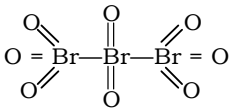
CHEMISTRY

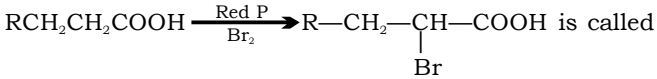
Single Correct Choice Type

This section contains 45 questions numbered 1 to 45. Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct.

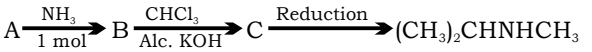
1. The compressibility of a gas is less than unity at STP. Therefore,
   (a) $V_m > 22.4$ L (b) $V_m < 22.4$ L
   (c) $V_m = 22.4$ L (d) $V_m = 44.8$ L
2. Oxidation number of bromine in sequence in Br_3O_8 is

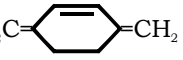


   (a) +8, +6, +8 (b) +6, +4, +6
   (c) 0, 0, 0 (d) +8, +4, +8
3. 1-Chlorobutane, on reaction with alcoholic potash (KOH), gives
   (a) 1-butene (b) 1-butanol
   (c) 2-butene (d) 2-butanol
4. The order of reactivities of the following alkyl halides for an S_N2 reaction is:
   (a) RF > RCl > RBr > RI (b) RF > RBr > RCl > RI
   (c) RCl > RBr > RF > RI (d) RI > RBr > RCl > RF
5. In both DNA and RNA, heterocyclic base and phosophate ester linkages are at
   (a) C-5' and C-2' respectively of the sugar molecule
   (b) C-2' and C-5' respectively of the sugar molecule
   (c) C-1' and C-5' respectively of the sugar molecule
   (d) C-5' and C-1' respectively of the sugar molecule
6. IUPAC name of 4-*iso*-propyl-*m*-xylene is
   (a) 1-*iso*-propyl-2, 4-dimethylbenzene
   (b) 4-*iso*-propyl-*m*-xylene
   (c) 4-*iso*-propyl-2, 3-dimethylbenzene
   (d) 4-*iso*-propyl-3, 5-dimethylbenzene
7. Which of the following is satisfied by an ideal solution?
   (a) Formation of an azeotropic mixture
   (b) $\Delta S_{mix} = 0$
   (c) Raoult's law is obeyed under particular set of conditions only
   (d) $\Delta H_{mix} = 0$
8. The reaction,



   (a) Reimer-Tiemann reaction
   (b) Hell-Volhard-Zelinsky reaction
   (c) Cannizzaro reaction
   (d) Sandmeyer reaction.
9. Identify A in the following sequence of reactions.



   (a) Ethyl halide (b) *Iso*-propylamine
   (c) *n*-Propyl halide (d) *Iso*-propyl halide
10. According to Bohr's theory, the angular momentum for an electron of 5th orbit is:
    (a) 2.5 h/ π (b) 5 h/ π
    (c) 25 h/ π (d) 6 h/2 π
11. Which of the following is aromatic in nature?
    (a)  (b) 
    (c)  (d) 
12. Transition elements exhibit higher enthalpies of atomization becuase
    (a) of large number of unpaired electrons
    (b) of having stronger interatomic interaction
    (c) of strong bonding between atoms
    (d) all of these
13. The number of Faradays needed to reduce 4 g equivalents of Cu^{2+} to Cu metal will be
    (a) 1 (b) 2
    (c) 1/2 (d) 4
14. Bakelite is obtained from phenol by reaction with
    (a) HCHO (b) $(CH_2OH)_2$
    (c) CH_3CHO (d) CH_3COCH_3
15. The reaction $Ar\overset{+}{N}_2Cl^- \xrightarrow{Cu/HCl} ArCl + N_2 + CuCl$ is named as _____.
    (a) Sandmeyer reaction
    (b) Gatterman reaction
    (c) Hofmann bromamide degradation reaction
    (d) Carbylamine reaction
16. In a solid lattice the cation and anion both have left a lattice site. The lattice defect is known as
    (a) interstitial defect (b) vacancy defect
    (c) Frenkel defect (d) Schottky defect
17. The pH of 0.05 M $Ba(OH)_2$ solution is:
    (a) 12 (b) 13
    (c) 1 (d) 10
18. Match the column I with column II and mark the appropriate choice.

Column I	Column II
(A) Ascorbic acid	(i) Beri-beri
(B) Retinol	(ii) Cracked lips
(C) Riboflavin	(iii) Scurvy
(D) Thiamine	(iv) Night blindness

    (a) (A) → (ii), (B) → (iii), (C) → (iv), (D) → (i)
    (b) (A) → (iii), (B) → (i), (C) → (ii), (D) → (iv)
    (c) (A) → (i), (B) → (ii), (C) → (iii), (D) → (iv)
    (d) (A) → (iii), (B) → (iv), (C) → (ii), (D) → (i)
19. PVC is an example of
    (a) thermosetting (b) thermoplastic
    (c) elastic (d) fibre
20. What is the decreasing order of strength of the bases OH^-, NH_2^-, $HC \equiv C^-$ and $CH_3CH_2^-$?
    (a) $CH_3CH_2^- > NH_2^- > HC \equiv C^- > OH^-$
    (b) $HC \equiv C^- > CH_3CH_2^- > NH_2^- > OH^-$

(c) $OH^- > NH_2^- > HC \equiv C^- > CH_3CH_2^-$

(d) $NH_2^- > HC \equiv C^- > OH^- > CH_3CH_2^-$

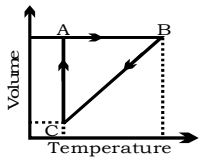
21. The arrangement ABC ABC ..... is referred to as
(a) octahedral close packing
(b) hexagonal close packing
(c) tetrahedral close packing
(d) cubic close packing

22. Primary, secondary and tertiary alcohols can be distinguished by
(a) Baeyer's reagent (b) Fehling's solution
(c) Sulphuric acid (d) Lucas reagent

23. Calculate the uncertainty in the momentum of an electron if it is confined to a linear region of length 1×10^{-10} metre.
(a) 5.37×10^{-27} kg m s^{-1} (b) 5.27×10^{-27} g ms^{-1}
(c) 5.37×10^{-25} g ms^{-1} (d) 5.27×10^{-25} kg ms^{-1}

24. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice.
Assertion: $[Cu(NH_3)_4]^{2+}$ is coloured while $[Cu(CN)_4]^{3-}$ ion is colourless.
Reason: $[Cu(NH_3)_4]^{2+}$ has dsp^2 hybridisation.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

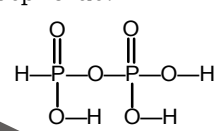
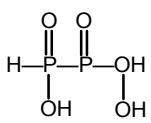
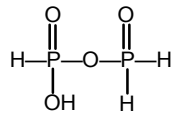
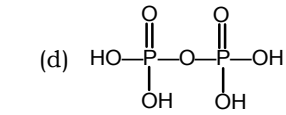
25. Five moles of a gas is put through a series of changes as shown graphically in a cyclic process. The processes A $\rightarrow$B, B $\rightarrow$C and C $\rightarrow$ A respectively are



(a) isochoric, isobaric, isothermal
(b) isobaric, isochoric, isothermal
(c) isothermal, isobaric, isochoric
(d) isochoric, isothermal, isobaric

26. Which one of the following reactions of xenon compounds is not feasible?
(a) $XeO_3 + 6HF \rightarrow XeF_6 + 3H_2O$
(b) $3XeF_4 + 6H_2O \rightarrow 2Xe + XeO_3 + 12HF + 1.5O_2$
(c) $2XeF_2 + 2H_2O \rightarrow 2Xe + 4HF + O_2$
(d) $XeF_6 + RbF \rightarrow Rb[XeF_7]$

27. Aspirin is an acetylation product of
(a) p-dihydroxybenzene
(b) o-hydroxybenzoic acid
(c) o-dihydroxybenzene
(d) m-hydroxybenzoic acid

28. Which of the following represents the isopolyacid of phosphorus?
(a) 
(b) 
(c) 
(d) 

29. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice.
Assertion : When $Q_c = K_c$, reaction is at equilibrium.
Reason : At equilibrium, $\Delta G°$ is 0.
(a) Both assertion and reason are true and reason is the correct explanation of assertion
(b) Both assertion and reason are true but reason is not the correct explanation of assertion
(c) Assertion is true but reason is false
(d) Both assertion and reason are false

30. Half-life period of a zero order reaction is
(a) proportional to initial concentrations of reactions
(b) independent of initial concentrations of reactants
(c) inversely proportional to initial concentrations of reactants
(d) inversely proportional to the square of initial concentrations of reactants

31. Magnitude of kinetic energy in an orbit is equal to
(a) Half of the potential energy
(b) Twice of the potential energy
(c) One fourth of the potential energy
(d) None of the above

32. For the reaction at 298 K
$A(g) + B(g) \rightleftharpoons C(g) + D(g)$
$\Delta H° = -29.8$ kcal, $\Delta S° = -0.100$ kcal K^{-1}
What is the value of $\Delta G°$?
(a) 1 (b) 0
(c) 2 (d) 4

33. Boric acid is used in carrom boards for smooth gliding of pawns because
(a) H_3BO_3 molecules are loosely chemically bonded and hence soft
(b) Its low density makes it fluffy
(c) It can be powered to a very small grain size
(d) H-bonding in H_3BO_3 gives it a layered structure

34. Racemic mixture is formed by mixing two
(a) Isomeric compounds
(b) Chiral compounds
(c) Meso compounds
(d) Enantiomers with chiral carbon

35. Mesomeric effect involves delocalisation of
(a) pi-electrons (b) Sigma-electrons
(c) Protons (d) None of these

36. Which of the following is most reactive towards nucleophilic substitution reaction?
(a) CH_2 = CH–Cl (b) C_6H_5Cl
(c) $C_6H_5CH_2Cl$ (d) $ClCH_2$–CH = CH_2

37. Corrosion of iron is essentially an electrochemical phenomenon where the cell reactions are
(a) Fe is oxidised to Fe^{2+} and dissolved oxygen in water is reduced to OH^-
(b) Fe is oxidised to Fe^{3+} and H_2O is reduced to O_2^{2-}
(c) Fe is oxidised to Fe^{2+} and H_2O is reduced to O_2^-
(d) Fe is oxidised to Fe^{2+} and H_2O is reduced to O_2

38. According to Freundlich adsoprtion whcih of the following is correct?

(a) $\frac{x}{m} \propto p^0$ (b) $\frac{x}{m} \propto p^1$

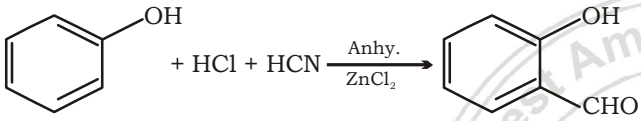
(c) $\frac{x}{m} \propto p^{1/n}$

(d) All of the above are correct for different range of pressure

39. Lanthanide contraction is caused due to
(a) the appreciable shielding on outer electrons by $4f$ electrons from the nuclear charge
(b) the appreciable shielding on outer electrons by $5d$-electrons from the nuclear charge
(c) the same effective nuclear charge from Ce to Lu
(d) the imperfect shielding on outer electrons by $4f-$electrons from the nuclear charge

40. Which one of the following has square planar structure?
(a) $[Ni(CN)_4]^{2-}$ (b) $[Ni(CO)_4]$
(c) $[NiCl_4]^{2-}$ (d) All of these

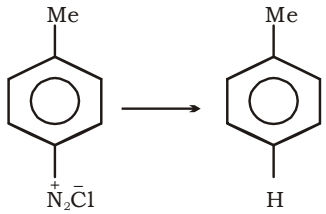
41. The following reaction is known as



(a) Perkin reaction (b) Gattermann reaction
(c) Kolbe reaction
(d) Gattermann-aldehyde reaction

42. The cleavage of an aryl-alkyl ether with cold HI gives
(a) alkyl iodide and water
(b) aryl iodide and water
(c) alkyl iodide, aryl iodide and water
(d) phenol and alkyl iodide

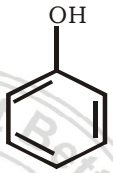
43. The reagent with which the following reaction is best accomplished is

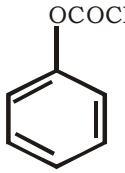


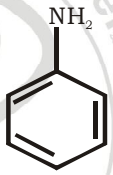
(a) H_3PO_2 (b) H_3PO_3 (c) H_3PO_4 (d) $NaHSO_3$

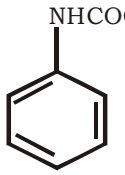
44. The tripeptide hormone present in most living cells is
(a) glutahione (b) glutamine
(c) oxytocin (d) ptyalin

45. Which of the following compounds will give significant amount of *meta*-product during mononitration reaction?

(a) 

(b) 

(c) 

(d) 

PHYSICS

Single Correct Choice Type

This section contains 45 questions numbered 46 to 90. Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct.

46. Which of the following pairs of physical quantities does not have dimension formula?
(a) Work and torque
(b) Angular momentum and Planck's constant
(c) Tension and surface tension
(d) Impulse and linear momentum

47. In one dimensional motion, instantaneous speed v satisfies $0 \le v \le v_0$.
(a) The displacement in time T must always take non-negative values.
(b) The displacement x in time T satisfies $-v_0T < x < v_0T$
(c) The acceleration is always a non-negative number.
(d) The motion has no turning points.

48. Which one of the following statements is true?
(a) A scalar quantity is the one that is conserned in a process
(b) A scalar quantity is the one that can never take negative values
(c) A scalar quantity i s the one that does not vary from one point to another in space
(d) A scalar quantity has the same value for observers with different orientation of the axes.

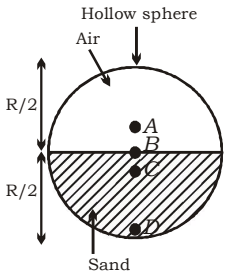
49. An iron block of sides 50 cm × 8 cm × 15 cm has to be pushed along the floor. The force required will be minimum when the surface in contact with ground is
(a) 8 cm × 15 cm surface (b) 50 cm × 15 cm surface
(c) 8 cm × 50 cm surface
(d) force is same for all surfaces

50. Conservation of momentum in a collision between particles can be understood from
(a) conservation of energy
(b) Newton's first law only
(c) Newton's second law only
(d) both Newton's second and third law

51. An electron and a proton are moving under the influence of mutual forces. In calculating the change in the kinetic energy of the system during motion, one ignores the magnetic force of one on another. This is because,
(a) the two magnetic forces are equal and opposite, so they produce no net effect.
(b) the magnetic forces do no work on each particle.
(c) the magnetic forces do equal and opposite (but non-zero) work on each particle
(d) the magnetic forces are necessarily negligible

52. Both earth and moon are subjected to the gravitational force of the sun. As observed from the sun, the orbit of the moon
(a) will be elliptical
(b) will not be stricity elliptical because the total gravitational force on it is not central
(c) is not elliptical but will necessarily be a closed curve
(d) deviates considerably from being elliptical due to influence of planets other than earth.

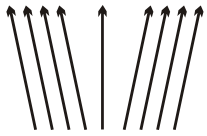
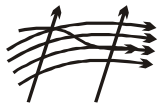
53. Which of the following points is the likely position of the centre of mass of the system shown in figure?



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

54. Consider two cylindrical rods of identical dimensions, one of rubber and the other of steel. Both the rods are fixed rigidly at one end to the roof. A mass M is attached to each of the free ends at the centre of the rods
(a) Both the rods will elongate but tere shall be no perceptible change in shape
(b) The steel rod will elongate and change shape but the rubber rod will only elongate
(c) The steel rod will elongate without any perceptible change in shape, but the rubber rod will elongate and the shape of the bottom edge will change to an ellipse
(d) The steel rod will elongate, without any perceptible change in shape, but the rubber rod will elongate with the shape of the bottom edge tapered to a tip at the centre.

55. Which of the following diagrams does not represent a streamline flow?

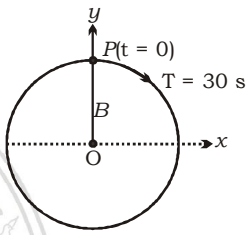
(a) 
(b) 
(c) 
(d) 

56. A uniform metallic rod rotates about its perpendicular bisector with constant angular speed. If it is heated uniformly to raise its temperature slightly
(a) its speed of rotation increases
(b) its speed of rotation decreases
(c) its speed of rotation remains same
(d) its speed increases because its moment of inertia increases

57. A carnot engine absorbs 750 J of heat energy from a reservoir at 137°C and rejects 500 J of heat during each cycle, then the temperature of sink is:
(a) 0.25°C (b) 0.34°C
(c) 0.44°C (d) 0.54°C

58. 1 mole of H_2 gas is contained in a box of volume V = 1.00 m^3 at T = 300 K. The gas is heated to a temperature of T = 3000 K and the gas gets converted to a gas of hydrogen atoms. The final pressure would be (considering all gases to be ideal)
(a) same as the pressure initially
(b) 2 times the pressure initially
(c) 10 times the pressure initially
(d) 20 times the pressure initially

59. Figure shows the circular motion of a particle. The radius of the circle, the period, sense of revolution and the initial position are indicated on the figure. The simple harmonic motion of the *x*-projection of the radius vector of the rotating particle *P* is:



(a) $x(t) = B\sin\left(\frac{2\pi}{30}t\right)$ (b) $x(t) = B\cos\left(\frac{\pi}{15}t\right)$

(c) $x(t) = B\sin\left(\frac{\pi}{15}t + \frac{\pi}{2}\right)$ (d) $x(t) = B\cos\left(\frac{\pi}{15}t + \frac{\pi}{2}\right)$

60. Equation of a plane progressive wave is given by $y = 0.6\sin 2\pi\left(t - \frac{x}{2}\right)$. On reflection from a denser medium its amplitude becomes $\frac{2}{3}$ of the amplitude of the incident wave. The equation of the reflected wave is:

(a) $y = 0.6\sin 2\pi\left(t + \frac{x}{2}\right)$ (b) $y = -0.4\sin 2\pi\left(t + \frac{x}{2}\right)$

(c) $y = 0.4\sin 2\pi\left(t + \frac{x}{2}\right)$ (d) $y = -0.4\sin 2\pi\left(t - \frac{x}{2}\right)$

61. A point charge +q, is placed at a distance *d* from an isolated conducting plane. The field at a point P on the other side of the plane is:
(a) directed perpendicular to the plane and away from the plane
(b) directed perpendicular to the plane but towards the plane
(c) directed radially away from the point charge
(d) directed radially towards the point charge

62. If a charged spherical conductor of radius 10 cm has potential V at a point distant 5 cm from its centre, then the potential at a point distance 15 cm from the centre will be

(a) 3V (b) $\frac{3}{2}$V

(c) $\frac{2}{3}$V (d) $\frac{1}{3}$ V

63. A resistance R is to be measured using a meter bridge. Student chooses the standard resistance S to be 100 Ω. He finds the null point at $l_1 = 2.9$ cm. He is told to attempt to improve the accuracy. Which of the following is a useful way?
(a) He should measure l_1 more accurately
(b) He should change S to 1000 Ω and repeat the experiment.
(c) He should change S to 3 Ω and repeat the experiment
(d) he should give up hope of a more accurate measurement with a meter bridge.

64. An electron is projected with uniform velocity along the axis of a current carrying long solenoid. Which of the following is true?
(a) The electron will be accelerated along the axis
(b) The electron path will be circular about the axis
(c) The electron will experience a force at 45^0 to the axis and hence execute a helical path
(d) The electron will continue to move with uniform velocity along the axis of the solenoid

65. Consider the two idealised systems
(i) a parallel plate capacitor with large plates and small separation and
(ii) a long solenoid of length L >> R, radius of cross-section.
In (i) $\vec{E}$ is ideally treated as a constant between plates and zero outside. In (ii) magnetic field is constant inside the solenoid and zero outside. These idealised assumptions, however, contradict fundamental laws as below
(a) case (i) contradicts Gauss's law for electrosatic fields.
(b) case (ii) contradicts Gauss's law for magnetic fields.
(c) case (i) agrees with $\oint \vec{E}.\vec{dl} = 0$.
(d) case (ii) contradicts $\oint \vec{H}.\vec{dl} = I_{en}$.

66. When the plane of the armature of an a.c. generator is parallel to the field, in which it is rotating
(a) both the flux linked and induced emf in the coil are zero
(b) theh flux linked with it is zero, while induced emf is maximum
(c) flux linked is maximum while induced emf is zero
(d) both the flux and emf have their respective maximum values

67. Quantity that remains unchanged in a transformer is
(a) voltage (b) current
(c) frequency (d) none of these

68. Frequency of radiations arising from two close energy levels in hydrogen, known as lamb shift is 1057 MHz. This frequency falls in which range of electromagnetic wave?
(a) Infrared rays (b) X-rays
(c) γ-rays (d) Radio waves

69. The angle of minimum deviation for prism of angle $\pi/3$ is $\pi/6$, if the velocity of light in vacuum is 3×10^8 ms^{-1}, then the velocity of light in material of the prism is
(a) 2.12×10^8 ms^{-1} (b) 1.12×10^8 ms^{-1}
(c) 4.12×10^8 ms^{-1} (d) 5.12×10^8 ms^{-1}

70. The number of capital letters such as A, B, C, D .... which are not laterally inverted by a plane mirror?
(a) 6 (b) 7
(c) 11 (d) 13

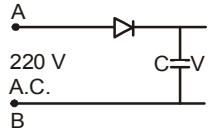
71. An optically active compound
(a) rotates the plane of polarised light
(b) changes the direction of polarised light
(c) does not allow plane polarised light to pass through
(d) none of these

72. The de Broglie wavelength of an electron in a metal at 27°C is
(Given $m_e = 9.1 \times 10^{-31}$ kg, $k_B = 1.38 \times 10^{-23}$ J K^{-1})
(a) 6.2×10^{-9} m (b) 6.2×10^{-10} m
(c) 6.2×10^{-8} m (d) 6.2×10^{-7} m

73. For the ground state, the electron in the H-atom has an angular momentum = $\hbar$, according to the simple Bohr model. Angular momentum is a vector and hence there will be infinitely many orbits with the vector pointing in all possible directions. In actually this is not true,
(a) because Bohr model gives incorrect values of angular momentum
(b) because only one of these would have a minimum energy
(c) angular momentum must be in the direction of spin of electron
(d) because electrons go around only in horizontal orbits

74. When a nucleus in an atom undergoes a radioactive decay, the electronic energy levels of the atom
(a) do not change for any type of radioactivity
(b) change for α and β radioactivity but not for γ-radioactivity
(c) change for α-radioactivity but not for others
(d) change for β-radioactivity but not for others

75. A 220 V ac supply is connected between points A and B as shown in figure. What will be the potential difference V across the capacitor?



(a) 220 V (b) 110 V
(c) 0 V (d) $220\sqrt{2}$ V

76. **Assertion:** An object may fall with a constant velocity.
Reason: This happens when acceleration of the object is equal to acceleration due to gravity.
(a) If both assertion and reason are true and reason is the correct explanation of assertion
(b) If both assertion and reason are ture 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.

77. Which one of the following can also act as a lubricant in the machines?
(a) Iron fillings
(b) Polish on machines
(c) Flow of water through the machine
(d) Flow of compressed and purified air.

78. The negative of the work done by the conservative internal forces on a system equals to the change in
(a) total energy (b) kinetic energy
(c) potential energy (d) none of these

79. When the load on a wire is increased from 3 kg wt to 5 kg wt the elongation increases from 0.61 mm to 1.02 mm. The required work down during the extension of the wire is
(a) 16×10^{-3} J (b) 8×10^{-2} J
(c) 20×10^{-2} J (d) 11×10^{-3} J

80. Heat is associated with
(a) kinetic energy of random motion of molecules
(b) kinetic energy of orderly motion of molecules
(c) total kinetic energy of random and orderly motion of molecules
(d) kinetic energy of random motion in some cases and kinetic energy orderly motion in other.

81. A closed organ pipe and an open organ pipe of same length produce 2 beats/second while vibrating in their fundamental modes. The length of the open organ pipe is halved and that of closed pipe is doubled. Then, the number of beats produced per second while vibrating in the fundamental mode is
(a) 2 (b) 6
(c) 8 (d) 7

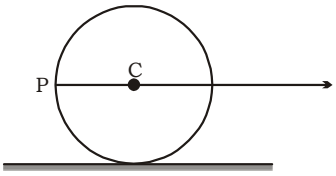
82. Which of the following statements is not true about Gauss's law?
(a) Gauss's law is true for any closed surface.
(b) The term q on the right side of Gauss's law includes the sum of all charges enclosed by the surface.
(c) Gauss's law is not much useful in calculating electrostatic field when the system has some symmetry.
(d) Gauss's law is based on the inverse square dependence on distance contained in the coulomb's law.

83. Four resistances of $3\Omega, 3\Omega, 3\Omega$ and 4Ω respectively are used to form a Wheatstone bridge. The 4Ω resistance is short circuited with a resistance R in order to get bridge balanced. The value of R will be
(a) 10Ω (b) 11Ω
(c) 12Ω (d) 13Ω

84. A 200 turn closely would circular coil of radius 15 cm carries a current of 4 A. The magnetic moment of this coil is
(a) 36.5 A m^2 (b) 56.5 A m^2
(c) 66.5 A m^2 (d) 108 A m^2

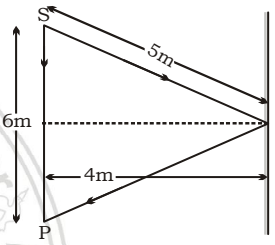
85. Wave theory cannot explain the phenomena of
A. Polarization B. Diffraction
C. Compton effect D. Photoelectric effect
Which of the following is correct?
(a) A and B (b) B and D
(c) C and D (d) D and A

86. A disc of radius R is rolling purely on a flat horizontal surface, with a constant angular velocity. The angle between the velocity and acceleration vectors of point P is



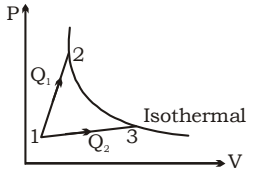
(a) zero (b) 45^0 (c) 135^0 (d) $\tan^{-1}\left(\frac{1}{2}\right)$

87. A person standing at a distance of 6 m from a source of sound receives sound wave in two ways, one directly from the source and the other after reflection from a rigid boundary as shown in the figure. The maximum wavelength for which, the person will receive maximum sound intensity, is (Assume that there is no phase change in reflection)



(a) 4 m (b) $\frac{16}{3}$ m (c) 2 m (d) $\frac{8}{3}$ m

88. A gas takes part in two processes in which it is heated from the same initial state 1 to the same final temperature. The process are shown on the $p-V$ diagram by the straight lines 1-2 and 1-3. 2 and 3 are the points on the same isothermal curve. Q_1 and Q_2 are the heat transfer along the two processes. Then



(a) $Q_1 = Q_2$ (b) $Q_1 < Q_2$
(c) $Q_1 > Q_2$ (d) Data insufficient

89. The refractive index of a prism is 2. The limiting value of angle of prism, so that no TIR takes place from opposite side of the prism is
(a) 60^0 (b) 30^0
(c) 45^0 (d) 90^0

90. Photons with energy 5 eV are incident on a cathode C, on a photoelectric cell. The maximum energy of the emitted photoelectrons is 2 eV. When photons of energy 6 eV are incident on C, no protoelectric will reach the anode A, if the stopping potential of A relative to C is
(a) 3V (b) -3V
(c) -1 V (d) 4 V

BIOLOGY

Single Correct Choice Type

This section contains 90 questions numbered 91 to 180. Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct.

91. Toxic substances are detoxified in human body in:
(a) kidney (b) lungs
(c) liver (d) stomach

92. Pollorum disease of poultry is caused by:
(a) *Mycobacterium* (b) *Salmonella*
(c) *Clostridium* (d) *Hemophilus*

93. Mirabilis jalapa shows:
(a) codominance (b) incomplete dominance
(c) dominance (d) complementary genes

94. Sometimes, the fern plant arises from fern prothallus without fertilization. This is an example of:
(a) apospory (b) apogamy
(c) parthenocarpy (d) gametogenesis

95. If a homozygous red flowered plant is crossed with a homozygous white flowered plant, the offsprings would be:
(a) all red flowered (b) half red flowered
(c) half white flowered (d) all white flowered

96. The plant body of Funaria is:
(a) sporophyte
(b) gametophyte
(c) predominantly sporophyte with independent gametophyte
(d) predominantly gameotophyte with dependent sporophyte

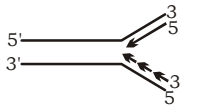
97. The places of first, second and third moulting of *Ascaris* larva are:
(a) soil, alveoli, lung (b) liver, soil, stomach
(c) soil, lung, liver (d) soil, intestine, lung

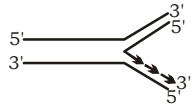
98. The quiescent centre in root meristem serves as a:
(a) site for storage of food which is utilized during maturation
(b) reservoir of growth hormones
(c) reserve for replenishment of damaged cells of the meristem
(d) region for absorption of water

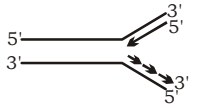
99. In a dicotyledonous stem, the sequence of tissues from the outside to the inside is:
(a) phellem-pericycle-endodermis-phloem
(b) phellem-phloem-endodermis-pericycle
(c) phellem-endodermis-pericycle-phloem
(d) pericycle phellem-endodermis-phloem

100. Which one of the following correctly represents the manner of replication of DNA?

(a) 

(b) 

(c) 

(d) 

101. Which fact suggests that most oxygen is transported from lungs to the tissue combined with haemoglobin rather than dissolved in blood plasma?
(a) O_2 carrying capacity of whole blood is much higher than that of plasma and O_2 content of blood leaving the lungs is greater than that of blood entering the lungs
(b) Haemoglobin can combine with O_2
(c) Oxyhaemoglobin can dissociate into haemoglobin and O_2
(d) Increase in CO_2 concentration decreases the O_2 affinity of haemoglobin

102. A person passes much urine and drinks much water but his blood glucose level is normal. This condition may be the result of:
(a) a reduction in insulin secretion from pancreas
(b) a reduction in vasopressin secretion from posterior pituitary
(c) a fall in the glucose concentration in urine
(d) an increase in secretion of glucagon

103. Which one of the following is a matching pair?
(a) Lubb-Sharp colour of AV valves at the beginning of ventricular systole
(b) Dup-Sudden opening of semilunar valves at the beginning of ventricular diastole
(c) Pulsation of the radial artery valves in the blood vessels
(d) Initiation of the heart beat Purkinje fibres

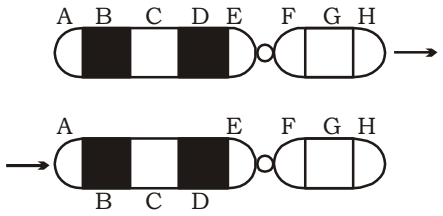
104. Which one of the following is a matching pair of a certain body feature and its value/count in a normal human adult?
(a) Urea 5 - 10 mg/100 mL of blood
(b) Blood sugar (fasting) -70 - 100 mg/100 mL
(c) Total blood volume -5 - 61
(d) ESR in Wintrobe method -9 - 15 mm in males and 20 34 mm in females

105. How many different types of gametes can be formed by F_1 progeny, resulting from the following cross?
AA BB CC × aa bb cc
(a) 3 (b) 8
(c) 27 (d) 64

106. Mosses and ferns are found in moist and shady places because both:
(a) require presence of water for fertilization
(b) do not need sunlight for photosynthesis
(c) depend for their nutrition on micro-organisms which can survive only at low temperature
(d) cannot compete with sun-loving plants

107. The bacteria *Pseudomonas* is useful because of its ability to:
(a) transfer genes from one plant to another
(b) decompose a variety of organic compounds
(c) fix atmospheric nitrogen in the soil
(d) produce a wide variety of antibiotics

108. Given below is representation of a kind of chromosomal mutation. What is the kind of mutation represented?



(a) Deletion
(b) Duplication
(c) Inversion
(d) Reciprocal translocation

109. A lake with an inflow of domestic sewage rich in organic waste may result in:
(a) drying of the lake very soon due to algal bloom
(b) an increased production of fish due to lot of nutrients
(c) death of fish due to lack of oxygen
(d) increased population of aquatic food web organisms.

110. Nitrogen oxides produced from the emission of automobiles and power plants are the source of fine air borne particles which lead to:
(a) photochemical smog (b) dry acid deposition
(c) industrial smog (d) wet acid deposition

111. Which one of the following is correctly matched regarding an Institute and its location?
(a) National Institute of Virology - Pune
(b) National Institute of Communicable disease - Lucknow
(c) Central Drug Research Institute - Kasauli
(d) National Institute of Nutrition - Mumbai

112. Unidirectional transmission of a nerve impulse through nerve fibre is due to the fact that:
(a) nerve fibre is insulated by a medullary sheath
(b) sodium pump starts operting only at the cyton and then continues into the nerve fibre
(c) neurotransmitters are released by dendrites and not by axon endings
(d) neurotransmitters are released by the axon endings and not by dendrites

113. Cultivation of Bt cotton has been much in the news. The prefix Bt means:
(a) barium-treated cotton seeds
(b) bigger thread variety of cotton with better tensile strength
(c) produced by biotechnology using restriction enzymes and ligases
(d) carrying an endotoxin gene from bacillus thuringiensis

114. Which one of the following is correct matching of a plant, its habit and the forest type where it normally occurs?
(a) Prosopis, tree, scrub
(b) Saccharum officinarum, grass, forest
(c) Shorea robusta, herb, tropical rain forest
(d) Acacia catechu, tree, coniferous forest

115. Autopolyploids (numeric or quantitative polyploids or intra specific polyploids) like ferns, garden plants, gram, maize, rice, banana, grapes, apple etc., show:
(a) increased gene dosage
(b) gigas effects and seedless fruits
(c) more yields and better adaptation
(d) all of the above

116. Three of the following statements regarding cell organelles are correct while one is wrong. Which one is wrong?
(a) Lysosomes are double membraned vesicles budded off from Golgi apparatus and contain digestive enzymes
(b) Endoplasmic reticulum consists of a network of membranous tubules and helps in transport, synthesis and secretion
(c) Leucoplasts are bound by two membranes, lack pigment but contain their own DNA and protein synthesizing machinery
(d) Sphaerosomes are single membrane bound and are associated with synthesis and storage of lipids

117. When synapsis is complete all along the chromosome, the cell is said to have entered a stage called:
(a) zygotene (b) pachytene
(c) diplotene (d) diakinesis

118. Which one of the following statements pertaining to plant structure is correct?
(a) Cork lacks stomata but lenticels carry out transpiration
(b) Passage cells help in transfer of food from cortex to phloem
(c) Sieve tube elements possess cytoplasm but no nuclei
(d) The shoot apical meristem has a quiescent centre

119. The family containing mustard and its main characters are:
(a) Brassicaceae - Tetramerous flowers,six stamens, bicarpellary gynoecium, siliqua type fruit
(b) Brassicaceae - Pentamerous flowers,many stamens, pentacarpellary gynoecium, capsule type fruit
(c) Solanaceae - Pentamerous flowers, five stamens, bicarpellary gynoecium berry type fruit
(d) Poaceae - Trimerous flowers, three stamens, monocarpellary gynoecium, caryopsis type of fruit

120. 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 when in fresth water
(c) Paramecium discharges concentrated salt solution by contractile vacuoles
(d) The body fluids of freshwater animals are generally hypotonic to surrounding water

121. A young drug addict used to show symptoms of depressed brain activity, feeling of calmness, relaxation and drowsiness. Possibly he was taking:
(a) amphetamine (b) marijuna
(c) pethidine (d) valium

122. One of the *ex situ* conservation methods for endangered species is:
(a) wildlife sanctuaries (b) biosphere reserves
(c) cryopreservation (d) national parks

123. Which one of the following is a correct statement?

(a) "Bt" in "Bt-cotton" indicates that it is a genetically modified organism produced through biotechnology
(b) Somatic hybridization involves fusion of two complete plant cells carrying desired genes
(c) The anticoagulant hirudin is being produced from transgenic Brassica napus seeds
(d) "Flavr Savr" variety of tomato has enhanced the production of ethylene which improves its taste

124. Somaclonal variation is seen in:
(a) tissue culture grown plants
(b) apomicts
(c) polyploids
(d) vegetatively propagated plants

125. During protein synthesis in an organism, at one point the process comes to a halt. Select the group of the three codons from the following, from which any one of the three could bring about this halt?
(a) UUU, UCC, UAU (b) UUC, UUA, UAC
(c) UAG, UGA, UAA (d) UUG, UCA, UCG

126. Keystone species deserve protection because these:
(a) are capable of surviving in harsh environmental conditions
(b) indicate presence of certain minerals in the soil
(c) have become rare due to over exploitation
(d) play an important role in supporting other species

127. Avena curvature test is a bioassy for examining the activity of:
(a) auxins (b) gibberellins
(c) cytokinins (d) ethylene

128. Among rust, smut and mushroom all the three:
(a) are pathogens (b) are saprobes
(c) bear ascocarps (d) bear basidiocarps

129. Both corpus luteum and macula lutea are:
(a) found in human ovaries
(b) a source of hormones
(c) characterised by a yellow colour
(d) contributory in maintaining pregnancy

130. In the following table identify the correct matching of the crop, its disease and the corresponding pathogen:

	Crop	**Disease**	**Pathogen**
(a)	Citrus	Canker	Pesudomonas rubrilineans
(b)	Potato	Late blight	Fusarium udum
(c)	Brinjal	Root-knot	Meloidogyne incognita
(d)	Pigeon pea	Seed gall	Phytophthora infestans

131. The type of epithelial cells which line the inner surface of fallopian tubes, bronchioles and small bronchi, are known as:
(a) squamous epithelium (b) columnar epithelium
(c) cilated epithelium (d) cubical epithelium

132. Virusus that infect bacteria multiply and cause their lysis, are called:
(a) lysozymes (b) lipolytic
(c) lytic (d) lysogenic

133. A cricket player is fast chasing a ball in the field. Which one of the following groups of bones are directly contributing in this movement?
(a) Femur, malleus, tibia, metatarsals
(b) Pelvis, ulna, patella,tarsals
(c) Sternum, femur, tibia, fibula
(d) Tarsals,femur, metatarsals,tibia

134. Which one of the following animals is correctly matched with its one characteristic and the taxon?

	Animals	**Characteristic**	**Taxon**
(a)	Millipded	Ventral nerve cord	Arachnida
(b)	Duckbilled platypus	Oviparous	Mammalian
(c)	Silverfish	Pectorol and pelvic fins	Chordate
(d)	Sea anemone	Triploblastic	Cnidaria

135. What would happen if in a gene encoding a polypeptide of 50 amino acids will be (UAC) is mutated to UAA?
(a) A polypeptide of 49 amino acids will be formed
(b) A polypeptide of 25 amino acids will be formed
(c) A polypeptide of 24 amino acids will be formed
(d) Two polypeptides of 24 and 25 amino acids will be formed

136. Which one of the following four glands is correctly matched with the accompanying description?
(a) Thyroid - Hyperactivity in young children causes cretinism
(b) Thymus - Starts undergoing atrophy after puberty
(c) Parathyroid - Secretes parathormone which promotes movement of calcium ions from blood into bones during calcification
(d) Pancreas - Delta cells of the Islets of Langerhans secrete a hormone which stimulates glycolysis in liver

137. A lake with an inflow of domestic sewage rich in organic waste may result in
(a) drying of the lake very soon due to algal bloom
(b) an increased production of fish due to lot of nutrients
(c) death of fish due to lack of oxygen
(d) increased population of aquatic food web organisms

138. Continued consumption of a diet rich in butter, red meat and eggs for a long period may lead to
(a) vitamin A toxicity
(b) kidney stones
(c) hypercholesterolemia
(d) urine laden with ketone bodies

139. A sewage treatment process in which a portion of the decomposer bacteria present in the waste is recycled into the beginning of the process, is called
(a) cyclic treatment
(b) primary treatment
(c) activated sludge treatment
(d) tertiary treatment

140. What is common among silver fish, scorpion, crab and honey bee?
(a) Compound eyes (b) Poison glands
(c) Jointed appendages (d) Metamorphosis

141. Match the following ovular structure with post fertilization structure and select the correct alternative

A.	Ovule	1.	Endosperm
B.	Funiculus	2.	Aril
C.	Nucellus	3.	Seed
D.	Polar nuclei	4.	Perisperm

Codes

	A	B	C	D
(a)	2	3	4	1
(b)	2	3	1	4
(c)	3	2	4	1
(d)	3	2	1	4

142. Match the following:

A.	*t*RNA	1.	Linking of amino acids
B.	*m*RNA	2.	Transfer of genetic information
C.	*r*RNA	3.	Nucleolar organising region
D.	Peptidyl transferase	4.	Transfer of amino acid from cytoplasm of ribosome

Codes

	A	B	C	D
(a)	4	2	3	1
(b)	1	4	3	2
(c)	1	2	3	4
(d)	1	3	2	4

143. Photosynthetic Active Radiation (PAR) has the following range of wavelengths
(a) 400 - 700 nm (b) 450 - 950 nm
(c) 340 - 450 nm (d) 500 - 600 nm

144. Down's syndrome is caused by an extra copy of chromosome number 21. What percentage of offspring produced by an affected mother and a normal father would be affected by this disorder?
(a) 50% (b) 25%
(c) 100% (d) 75%

145. An action potential in the nerve fibre is produced when positive and negative charges on the outside and the inside of the axon membrane are reversed, because
(a) more potassium ions enter the axon as compared to sodium ions leaving it
(b) more sodium ions enter the axon as compared to potassium ions leaving it
(c) all potassium ions leave the axon
(d) all sodium ions enter the axon

146. In a given plant, red colour (R) of fruits is dominant over white fruit (r): and tallness (T) is dominant over dwarfness (t). If a plant with genotype RRTt is crossed with a plant of genotype rrtt, what will be the percentage of tall plants with red fruits in the next generation?
(a) 100% (b) 25%
(c) 50% (d) 75%

147. *E. coli* about to replicate was placed in a medium containing radioactive thynidine for five minutes. Then it was made to replicate in a normal medium. Which of the following observation will be correct?
(a) Both the strands of DNA will be radioactive
(b) One strand radioactive
(c) Each strand half radioactive
(d) None is radioactive

148. Which one of the following precedes re-romation of the nuclear envelope during M-phase of the cell cycle?
(a) Decondensation from chromosomes and reassembly of the nuclear lamina
(b) Transcription from chromosomes and reassembly of the nuclear lamina
(c) Formation of the contractile ring and formation of the phragmoplast
(d) Formation of the contractile ring and transcription from chromosomes

149. Genes present in the cytoplasm of eukaryotic cells, are found in
(a) mitochondria and inherited via egg cytoplasm
(b) lysosomes and peroxisomes
(c) Golgi bodies and smooth endoplasmic reticulum
(d) plastids and inherited via male gamete

150. Mating of an organism to a double recessive in order to determine whether it is homozyogous or heterozygous for a character under consideration is called
(a) reciprocal cross (b) test cross
(c) dihybrid cross (d) back cross

151. Which of the following pair of feature is a good example of polygenic inheritance?
(a) Human height and skin colour
(b) ABO blood group in humans and flower colour of Mirabilis jalapa
(c) Hair pigment of mouse and tongue rolling in humans
(d) Human eye colour and sickle cell anaemia

152. Grain colour in wheat is determined by three pairs of polygene. Following the cross AABBCC (dark colour) × aabbcc (light colour), in F_2 generation what proportion of the progeny is likely to resemble either parent?
(a) Half (b) Less than 5 percent
(c) one third (d) None of these

153. Formation of non-functional methaemoglobin causes blue-baby syndrome. This is due to
(a) excess of arsenic concentration in drinking water
(b) excess of nitrates in drinking water
(c) deficiency of iron in food
(d) increased methane content in the atmosphere

154. One of the *ex situ* conservation methods for endangered species is
(a) wild-life sanctuaries (b) biosphere reserves
(c) cryopreservation (d) national parks

155. Based on cellular mechanisms there are two major types of regeneration found in the animals. Which one of the following is the correct example of the type mentioned?
(a) Morphollaxis - Regeneration of two transversely cut equal pieces of a Hydra into two small hydras
(b) Epimorphosis - Replacement of old and dead erythrocytes by the new ones
(c) Morphollaxis - Healing up of a wound in the skin.
(d) Epimorphosis - Regeneration of crushed and fitered out pieces of a *Planaria* into as many new Planarians

156. Which one of feature is common to leech, cockroach and scorpion?
(a) Nephridia (b) Ventral nerve cord
(c) Cephalization (d) Antennae

157. In almost all Indian metropolitan cities like Delhi, the major atmospheric pollutant(s) is/are
(a) Suspended Particulate Matter (SPM)

(b) oxides of sulphur
(c) carbon dioxide and carbon mono-oxide
(d) oxides of nitrogen

158. Which one of the following is a matching pair?
(a) Lubb - Sharp closure of AV values at the beginning of ventricular systole.
(b) Dup - Sudden opening of semilunar valves at the beginning of ventricular diastole
(c) Pulsation of the radial artery values in the blood vessels
(d) Initiation of the heart beat - Purkinje fibres

159. Which part of embryo comes out first during seed germination?
(a) Radicle (b) Plumule
(c) Hypocotyl (d) Epicotyl

160. Powdery mildews of crops are caused by:
(a) bacteria (b) ascomycetes
(c) basidiomycetes (d) phycomycetes

161. The usage of binomial names, for plant species was accepted by all after the publication of the work by:
(a) Hooker (b) Linnaeus
(c) Bentham (d) Darwin

162. Sex organs in *Funaria* develop:
(a) in protonema
(b) outside capsule
(c) in the axil of leaf
(d) at the tip of gametophore

163. Wharton's duct is the duct of:
(a) parotid gland
(b) submandibular salivary gland
(c) submaxillary gland
(d) pancreatic gland

164. *Hydra* receives impulses and stimuli through:
(a) nerve cells (b) sensory cells
(c) neuron cell (d) nematocysts

165. If a homozygous red flowered plant is crossed with a homozygous white flowered plant, the offsprings would be:
(a) all red flowered (b) half red flowered
(c) half white flowered (d) all white flowered

166. In almost all Indian metropholitan cities like Delhi, the major atmospheric pollutant(s) is/are:
(a) suspended particulate matter (SPM)
(b) oxides of sulphur
(c) carbon dioxide and carbon monoxide
(d) oxides of nitrogen

167. Just as *Xenopsylla* is to Yersenia pestis, so is:
(a) Glossina palpalis to Wuchereria bancrofti
(b) Culex to Plasmodium falciparum
(c) Homo sapiens to Taenia solium
(d) Phlebotomous to Leishmania donovani

Directions for Q 168. to 180: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Select the most appropriate response as-

(a) If both the Assertion and the Reason are true and the Reason is a correct explanation of the Assertion
(b) If both the Assertion and the Reason are true, but the Reason is not a correct explanation of the Assertion
(c) If the Assertion is true, but the Reason is false.
(d) If the assertion is false but the reason is true.

168. **Assertion:** Plasmodium vivax is responsible for malaria.
Reason: Malaria is caused by polluted water.

169. **Assertion:** During physiology of excretion, deamination does not take place in liver.
Reason: Deamination is a process to make use of excess of amino acids which can not be incorporated into protoplasm.

170. **Assertion**: Mosses are evolved from algae.
Reason: Protonema of mosses is similar to some green algae.

171. **Assertion**: Collenchyma is thick walled dead tissue.
Reason: Collenchymatous cells show thickenings ofpectin.

172. **Assertion**: Bacterial photosynthesis occurs by utilizing wavelength longer than 700 nm.
Reason: Here reaction centre is P-890

173. **Assertion:** Mast cells in the human body release excessive amounts of inflammatory chemicals which cause allergic reactions.
Reason: Allergens in the environment on reaching human body stimulate mast cells in certain individuals.

174. **Assertion:** All birds, except the ones like koel (cuckoo) build nests for retiring and taking rest during night time (day time for nocturnal).
Reason: Koel lays its eggs in the nests of tailor bird.

175. **Assertion:** Natural selection is the outcome of differences in survival and reproduction among individuals that show variation in one or more traits.
Reason: Adaptive forms of a given trait tend to become more common; less adaptive ones becomes less common or disappear.

176. **Assertion:** The duck-billed platypus and the spiny ant-eater, both are egg-laying animals yet they are grouped under mammals.
Reason: Both the them have seven cervical vertebrae and 12 pairs of cranial nerves.

177. **Assertion:** In recombinant DNA technology, human genes are often transferred into bacteria (prokaryotes) or yeast (eukaryotes).
Reason: Both bacteria and yeast multiple very fast to form huge population which express the desired gene.

178. **Assertion:** Eukaryotic cells have the ability to adopt a variety of shapes and carry out directed movements.
Reason: There are three principal types of protein filaments-actin filament, microtubules and intermediate filaments, which constitute the cytoskeleton.

179. **Assertion:** A person who has received a cut and is bleeding needs to be given anti-tetanus treatment.
Reason: Anti-tetanus injection provides immunity by producing antibodies for tetanus.

180. **Assertion:** In cymose tap root system, oldest branch lies very near the growing point of the root while the youngest branch is farthest away from it.
Reason: In cymose tap root system, the primary root itself stops growing after some time; but secondary roots carry on further growth of the root system.

Best Of Luck