant $(V_A - V_B)$ = 0.5 volt, I = 0.5 amp and $(\Delta I/\Delta t)$ = 8 A/s. Find the inductance of the coil:

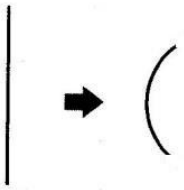


(a) 0.01 H (b) 0.02 H
(c) 0.05 H (d) 0.5 H

22. A bar magnet having a magnetic moment of 2×10^4 JT^{-1} is free to rotate in a horizontal plane. A horizontal magnetic field $B = 6 \times 10^{-4}$ T exists in the space. The work done in taking the magnet slowly from a direction parallel to the field to a direction 60° from the field is **[2009]**

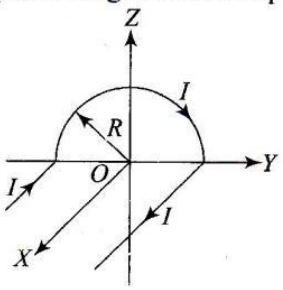
(a) 0.6 J (b) 12 J
(c) 6 J (d) 2 J

23. A magnetised wire of moment M is bent into an arc of a circle subtending an angle of 60° at the centre. The new magnetic moment is



(a) $(2\,M/\pi)$ (b) (M/π)
(c) $(3\sqrt{3}M/\pi)$ (d) $(3\,M/\pi)$

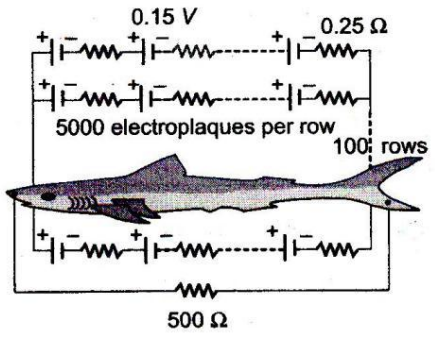
24. A wire carrying current I has the shape as shown in the adjoining figure. Linear parts of the wire are very long and parallel to *X*-axis while semicircular portion of radius R is lying in *Y*-*Z* plane. Magnetic field at point *O* is **[2015]**



(a) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$ (b) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}(\pi\hat{i} - 2\hat{k})$

(c) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$ (d) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} - 2\hat{k}\right)$

25. Eels are able to generate current with biological cells called electroplaques. The electroplaques in an eel are arranged in 100 rows, each row stretching horizontally along the body of the fish containing 5000 electroplaques. The arrangement is suggestively shown below. Each electroplaques has an emf of 0.15 V and internal resistance of 0.25 Ω **[2004]**



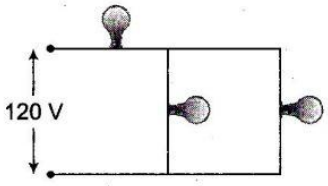
26. The water surrounding the eel completes a circuit between the head and its tail. If the water surrounding it has a resistance of 500 Ω, the current an eel can produce in water is about

(a) 1.5 A (b) 3.0 A
(c) 15 A (d) 30 A

27. A moving coil galvanometer is converted into an ammeter reads up to 0.03 A by connecting a shunt of resistance $4r$ across it and ammeter reads up to 0.06 A, when a shunt of resistance r is used. What is the maximum current which can be sent through this galvanometer if no shunt is used? **[2002]**

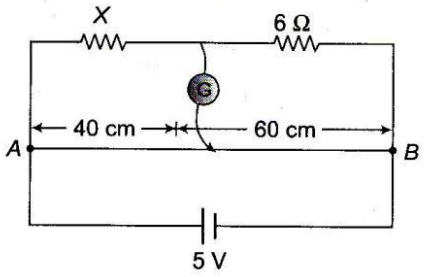
(a) 0.03 A (b) 0.04 A
(c) 0.02 A (d) 0.01 A

28. Three 60 W, 120 V light bulbs are connected across a 120 V power source. If resistance of each bulb does not change with current then find out total power delivered to the three bulbs.



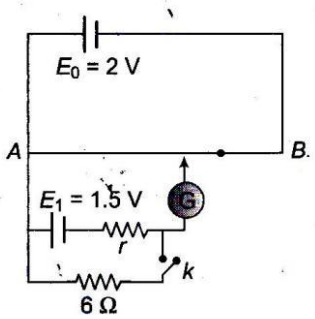
(a) 180 W (b) 20 W
(c) 40 W (d) 60 W

29. In the circuit shown, a meter bridge is in its balanced state. The meter bridge wire has a resistance 0.1 ohm/cm. The value of unknown resistance X and the current drawn from the battery of negligible resistance is



(a) 6 Ω, 5 amp (b) 10 Ω, 0.1 amp
(c) 4 Ω, 1.0 amp (d) 12 Ω, 0.5 amp

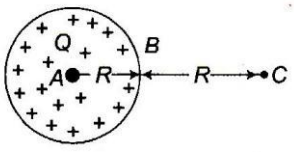
30. For the arrangement of the potentiometer shown in the figure, the balance point is obtained at a distance 75 cm from A when the key k is open.



The second balance point is obtained at 60 cm from A when the key k is closed. Find the internal resistance of the battery E_1.

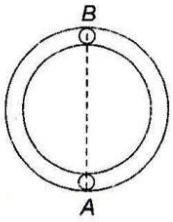
(a) 1.5 Ω (b) 2 Ω
(c) 0.5 Ω (d) 1 Ω

31. Find the ratio of electric work done in bringing a charge q from A to B (W_{AB}) and that from B to C (W_{BC}) in a sphere of charge Q distributed uniformly throughout its volume.



(a) 1 (b) 1.5
(c) 0.75 (d) None of these

32. Two equal spheres A and B lie on a smooth horizontal circular groove at opposite ends of a diameter. At time $t = 0$, A is projected along the groove and it first inpinges on B at time $t = T_1$ and again at time $t = T_2$. If e is the coefficient of restitution, the ratio T_2/T_1 is



(a) $\frac{2}{e}$ (b) $\frac{(2+e)}{2}$

(c) $\frac{2(e+1)}{e}$ (d) $\frac{(2+e)}{e}$

33. A set of n identical cubical blocks lies at rest parallel to each other along a line on a smooth horizontal surface. The separation between the near surfaces of any two adjacent blocks is L. The block at one end is given a speed v towards the next one at time $t = 0$. All collisions are completely inelastic, then the last block starts moving at

(a) $\frac{(n-1)L}{v}$ (b) $\frac{n(n-1)L}{2v}$

(c) $\frac{(n+1)L}{v}$ (d) $\frac{n(n+1)L}{2v}$

34. A closed organ pipe of length L and an open organ pipe contain gases of densities ρ_1 and ρ_2 respectively. The compressibility of gases are equal in both the pipes. Both the pipes are vibrating in their first overtone with same frequency. The length of the open organ pipe is

(a) $\frac{L}{3}$ (b) $\frac{4L}{3}$

(c) $\frac{4L}{3}\sqrt{\frac{\rho_1}{\rho_2}}$ (d) $\frac{4L}{3}\sqrt{\frac{\rho_2}{\rho_1}}$

35. A sonometer wire resonates with a given tuning fork forming standing waves with five antinodes between the two bridges when a mass of 9 kg is suspended from the wire. When this mass is replaced by a mass M, the wire resonates with the same tuning fork forming three antinodes for the same positions of the bridges. The value of M is

(a) 25 kg (b) 5 kg

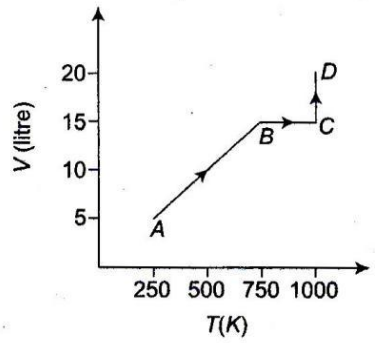
(c) 12.5 kg (d) 1/25 kg

36. Three samples of the same gas A, B and C ($\gamma = 3/2$) have initially equal volume. Now the volume of each sample is doubled. The process is adiabatic for A, isobathic for B and isothermal for C. If the final pressures are equal for all the three samples, the ratio of their initial pressures is:

(a) $2\sqrt{2}:2:1$ (b) $2\sqrt{2}:1:2$

(c) $\sqrt{2}:1:2$ (d) $2:1:\sqrt{2}$

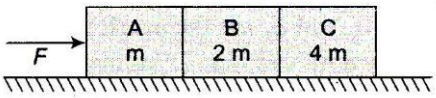
37. Two moles of helium gas are taken along the path $ABCD$ (as shown in figure). The work done by the gas is



(a) $2000R\left(1+\ln\frac{4}{3}\right)$ (b) $500R(3+\ln 4)$

(c) $500R\left(2+\ln\frac{16}{9}\right)$ (d) $1000R\left(1+\ln\frac{16}{9}\right)$

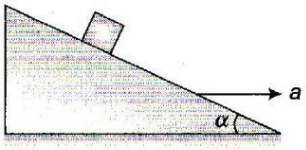
38. A force F is applied on block A as shown in figure. The contact force between the blocks A and B and between the blocks B and C respectively are (Assume frictionless surface)



(a) $\frac{F}{7}, \frac{2F}{7}$ (b) $\frac{6F}{7}, \frac{4F}{7}$

(c) $F, \frac{F}{2}$ (d) $\frac{4F}{7}, \frac{6F}{7}$

39. A block is kept on a frictionless inclined surface with angle of inclination 'α'. The incline is given an acceleration 'a' to keep the block stationary. Then a is equal to



(a) g (b) $g \tan \alpha$
(c) $g/\tan \alpha$ (d) $g \operatorname{cosec} \alpha$

40. A body weighs 250 N on the surface of the earth. How much will it weigh half way down to the centre of the earth?

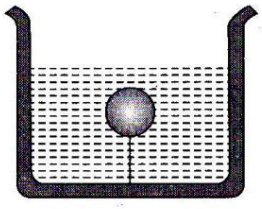
(a) 125 N (b) 150 N
(c) 175 N (d) 250 N

41. A satellite can be in a geostationary orbit around earth in an orbit of radius r. If the angular velocity of earth about its axis doubles, a satellite can now be in a geostationary orbit around earth of radius

(a) $\frac{r}{2}$ (b) $\frac{r}{2\sqrt{2}}$

(c) $\frac{r}{(4)^{1/3}}$ (d) $\frac{r}{(2)^{1/3}}$

42. A solid sphere of density η (> 1) times lighter than water is suspended in a water tank by a string tied to its base as shown in fig. If the mass of the sphere is m then the tension in the string is given by

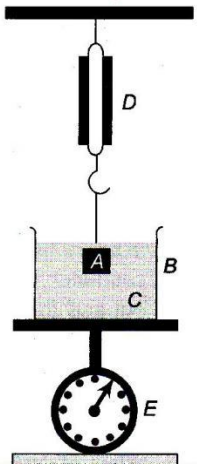


(a) $\left(\frac{\eta-1}{\eta}\right)mg$ (b) ηmg

(c) $\frac{mg}{\eta-1}$ (d) $(\eta-1)mg$

43. In figure, block A hangs by a cord from spring balance D and it submerged in a liquid C contained in a beaker B. The mass of the beaker is 1 kg. The mass of the liquid is 1.5 kg. Balance D reads 7.5 kg. The volume of block A is 0.003 m^3. The mass per unit volume of the liquid is

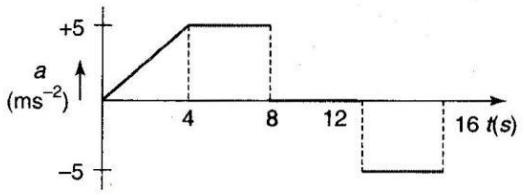
(a) 2500 kg m^{-3}
(b) 5000 kg m^{-3}
(c) 1 kg m^{-3}
(d) $\frac{5000}{3}$ kg m^{-3}



44. A boy throws a ball upward with velocity v_0 = 20 m./s. The wind imparts a horizontal acceleration of 4 m/s^2 to the left. The angle θ at which the ball must be thrown so that the ball returns to the boy's hand is: (g = 10 m/s^2)

(a) $\tan^{-1}(1.2)$ (b) $\tan^{-1}(0.2)$
(c) $\tan^{-1}(2)$ (d) $\tan^{-1}(0.4)$

45. The acceleration of a particle traveling along a straight line is shown in the figure. The maximum speed of the particle is



(a) 20 ms^{-1} (b) 30 ms^{-1}
(c) 40 ms^{-1} (d) 60 ms^{-1}

46. **If 0.1 M solution of glucose and 0.1 M solution of urea are placed on two sides of the semipermeable membrane to equal heights, then it will be correct to say that**

(a) There will be no net movement across the membrane
(b) Glucose will flow towards urea solution
(c) urea will flow towards glucose solution
(d) water will flow from urea solution to glucose

47. **In the Freidel Craft's acylation reaction, the effective electrophile is**

(a) $RCOCl^{\oplus}$ **(b) $AlCl_3$**
(c) RCOCl **(d) $RCO^{\oplus}$**

48. White lead is
(a) Pb_3O_4
(b) PbO
(c) $2PbCO_3.Pb(OH)_2$
(d) $Pb(CH_3COO)_2.Pb(OH)_2$

49. Specific volume of cylindrical virus particle is 6.02×10^{-2} cc/gm. whose radius and length 7 Å & 10 Å respectively. If $N_A = 6.02 \times 10^{23}$, find molecular weight of virus
(a) 3.08×10^3 kg/mol (b) 3.08×10^4 kg/mol
(c) 1.54×10^4 kg/mol (d) 15.4 kg/mol

50. Excess of ethanol and con. H_2SO_4 on heating upto 140°C produces
(a) diethyl ether
(b) diethyl sulphate
(c) ethyl hydrogen sulphate
(d) ethylene

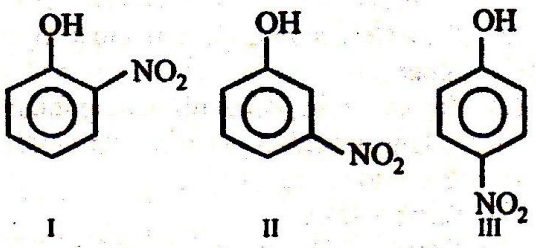
51. Consider the following statements
I. The radius of an anion is larger than that of the parent atom.
II. The ionization energy generally increases with increasing atomic number in a period.
III. The electronegativity of an element is the tendency of an isolated atom to attract an electron.
Which of the above statements is/are correct?
(a) I alone (b) II alone
(c) I and II (d) II and III

52. Cl_2 changes to Cl^- and ClO^- in cold NaOH. Equivalent weight of Cl_2 will be
(a) M (b) $\frac{M}{2}$
(c) $\frac{M}{3}$ (d) $\frac{3M}{3}$

53. Which of the following pentafluoride is not obtained?
(a) SbF_5 (b) BiF_5
(c) PF_5 (d) AsF_5

54. In the conversion of Br_2 to BrO_3^-, the oxidation number of Br changes from
(a) zero to +5 (b) +1 to +5
(c) zero to −3 (d) +2 to +5

55. Arrange the following phenols in order of their increasing acidity.

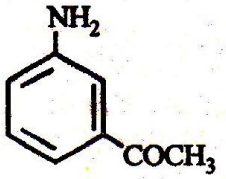


I II III

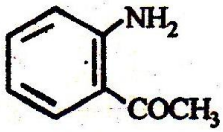
(a) I > III > II (b) I > II > III
(c) III > I > II (d) III > II > I

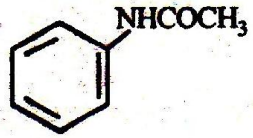
56. The average molecular speed is greatest in which of the following gas samples ?
(a) 1.0 mol of O_2 at 560 K
(b) 0.50 mol of Ne at 500 K
(c) 0.20 mol of CO_2 at 440 K
(d) 2.0 mol of He at 140 K

57. Aniline is an activated system for electrophilic substitution. The compound formed on heating aniline with acetic anhydride is

(a) 

(b) 

(c) 

(d) 

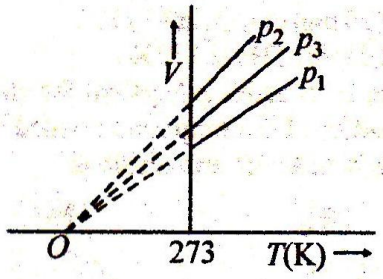
58. The formula mass of Mohr's salt is 392. The iron present in it is oxidised by $KMnO_4$ in acid medium. The equivalent mass of Mohr's salt is
(a) 392 (b) 31.6
(c) 278 (d) 156

59. Sewage mostly constitutes
(a) Non-biodegradable pollutants
(b) Biodegradable pollutants
(c) Effluents
(d) Air pollutants

60. The Langmuir adsorption isotherm is deduced using the assumption
(a) the adsorption sites are equivalent in their ability to adsorb the particles
(b) the heat of adsorption varies with coverage
(c) the adsorbed molecules interact with each other
(d) the adsorption takes place in multilayers.

61. Three dimensional molecules with cross links are formed in the case of a
(a) thermoplastic
(b) thermosetting plastic
(c) both (a) and (b)
(d) none of the above

62. The volume-temperature graphs of a given mass of an ideal gas at constant pressure are shown below.



What is the correct order of pressures ?
(a) $p_1 > p_3 > p_2$ (b) $p_1 > p_2 > p_3$
(c) $p_2 > p_3 > p_1$ (d) $p_2 > p_1 > p_3$

63. Which of the following is used for making optical instruments?
(a) SiO_2 (b) Si
(c) SiH_4 (d) SiC

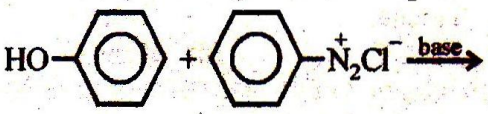
64. The correct order of acid strength of oxyacids is:
(a) $HClO > HClO_2 > HClO_3 > HClO_4$
(b) $HClO_2 > HClO_3 > HClO > HClO_4$
(c) $HClO_4 > HClO_3 > HClO_2 > HClO$
(d) $HClO_3 > HClO_4 > HClO > HClO_2$

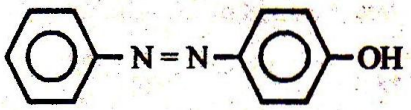
65. 25.3 g of sodium carbonate, Na_2CO_3 is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ions, Na^+ and carbonate ions, CO_3^{2-} are respectively (Molar mass of $Na_2CO_3 = 106\ g\ mol^{-1}$)
(a) 0.955 M and 1.910 M
(b) 1.910 M and 0.955 M
(c) 1.90 M and 1.910 M
(d) 0.477 M and 0.477 M

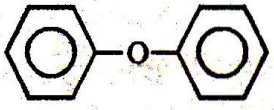
66. In which alkyl halide, S_N2 mechanism is favoured maximum?
(a) CH_3Cl (b) CH_3CH_2Cl
(c) $(CH_3)_2CHCl$ (d) $(CH_3)_3C-Cl$

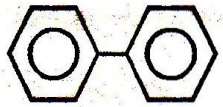
67. Equilibrium constant K changes with temperature. At 300 K, equilibrium constant is 25 and at 400 K it is 10. Hence, backward reaction will have energy of activation
(a) equa to that of forward reaction
(b) less than that of forward reaction
(c) greater than that of forward reaction
(d) given values are not sufficient to explain given statement

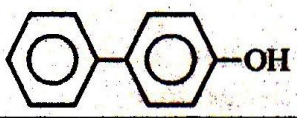
68. Which of the two ions from the list given below that have the geometry that is explained by the same hybridization of orbitals, NO_2^-, NO_3^-, NH_2^-, NH_4^+, SCN^-?
(a) NO_2^- and NO_3^- (b) NH_4^+ and NO_3^-
(c) SCN^- and NH_2^- (d) NO_2^- and NH_2^-

69. 

(a) 

(b) 

(c) 

(d) 

70. White lead is
(a) Pb_3O_4
(b) PbO
(c) $2PbCO_3.Pb(OH)_2$
(d) $Pb(CH_3COO)_2.Pb(OH)_2$

71. The commonest method for the extraction of metals from oxide ores involves :
(a) Reduction with carbon and carbon monoxide
(b) Reduction with aluminium
(c) Reduction with hydrogen
(d) Electrolytic method

72. With which one of the following elements silicon should be doped so as to give p-type of semiconductor ?
(a) Germanium (b) Arsenic
(c) Selenium (d) Boron

73. IUPAC name of $[Pt(NH_3)_3(Br)(NO_2)Cl]Cl$ is
(a) Triamminechlorobromonitroplatinum (IV) chloride
(b) Triamminebromonitrochloroplatinum (IV) chloride
(c) Triamminebromochloronitroplatinum (IV) chloride
(d) Triamminenitrochlorobromoplatinum (IV) chloride

74. Van't Hoff factor is:
(a) More than one in case of association
(b) Less than one in case of dissociation
(c) $\frac{\text{normal molecular mass}}{\text{observed molecular mass}}$
(d) $\frac{\text{observed molecular mass}}{\text{normal molecular mass}}$

75. Which of the following compound will undergo self aldol condensation in the presence of cold dilute alkali ?
(a) $CH_2 = CH - CHO$
(b) $CH \equiv C - CHO$
(c) C_6H_5CHO
(d) CH_3CH_2CHO.

76. When one mole of an ideal gas is compressed to half its initial volume and simultaneously heated to twice in initial temperature, the change in entropy (ΔS) is
(a) $C_V \ln 2$ (b) $C_P \ln 2$
(c) $R \ln 2$ (d) $(C_V - R) \ln 2$

77. If x is amount of adsorbate and m is amount of adsorbent, which of the following relations is not related to adsorption process ?
(a) $x/m = K(p)$ at very low pressure.
(b) $x/m = Kp^{1/n}$ at inter mediate pressure
(c) $\frac{x}{m} = K$ at very high pressure
(d) $\frac{x}{m} = p$

78. For the reaction of one mole of zinc dust with one mole of sulphuric acid in a bomb calorimeter, ΔU and w corresponds to
(a) $\Delta U < 0, w = 0$ (b) $\Delta U < 0, w < 0$
(c) $\Delta U > 0, w = 0$ (d) $\Delta U > 0, w > 0$

79. Reactivity of hydrogen atoms attached to different carbon atoms in alkanes has the order
(a) Tertiary > Primary > Secondary
(b) Primary > Secondary > Tertiary
(c) Both (a) and (b)
(d) Tertiary > Secondary > Primary.

80. In most cases, for a rise of 10K temperature the rate constant is doubled to tripled. This is due to the reason that
(a) collision frequency increases by a factor of 2 to 3.
(b) fraction of molecules possessing threshold energy increases by a factor of 2 to 3
(c) Activation energy is lowered by a factor of 2 to 3.
(d) none of these

81. The restricted rotation about carbon carbon double bond in 2-butene is due to
(a) Overlap of one s- and sp^2-hybridized orbitals
(b) Overlap of two sp^2 - hybridized orbitals
(c) Overlap of one p- and one sp^2-hybridized orbitals
(d) Sideways overlap of two p- orbitals.

82. Which of the following colligative property can provide molar mass of proteins (or polymers or colloids) with greatest precision ?
(a) Osmotic pressure
(b) Elevation of boiling point
(c) Depression of freezing point
(d) Relative lowering of vapour pressure

83. Cyclic hydrocarbon 'A' has all the carbon and hydrogen atoms in a single plane. All the carbon carbon bonds have the same length, less than 1.54 Å, but more than 1.34 Å. The C – C – C bond angle will be
(a) 109°28' (b) 100°
(c) 180° (d) 120°

84. The boiling point of three saturated hydrocarbons A, B and C are – 102°C, –43.4°C and – 0.6°C respectively. The hydrocarbon having the maximum number of carbon atoms in its molecule is
(a) A (b) B
(c) C (d) none of these

85. Which of the following electrolyte will have maximum flocculation value for $Fe(OH)_3$ sol?
(a) NaCl (b) Na_2S
(c) $(NH_4)_3PO_4$ (d) K_2SO_4

86. In DNA the complementary bases are
(a) adenine and thymine; guanine and cytosine
(b) uracil and adenine; cytosine and guanine
(c) adenine and guanine; thymine and cytosine
(d) adenine and thymine; guanine and uracil

87. What is the correct order of spin only magnetic moment (in BM) of Mn^{2+}, Cr^{2+} and V^{2+} ?
(a) $Mn^{2+} > V^{2+} > Cr^{2+}$
(b) $V^{2+} > Cr^{2+} > Mn^{2+}$
(c) $Mn^{2+} > Cr^{2+} > V^{2+}$
(d) $Cr^{2+} > V^{2+} > Mn^{2+}$

88. In which of the following cases, pH is greater than 7?
(a) 50 ml of 0.1 M HCl + 50 ml of 0.1 M NaCl
(b) 50 ml of 0.1 M H_2SO_4 + 50 ml of 0.2 M NaOH
(c) 50 ml of 0.1 M CH_3COOH + 50 ml of 0.1 M KOH
(d) 50 ml of 0.1 M HNO_3 + 50 ml of 0.1 M NH_3

89. In the presence of platinum catalyst, hydrocarbon A adds hydrogen to form n-hexane. When hydrogen bromide is added to A instead of hydrogen, only a single bromo compound is formed. Which of the following is A?
(a) $CH_3 - CH_2 - CH = CH - CH_2 - CH_3$
(b) $CH_3 - CH_2 - CH_2 - CH = CH - CH_3$
(c) $CH_3 - CH = CH - CH_2 - CH_2 - CH_3$
(d) $CH_2 = CH - CH_2 - CH_2 - CH_2 - CH_3$

90. $\underset{\text{Benzene}}{C_6H_6} + \underset{\text{Methyl chloride}}{CH_3Cl} \xrightarrow{AlCl_3} \underset{\text{Toluene}}{C_6H_5CH_3} + HCl$

The above reaction is:
(a) Wurtz Fittig reaction
(b) Grignard reaction
(c) Friedel-Craft's reaction
(d) Ullmann reaction

SECTION 3 - BOTANY

91. Most plants are green in colour because
(a) the atmosphere filters out all the colours of the visible light spectrum except green.
(b) green light is the most effective wavelength region of the visible spectrum in sunlight for photosynthesis.
(c) chlorophyll is least effective in absorbing green light.
(d) green light allows maximum photosynthesis.

92. Which of the following organism possesses characteristics of both a plant and an animal?
(a) Bacteria (b) *Euglena*
(c) *Mycoplasma* (d) *Paramecium*

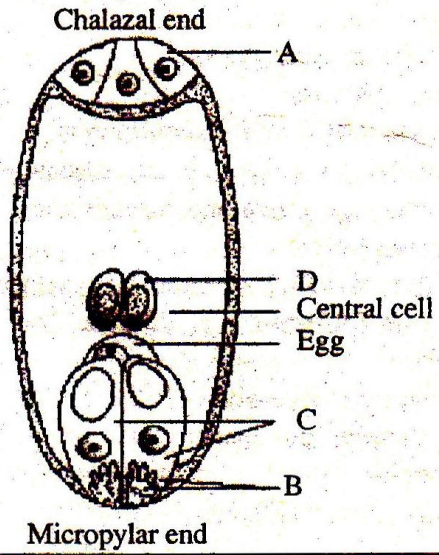
93. Function of companion cells is
(a) providing energy to sieve elements for active transport.
(b) providing water to phloem.
(c) loading of sucrose into sieve elements by passive transport.
(d) loading of sucrose into sieve elements.

94. In cell cycle, DNA replication takes place in
(a) G_1 phase
(b) G_2 phase
(c) mitotic metaphase
(d) S phase

95. During cell division, the spindle fibres attach to the chromosome at a region called
(a) chromocentre (b) kinetochore
(c) centriole (d) chromomere

96. Organisms which are indicator of SO_2 pollution of air are
(a) Mosses (b) Lichens
(c) Mushrooms (d) Puffballs

97. Choose the correct option for A, B, C and D of a mature embryo sac .



(a) A – Filiform apparatus; B – Antipodal cells; C – Synergids; D – Polar nuclei
(b) A – Antipodal cells; B – Filiform apparatus; C – Synergids; D – Polar nuclei
(c) A – Antipodal cells; B – Filiform apparatus; C – Polar nuclei; D – Synergids
(d) A – Antipodal cells; B – Polar nuclei; C – Filiform apparatus; D – Synergids

98. In which one pair both the plants can be vegetative propagated by leaf pieces?
(a) *Bryophyllum* and *Kalanchoe*
(b) *Chrysanthemum* and *Agave*
(c) *Agave* and *Kalanchoe*
(d) *Asparagus* and *Bryophyllum*

99. Syngamy means
(a) fusion of gametes
(b) fusion of cytoplasms
(c) fusion of two similar spores
(d) fusion of two dissimilar spores

100. Identify the correctly matched pair.
(a) Basal Convention - Biodiversity Conservation
(b) Kyoto Protocol - Climatic change
(c) Montreal Protocol - Global warming
(d) Ramsar Convention - Ground water pollution

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

102. A mutually beneficial association necessary for survival of both partners is
(a) mutualism/symbiosis
(b) commensalism
(c) amensalism
(d) both (a) and (b)

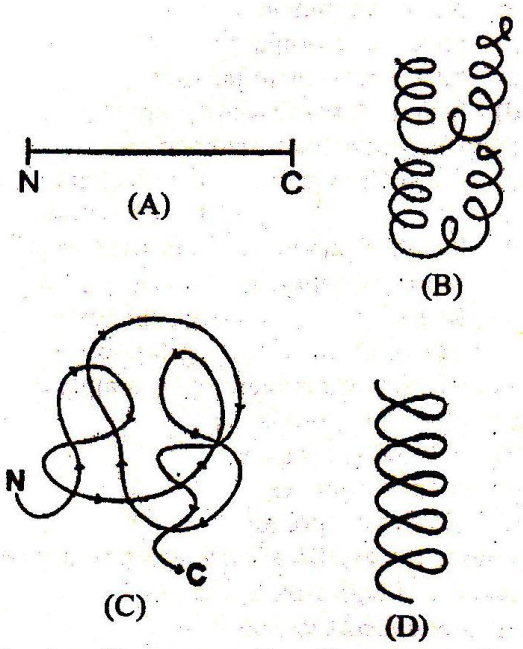
103. Cotyledons and testa respectively are edible parts in
(a) walnut and tamarind
(b) french bean and coconut
(c) cashew nut and litchi
(d) groundnut and pomegranate

104. When pollen grains are not transferred from anthers to stigma in a flower, due to the barrier, it is called
(a) herkogamy (b) heterogamy
(c) cleistogamy (d) dichogamy

105. Water potential is equal to
(a) $\Psi_s + O.P.$ (b) $\Psi_s + T.P.$
(c) $\Psi_p + \Psi_w$ (d) $\Psi_s + \Psi_p$

106. Which of the following is a free living aerobic non-photosynthetic nitrogen-fixer?
(a) *Rhizobium* (b) *Azotobacter*
(c) *Azospirillum* (d) *Nostoc*

107. What kinds of the structures of proteins are shown in the following figure ?



(a) A = 1° structure, B = 2° structure, C = 3° structure, D = 4° structure
(b) A = 4° structure, B = 2° structure, C = 3° structure, D = 2° structure
(c) A = 1° structure, B = 4° structure, C = 3° structure, D = 2° structure
(d) A = 4° structure, B = 3° structure, C = 2° structure, D = 1° structure

108. In soil, the water available for root absorption is
(a) gravitational water
(b) capillary water
(c) hygroscopic water
(d) combined water

109. Which one of the following mineral elements plays an important role in biological nitrogen fixation ?
(a) Molybdenum
(b) Copper
(c) Manganese
(d) Zinc

110. C_4 acid, formed in the mesophyll of C_4 plants leaf during photosynthesis is
(a) OAA or malic acid or aspartic acid
(b) pyruvic acid
(c) succinic acid
(d) fumaric acid

111. *Azotobacter* and *Beijerinckia* are the examples of
(a) symbiotic nitrogen-fixers
(b) non-symbiotic nitrogen-fixers
(c) ammonifying bacteria
(d) disease causing bacteria

112. The first carbon dioxide acceptor in C_4-plants is
(a) Phosphoenol-pyruvate
(b) Ribulose 1, 5-diphosphate
(c) Oxalo-acetic acid
(d) Phosphoglyceric acid

113. DNA replication is
(a) conservative and discontinuous
(b) semiconservative and semi discontinuous
(c) semiconservative and discontinuous
(d) conservative

114. Red (RR) *Antirrhinum* is crossed with white (WW) one. Offspring RW are pink. This is an example of
(a) dominant -recessive
(b) incomplete dominance
(c) hybrid
(d) supplementary genes

115. Food chain in which micro-organisms breakdown the food formed by primary producers is
(a) parasitic food chain
(b) detritus food chain
(c) consumer food chain
(d) predator food chain

116. Which of the following pairs is a sedimentary type of biogeochemical cycle?
(a) Oxygen and nitrogen
(b) Phosphorus and sulphur
(c) Phosphorus and nitrogen
(d) Phosphorus and carbon dioxide

117. Independent assortment of genes does not take place when
(a) genes are located on homologous chromosomes
(b) genes are linked and located on same chromosomes
(c) genes are located on non-homologous chromosomes
(d) All the above

118. Breeding of crops with high levels of minerals, vitamins and proteins is called
(a) Somatic hybridisation
(b) Biofortification
(c) Biomagnification
(d) Micropropagation

119. If we completely remove the decomposers from an ecosystem, its functioning will be adversely affected, because
(a) energy flow will be blocked
(b) herbivores will not receive solar energy
(c) mineral movement will be blocked
(d) rate of decomposition will be very high

120. A nucleotide is formed of
(a) Purine, pyrimidine and phosphate
(b) Purine, sugar and phosphate
(c) Nitrogen base, sugar and phosphate
(d) Pyrimidine, sugar and phosphate

121. A chemical believed to be involved in flowering is
(a) gibberellin (b) kinetin
(c) florigen (d) IBA

122. In RNA, thymine is replaced by
(a) Adenine (b) Guanine
(c) Cytosine (d) Uracil

123. Which of the following is a reducing sugar?
(a) Galactose
(b) Gluconic acid
(c) β-methyl galactoside
(d) Sucrose

124. Which of the following processes make direct use of oxygen ?
(a) Glycolysis
(b) Fermentation
(c) Electron transport
(d) Krebs citric acid cycle

125. Glycolysis is a
(a) redox process (b) aerobic process
(c) oxidative process (d) reductive process

126. Which of the following is a biological uncoupler of oxidative phosphorylation ?
(a) Thermogenin
(b) 2, 4 – Dichlorophenoxy acetic acid
(c) 2, 4 – Dinitrophenol
(d) Ethylene diaminotetra acetic acid

127. Wildlife is destroyed most when
(a) there is lack of proper care
(b) mass scale hunting for foreign trade
(c) its natural habitat is destroyed
(d) natural calamity occurs

128. Golden rice is a transgenic crop of the future with the following improved trait :
(a) insect resistance
(b) high lysine (essential amino acid) content
(c) high protein content
(d) high vitamin-A content

129. Largest amount of fresh water is found in
(a) lakes and streams
(b) underground
(c) polar ice caps and glaciers
(d) rivers

130. A common biocontrol agent for the control of plant diseases is
(a) Baculovirus
(b) *Bacillus thuringiensis*
(c) *Glomus*
(d) *Trichoderma*

131. A nitrogen-fixing microbe associated with *Azolla* in rice fields is :
(a) *Spirulina* (b) *Anabaena*
(c) *Frankia* (d) *Tolypothrix*

132. Which group of vertebrates comprises the highest number of endangered species ?
(a) Birds (b) Mammals
(c) Fishes (d) Reptiles

133. PCR and Restriction Fragment Length Polymorphism are the methods for :
(a) Study of enzymes
(b) Genetic transformation
(c) DNA sequencing
(d) Genetic Fingerprinting

134. The C_4 plants are photosynthetically more efficient than C_3 plants because:
(a) the CO_2 compensation point is more
(b) CO_2 generated during photorespiration is trapped and recycled through PEP carboxylase
(c) the CO_2 efflux is not prevented
(d) they have more chloroplasts

135. The enormous diversity of protein molecules is due mainly to the diversity of
(a) amino groups on the amino acids
(b) R groups on the amino acids
(c) amino acid sequences within the protein molecule
(d) peptide bonds

SECTION 4 - ZOOLOGY

136. 'Comma' shaped bacteria are known as
(a) coccus (b) spiral
(c) spirillum (d) vibrio

137. Which one of the following pairs of animals comprises 'jawless fishes'?
(a) Mackerals and Rohu
(b) Lampreys and hag fishes
(c) Guppies and hag fishes
(d) Lampreys and eels

138. Intercalated discs are the communication junctions between the cells of
(a) cardiac muscles
(b) striped muscles
(c) adipose tissue
(d) nerve and striated muscles

139. Which one of the following groups of animals is bilaterally symmetrical and triploblastic?
(a) Aschelminthes (round worms)
(b) Ctenophores
(c) Sponges
(d) Coelenterates (Cnidarians)

140. Pseudostratified epithelium is found in
(a) oesophagus (b) respiratory tract
(c) urinary tract (d) kidney

141. Male and female cockroaches can be distinguished externally through
(a) anal styles in male
(b) anal cerci in female
(c) anal style and antennae in females
(d) Both (b) and (c)

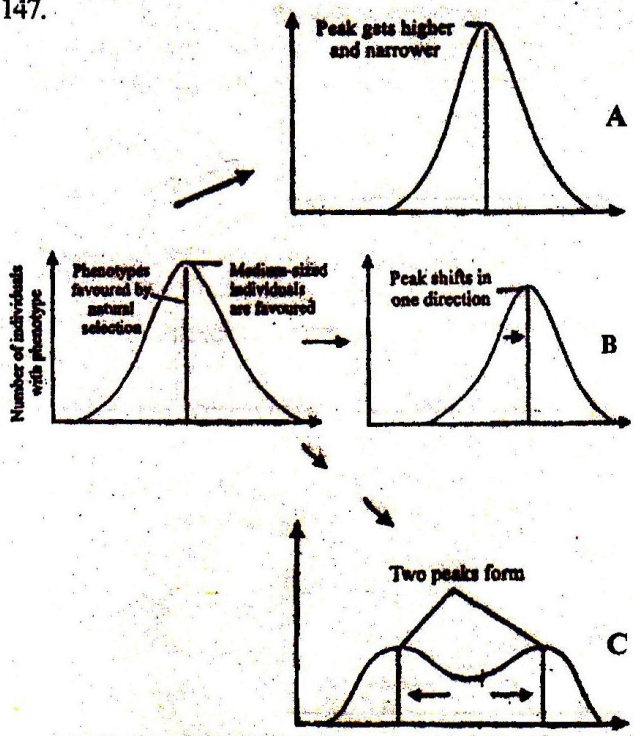
142. Nerve cells do not divide because they do not have
(a) nucleus (b) centrosome
(c) golgi body (d) mitochondria

143. Binary fission is found in –
(a) *Amoeba* (b) *Paramecium*
(c) *Planaria* (d) All of these

144. Human population growth in India
(a) tends to follow a sigmoid curve as in case of many other animal species
(b) tends to reach a zero population growth as in case of some animal species
(c) can be reduced by permitting natural calamities and enforcing birth control measures
(d) can be regulated by following the national programme of family planning

145. The diaphragm, cervical cap and vaults are
(a) Disposable contraceptive devices
(b) Reusable contraceptives
(c) IUDs
(d) Implants

146. The human embryo, with 8 to 16 blastomere is called
(a) Morula (b) Blastula
(c) Gastrula (d) Foetus

147. 

Following diagrammatic representation refers the natural selection on different traits. In which all the three graphs A, B and C are identified correctly
(a) A – Directional, B – Stabilising, C – Disruptive
(b) A – Stabilising, B – Directional, C – Disruptive
(c) A – Stabilising, B – Disruptive, C – Directional
(d) A – Directional, B – Disruptive, C – Stabilising

148. Which one of the following statements about human sperm is correct?
(a) Acrosome has a conical pointed structure used for piercing and penetrating the egg, resulting in fertilisation
(b) The sperm lysis in the acrosome dissolve the egg envelope facilitating fertilisation
(c) Acrosome serves as a sensory structure leading the sperm towards the ovum
(d) Acrosome serves no particular function

149. Bulbourethral gland is present in
(a) Males and is another name for Uterus masculina
(b) Females and is another name for Bertholin's gland
(c) Males and is another name for Cowper's gland
(d) None of these

150. Which of the following are water soluble vitamins?
(a) B, C (b) A, D, K
(b) A, D, E, K (d) K, B, A, E

151. Blood pressure is measured by
(a) sphygmomanometer
(b) stethoscope
(c) electrocardiogram
(d) phonocardiogram

152. Oxyntic cells are located in
(a) Islets of Langerhans
(b) Gastric epithelium and secrete pepsin
(c) Kidneys and secrete renin
(d) Gastric epithelium and secrete HCl

153. If Henle's loop were absent from mammalian nephron which of the following is to be expected?
(a) The urine will be more concentrated
(b) The urine will be more dilute
(c) There will be no urine formation
(d) There will be hardly any change in the quality and quantity of urine formed

154. Hepatic portal system carries
(a) Oxygenated blood from liver to intestine
(b) Deoxygenated blood from liver to intestine
(c) Oxygenated blood from intestine to liver
(d) Deoxygenated blood from intestine to liver

155. "Kwashiorkar' and 'Beri-Beri' are
(a) communicable diseases
(b) infectious diseases
(c) deficiency diseases
(d) None of the above

156. ABO blood group system is due to
(a) multifactor inheritance
(b) incomplete dominance
(c) multiple allelism
(d) epistasis

157. Evolution is
(a) progressive development of a race
(b) history and development of a race alongwith variations
(c) history of a race
(d) development of a race

158. Bull semen for the purpose of artificial insemination is stored in
(a) Ice (b) Liquid oxygen
(c) Liquid nitrogen (d) Liquid CO_2

159. The kind of evolution in which two species of different geneology come to resemble one another closely, is termed as
(a) progressive evolution
(b) convergent evolution
(c) parallel evolution
(d) retrogressive evolution

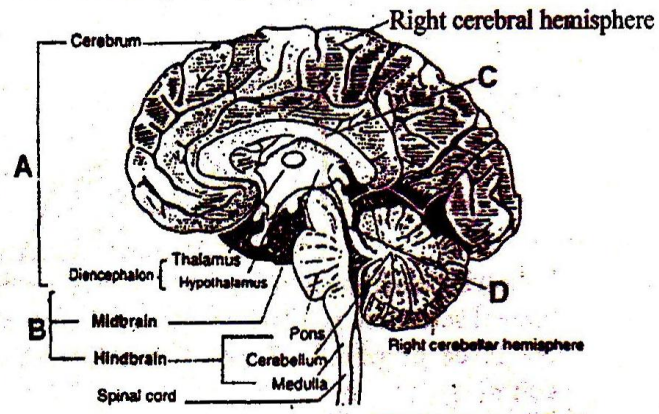
160. *Drosophila* flies with XXY genotype are females, but human beings with such genotype are abnormal males. It shows that
(a) Y-chromosome is essential for sex determination in *Drosophila.*
(b) Y-chromosome is female determinant in *Drosophila.*
(c) Y-chromosome is male determination in human beings.
(d) Y-chromosome has no role in sex determination either in ***Drosophila*** or in human beings.

161. Hinny is a hybrid of male
(a) Horse and female donkey
(b) Donkey and female horse
(c) Goat and female lamb
(d) Sheep and female goat.

162. According to Oparin, which one of the following was ***not*** present in the primitive atmosphere of the earth?
(a) Methane (b) Oxygen
(c) Hydrogen (d) Water vapour

163. When CO_2 concentration in blood increases, breathing becomes
(a) shallower and slow
(b) there is no effect on breathing
(c) slow and deep
(d) faster and deeper

164. Identify A, B, C and D



(a) A – Forebrain, B – Brainstem, C – Corpus callosum, D – Cerebral aqueduct
(b) A – Forebrain, B – Brainstem, C – Cerebral aqueduct, D – Corpus callosum
(c) A – Brainstem, B – Forebrain, C – Corpus callosum, D – Cerebral aqueduct
(d) A – Brainstem, B – Forebrain, C – Cerebral aqueduct, D – Corpus luteum

165. Afferent nerve fibres carry impulses from
(a) effector organs to CNS
(b) receptors to CNS
(c) CNS to receptors
(d) CNS to muscles

166. Which one of the following is the correct statement for respiration in humans?
(a) Workers in grinding and stone-breaking industries may suffer from lung fibrosis.
(b) About 90% of carbon dioxide (CO_2) is carried by haemoglobin as carbaminohaemoglobin.
(c) Cigarette smoking may lead to inflammation of bronchi.
(d) Neural signals from pneumotoxic centre in pons region of brain can increase the duration of inspiration.

167. The blood calcium level is lowered by the deficiency of
(a) parathormone
(b) thyroxine
(c) both calcitonin and parathormone
(d) calcitonin

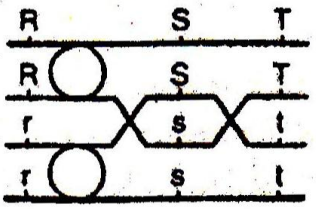
168. Which of the following statements regarding glucagon is false?
(a) It is secreted by α-cells of Langerhans.
(b) It acts antagonistically to insulin.
(c) It decreases blood sugar level.
(d) The gland responsible for its secretion is heterocrine gland.

169. Which hormone possesses anti-insulin effect?
(a) Cortisol (b) Calcitonin
(c) Oxytocin (d) Aldosterone

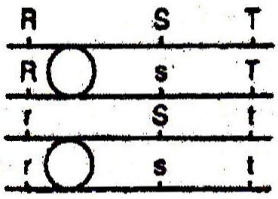
170. Which is the example of conditioned reflex ?
(a) Eyes closed when anything enter into it.
(b) Hand took up when piercing with needle.
(c) Salivation in a hungry dog in response to ringing of a bell.
(d) Digestion food goes forward in alimentary canal.

171. Which one of the following techniques made it possible to genetically engineerd living organism ?
(a) Recombinant DNA techniques
(b) X-ray diffraction
(c) Heavier isotope labelling
(d) Hybridization

172. The diagram opposite shows a homologous (bivalent) pair of chromosomes during meiosis.



Which of the following correctly represents the final products of the second meiotic division ?

(a)


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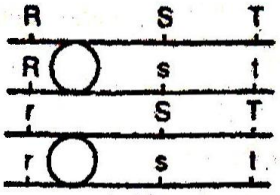

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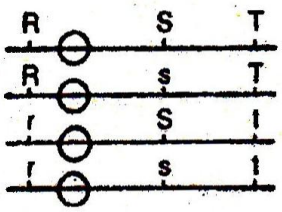
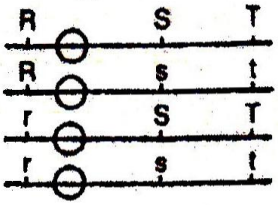


(d)


173. A sexually transmitted disease caused by bacteria is
(a) Leprosy
(b) AIDS
(c) Syphilis
(d) Pertussis

174. What is mode of bacterial resistance against antibiotics ?
(a) Development of thick mucilaginous layer
(b) Alteration of cell membrane
(c) Mutation in bacteria
(d) All the above

175. Which one of the following is a wrong matching of a microbe and its industrial product, while the remaining three are correct ?
(a) Yeast - statins
(b) *Acetobacter aceti* - acetic acid
(c) *Clostridium butylicum* - lactic acid
(d) *Aspergillus niger* - citric acid

176. To which type of barriers under innate immunity, do the saliva in the mouth and the tears from the eyes, belong?
(a) Cytokine barriers
(b) Cellular barriers
(c) Physiological barriers
(d) Physical barriers

177. Select the correct statement with respect to diseases and immunisation?
(a) If due to some reason B-and T-lymphocytes are damaged, the body will not produce antibodies against a pathogen
(b) Injection of dead / inactivated pathogens causes passive immunity
(c) Certain protozoans have been used to mass produce hepatitis B vaccine.
(d) Injection of snake antivenom against snake bite is an example of active immunisation

178. Which one of the following is a matching pair of a vitamin and the deficiency disease related with it ?
(a) Riboflavin — beri beri
(b) Thiamine — xerophthalmia
(c) Niacin — pellagra
(d) Calciferol — scurvy

179. Which one of the following is the correct matching of three items and their grouping category?

	Items	Group
(a)	Ilium, ischium, pubis	- coxal bones of pelvic girdle
(b)	Actin, myosin, rhodopsin.	- muscle proteins
(c)	Cytosine, uracil, thiamine	- pyrimidines
(d)	Malleus, incus, cochlea	- ear ossicles

180. What is the first step in the Southern blot technique?
(a) Denaturation of DNA on the gel for hybridization with specific probe.
(b) Production of a group of genetically identical cells.
(c) Digestion of DNA by restriction enzyme.
(d) Denaturation of DNA from a nucleated cell such as the one from the scene of crime.