Manipal

Medical Entrance Exam

Solved Paper 2013

Physics

1. A body freely falling from the rest has a velocity v after his falls through a height h. The distance, it has to fall down further for its velocity becomes double, is

(a) 4 h (b) 2 s
(c) $1/\sqrt{2}$ s (d) $\sqrt{2}$ s

2. A 600 kg rocket is set for vertical firing the exhaust speed is 800 m/s to given an initial upward acceleration of 20 m/s^2, the amount of gas ejected per second to supply. The needed thrust will be

(a) 137.5 kg/s (b) 185.5 kg/s
(c) 187.5 kg/s (d) 127.5 kg/s

3. A running man has half the kinetic energy of that of a boy of half of his mass. The man speeds up by 1 m/s. So as to have same kinetic energy as that of the boy. The original speed of the man is

(a) $\sqrt{2}$ m/s (b) $(\sqrt{2}-1)$ m/s
(c) $\frac{1}{\sqrt{2}}$ m/s (d) $\frac{1}{\sqrt{2}-1}$ m/s

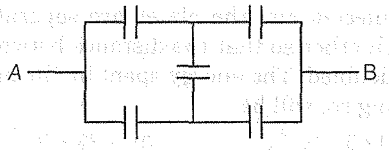
4. If a cycle wheel of radius 4m completes one revolution in two seconds. Then acceleration of the cycle is

(a) $4\pi^2$ m/s^2 (b) $2\pi^2$ m/s^2
(c) π^2 m/s^2 (d) 4 m/s^2

5. 5g of ice at 0°C is mixed with 5 g of steam at 100°C, what is the final temperature?

(a) 100°C (b) 50°C
(c) 0°C (d) None of these

6. Each capacitor shown in figure is 2 μF. Then the equivalent capacitance between A and B is



(a) 2 μF (b) 4 μF (c) 6 μF (d) 8 μF

7. What is the refractive index of a prism whose angle $A = 60°$ and angle of minimum deviation $d_m = 30°$?

(a) $\sqrt{2}$ (b) $\sin^{-1}(\sqrt{3})$
(c) $\tan^{-1}(\sqrt{2})$ (d) $\tan^{-1}(\sqrt{3})$

8. A cell of constant emf first connected to a resistance R_1 and then connected to a resistance R_2. If power delivered in both cases is same, then the internal resistance of the cell is

(a) $\sqrt{R_1 R_2}$ (b) $\sqrt{\frac{R_1}{R_2}}$
(c) $\frac{R_1 - R_2}{2}$ (d) $\frac{R_1 + R_2}{2}$

9. A gas is compressed at constant pressure 50 N/m^2 from a volume of 10 m^3 to a volume 4m^3. Energy 100 J is then added to the gas by heating. Its internal energy is

(a) increased by 100 J
(b) increased by 200 J
(c) decreased by 200 J
(d) increased by 400 J

volume to its initial volume will be

(a) between $\frac{3}{2}$ and 2 (b) $\frac{1}{2}$

(c) more than $\frac{1}{2}$ (d) less than $\frac{1}{2}$

11. Energy is being emitted from the surface of a black body at 127°C at the rate of $(1.0 \times 10^6)/\text{sm}^2$. The temperature of a black body at which the rate of energy emission is $(16.0 \times 10^6)/\text{sm}^2$ will be

(a) 727°C (b) 527°C

(c) 508°C (d) 254°C

12. Two plates of a parallel plate capacitor of capacity 50 μF are charged by a battery to a potential of 100 V. The battery remains connected and the plates are separated from each other so that the distance between them is doubled. The energy spent by the battery in doing so, will be

(a) 12.5×10^{-2} J (b) -25×10^{-2} J

(c) 25×10^{-2} J (d) -12.5×10^{-1} J

13. An electron moves in a circle of radius 1.0 cm with a constant speed of 4.0×10^6 m/s, the electric current at a point on the circle will be

($e = 1.6 \times 10^{-19}$ C)

(a) 1×10^{-11} Ω (b) 1.1×10^{-7} Ω

(c) 5.1×10^{-7} Ω (d) 2.1×10^{-7} Ω

14. A light ray is incident normally on a plane mirror. The angle of reflection will be

(a) 135 (b) 90

(c) 45 (d) zero

15. In an artificial satellite, a space traveller tries to fill ink in a pen by dipping it in ink. The amount of ink filled in the pen as compared to the quantity of ink filled on the earth's surface will be

(a) less (b) more

(c) same (d) nil

16. The earth revolves round the sun in one year. If the distance between them becomes doubles, then the new period of the revolution will be

(a) 1/2 yr (b) $2\sqrt{2}$ yr

(c) 4 yr (d) 8 yr

17. A block of mass 5 kg is at rest on a horizontal floor. If a force of 2.5 N is applied on the block as shown in the figure, the frictional force between the block and the floor will be

(a) 2.5 N (b) 5 N

(c) 7.84 N (d) 10 N

18. A string of length (L) and unifrom cross-section is spread on a smooth plane. One of its ends is pulled by a force F. Find the tension in it at a distance l from this end

(a) $\frac{1}{2}F$ (b) $\frac{L}{l}F$

(c) $\left(1-\frac{l}{L}\right)F$ (d) $\left(1+\frac{l}{L}\right)F$

19. A fighter plane is moving in a vertical circle of radius 'r'. Its minimum velocity at the highest point A of the circle will be

(a) $\sqrt{3gr}$ (b) $\sqrt{2gr}$

(c) $\sqrt{gr}$ (d) $\sqrt{gr/2}$

20. Pressure inside two soap bubbles are 1.01 atm and 1.03 atm. Ratio between their volumes is

(a) 27 : 1 (b) 3 : 1

(c) 127 : 101 (d) None of these

21. A stationary object at 4°C and weighing 3.5 kg falls from a height 2000 m on a snow mountain at 0°C. If the temperature of the object just before hitting the snow is 0°C and the object before comes to rest immediately ($g = 10$ m/s^2) and latent heat of ice = 3.5×10^5 J/s), then the object

(a) 2kg of ice (b) 200g of ice

(c) 20g ice (d) 2g ice

22. A sphere at temperature 600 K is placed in environment of temperature 200 K, its cooling rate is H. If the temperature is reduced to 400 K, the cooloing is same environment will be

(a) $\frac{H}{16}$ (b) $\left(\frac{9}{27}\right)H$

(c) $\left(\frac{16}{3}\right)H$ (d) $\left(\frac{3}{16}\right)H$

23. The acceleration due to gravity on the planet A is 9 times the acceleration due to gravity on the planet B. A man jumps to a height of 2m on the surface of A. What is the height of jump by the same person on the planet B?

(a) 6 m (b) 2/9 m
(c) 2/3 m (d) 18 m

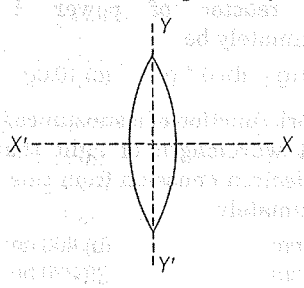
24. When a long spring is stretched by 2 cm, its potential energy is U. If the spring is stretched by 10 cm, the potential energy in it will be

(a) $2U$ (b) $25U$ (c) $U/5$ (d) $5U$

25. An observer moves towards a stationary source of sound with a speed $1/5^{th}$ of the speed of sound. The wavelength and frequency of the source emitted are λ and f respectively. The apparent frequency and wavelength recorded by the observer are respectively

(a) $f, 1.2\lambda$
(b) $0.8f, 0.8\lambda$
(c) $1.2f, 1.2\lambda$
(d) $1, 2f\ \lambda$

26. An equiconvex lens is cut into two halves a long (i) XOX and (ii) YOY as shown in the figure let $f.f', f''$ be the focal lengths of the complete lens of each half in case (i) and of each half in case (ii) respectively.



Choose the correct statement from the following

(a) $f' = f \cdot f'' = f$
(b) $f' = 2f, f'' = 2f$
(c) $f' = f, f'' = 2f$
(d) $f' = 2f, f'' = f$

27. A diamagnetic material in a magnetic field moves

(a) perpendicular to the field
(b) from weaker to the stronger parts of the field
(c) from stronger to the weaker parts of the field
(d) in none of the above directions

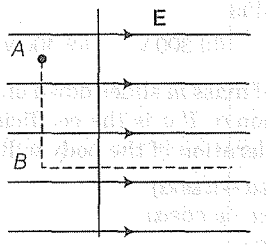
28. A coil in the shape of an equilateral triangles of side l is suspended between the pole pieces of a permanent magnet such that $\mathbf{B}$ is in plane of the coil. If due to a current i in the triangle, a torque τ acts on it, the side l of the triangle is

(a) $\frac{2}{\sqrt{3}}\left(\frac{\tau}{Bi}\right)^{1/2}$ (b) $\frac{2}{3}\left(\frac{\tau}{Bi}\right)$
(c) $2\left(\frac{\tau}{\sqrt{3}Bi}\right)^{1/2}$ (d) $\frac{1}{\sqrt{3}}\frac{\tau}{Bi}$

29. A certain electrical conductor has a square cross-section, 2.0 mm on a side and is 12 m long. The resistance between its ends is 0.072 Ω. The resistivity of its material is equal to

(a) 2.4×10^{-6} Ωm (b) 1.2×10^{-6} Ωm
(c) 1.2×10^{-8} Ωm (d) 2.4×10^{-8} Ωm

30. Figure shows three points A, B and C in a region of uniform electric field $\mathbf{E}$. The line AB is perpendicular and BC is parallel to the field lines. Then which of the following holds good?



(a) $V_A = V_B = V_C$ (b) $V_A = V_B > V_C$
(c) $V_A = V_B < V_C$ (d) $V_A > V_B = V_C$

where V_A, V_B and V_C represent the electric potential at the points A, B and C respectively.

31. The (x, y, z) co-ordinates of two points A and B are given respectively as $(0, 3, -1)$ and $(-2, 6, 4)$. The displacement vector from A to B may be given by

(a) $-2\mathbf{i} + 6\mathbf{j} + 4\mathbf{k}$
(b) $-2\mathbf{i} + 3\mathbf{j} + 3\mathbf{k}$
(c) $-2\mathbf{i} + 3\mathbf{j} + 5\mathbf{k}$
(d) $2\mathbf{i} - 3\mathbf{j} - 5\mathbf{k}$

32. In the first second of its flight, rocket ejects 1/60 of its mass with a velocity of 2400 m/s. The acceleration of the rocket is

(a) 19.6 m/s^2 (b) 30.2 m/s^2
(c) 40 m/s^2 (d) 49.8 m/s^2

from 400 m/s to v_s. The v_s is

(a) 516 m/s (b) 450 m/s (c) 310 m/s (d) 746 m/s

34. A bar magnet of magnetic moment **M** is placed in the magnetic field **B**. The torque acting on the magnet is.

(a) $\mathbf{M} \times \mathbf{B}$ (b) $\mathbf{M} - \mathbf{B}$ (c) $\frac{1}{2}\mathbf{M} \times \mathbf{B}$ (d) $\mathbf{M} + \mathbf{B}$

35. For the production of characteristic $kr - x$-ray the electron transition is

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

36. The current passing through an inductor coil of 5H is decreasing at the rate of 2A/s, the emf developed across the coil is

(a) + 10.0 V (b) – 10.0 V (c) + 2.5 V (d) – 2.5 V

37. A capacitor of 10 μF charged upto 250 V is connected in parallel with another capacitor of 5 μF charged upto 100 V. The common potential is

(a) 200 V (b) 300 V (c) 400 V (d) 500 V

38. A body of mass m slides down on a rough plane inclination α. If μ is the coefficient of friction, the acceleration of the body will be

(a) $g\ (\cos\alpha - \mu \sin\alpha)$
(b) $g\ (\sin\alpha - \mu \cos\alpha)$
(c) $\mu \cos\alpha$
(d) $g \sin\alpha$

39. Half-life of radium is 1600 yr. If the initial mass is 1 kg, what is the amount of radium left after 4800 yr?

(a) Zero (b) 0.125 kg
(c) 0.5 kg (d) 0.25 kg

40. Light of wavelength $\lambda = 4000$ Å and intansity 100 W/m^2 is incident on a plate of threshold frequency 5.5×10^{14} Hz. Find the number of photons incident m^2 per sec.

(a) 10^{21} (b) 3.0×10^{19}
(c) 2.02×10^{20} (d) 2.02×10^{21}

41. When electron is accelerated between 500 keV, what is the percentage increase in mass?

(a) 82.35% (b) 97.85%
(c) 42.35% (d) 59.45%

Y = Young's modulus, T = time period, τ = Torque and l = length, then find the value of x.

(a) zero (b) 1 (c) 2 (d) 3

43. The speed of sound in hydrogen at NTP is 1270 m/s. Then, the speed in a mixture of hydrogen and oxygen in the ratio 4 : 1 by volume will be

(a) 317 m/s (b) 635 m/s (c) 830 m/s (d) 950 m/s

44. The displacement of a particle executing periodic motion is given by

$$y = 4\cos^2\left(\frac{t}{2}\right)\sin 1000\,\omega t.$$

This expression may be considered to be a result of superposition of

(a) two waves (b) three waves
(c) four waves (d) five waves

45. Assuming that about 20 MeV of energy is released per fusion reaction,

$$_1H^2 + {}_1H^3 \longrightarrow {}_on^1 + {}_2He^4$$

then the mass of $_1H^1$ consumed per day in a fusion reactor of power 1 MW will approximately be

(a) 0.001g (b) 0.1 g (c) 10.0g (d) 100g

46. The work function of a substance is 4.0 eV. The longest wavelength of light that can cause photoelectron emission from this substance is approximately

(a) 540 nm (b) 400 nm
(c) 310 nm (d) 220 nm

47. When light wave suffers reflection at the interference between air and glass, the change of phase of reflected wave is equal to

(a) zero (b) $\pi/2$ (c) π (d) 2π

48. A convex lens of focal length 1.0 m and a concave lens of focal length 0.25 m are 0.75 m apart. A parallel beam of light is incident in the convex lens. The beam emerging after refraction from both lenses is

(a) parallel to principal axis (b) canvergence
(c) divergence (d) None of these

49. Two instruments having stretched strikes are being played in unison. When the tension in one of the instrument is increased by 1%, 3 beats, are produced in 2s. The initial frequency of vibration of each wire is

(a) 600 Hz (b) 300 Hz
(c) 200 Hz (d) 150 Hz

50. Find the inductance L of a solenoid of length l whose windings are made of material of density D and resistivity ρ. The winding resistance is R

(a) $\frac{\mu_0}{4\pi l} \cdot \frac{R_m}{\rho D}$ (b) $\frac{\mu_0}{4\pi R} \cdot \frac{l_m}{\rho D}$
(c) $\frac{\mu_0}{4\pi l} \cdot \frac{R^2 m}{\rho D}$ (d) $\frac{\mu_0}{2\pi R} \cdot \frac{l_m}{\rho D}$

51. A long straight wire carrying a current of 30 A is placed in an external uniform magnetic field of induction 4×10^{-4} T. The magnetic field is acting parallel to the direction of current. The magnitude of the resultant magnetic induction in tesla at a point 2.0 cm away from the wire is $(\mu_0 = 4\pi \times 10^{-7}$ H/m)

(a) 10^{-4}
(b) 3×10^{-4}
(c) 5×10^{-4}
(d) 6×10^{-4}

52. A block of mass 10 kg is moving in x-direction with a constant speed of 10 m/s. It is subjected to a retarding force $F = -0.1x$ J/m during its travel from $x = 20$ m to $x = 30$ m. Its final kinetic energy will be

(a) 475 J (b) 450 J
(c) 275 J (d) 250 J

53. What is the effect of increasing the intensity of light that falls on the emitter in a photoelectric effect apparatus?

(a) Cut-off frequency decrease
(b) Stopping potential decrease
(c) Time delay for emission of photoelectron decrease
(d) Saturation photocurrent increases

54. A body falls from rest. In the last second of its fall it covers half of the total distance. If g is 9.8 m/s^2, then the total time of its falls is (in second)

(a) 2 (b) $2 + \sqrt{2}$
(c) $4 - \sqrt{2}$ (d) 3

55. If $|\mathbf{A} \times \mathbf{B}| = \sqrt{3}\ \mathbf{A} \cdot \mathbf{B}$, then the value of $|\mathbf{A} + \mathbf{B}|$ is

(a) $(A^2 + B^2 + AB)^{1/2}$
(b) $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$
(c) $A + B$
(d) $(A^2 + B^2 + \sqrt{3}AB)^{1/2}$

56. The distance between the two successive nodes is

(a) $\frac{\lambda}{4}$ (b) $\frac{\lambda}{2}$ (c) λ (d) 2λ

57. Doppler's effect in sound takes place when source and observer are

(a) stationary
(b) moving with same velocity
(c) in relative motion
(d) None of the above

58. The current and voltage in AC circuit are given by

$$I = 5\sin\left(100t - \frac{\pi}{2}\right) \text{ A and}$$

$V = 200\sin(100t)$ volt. The power dissipated in the circuit will be

(a) 20 W (b) 40 W (c) 1000 W (d) zero

59. Copper has facecentered cubic (fcc) lattice with interatomic spacing equal to 2.54 Å, the value of lattice constant for this lattice is

(a) 1.27 Å (b) 5.08 Å
(c) 2.54 Å (d) 3.57 Å

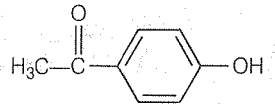
60. The wavelength of a radiowave of frequency 1 MHz is

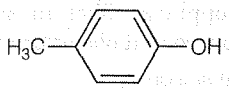
(a) 400 m (b) 300 m
(c) 350 m (d) 200 m

1. Which of the following compounds can exist in enantiomeric (*i.e.*, Dand L) forms?
(a) 3-methyl butanoic acid
(b) *cis*-2-butene
(c) isopropyl amine
(d) 1-methyl butanamine

2. Among the following molecules or ions, which has the longest C — N bond?
(a) H_2CNCH_3 (b) H_3CCN
(c) $(H_3C)_4N^+$ (d) $(H_2C)_2N^+$

3. Which statement best explains why '*A*' is more acidic than *B*?


(*A*)


(*B*)

(a) The larger size of ketone group helps to stabilise the conjugate base
(b) The ketone group exert a large inductive effect in conjugate base of *A*
(c) The ketone group allows for resonance delocalisation of the charge in conjugate base
(d) The OH oxygen in *A* is more electronegative than the OH oxygen in *B*

4. Choose the reagent to carry out the reaction.

$$CH_3C{\equiv}CCH_3 \longrightarrow \underset{cis\ \text{form}}{CH_3CH{=}CHCH_3}$$

(a) H_2 + Lindlar reagent (b) Li + NH_3
(c) Conc. H_2SO_4 (d) $H_2O + H^+$

5. Which of the following would not form upon electrolysis of aqueous solution of potassium propanoate?
(a) Butane (b) Ethyl ethanoate
(c) Ethyl propanoate (d) Ethene

6. $Ca(HCO_3)_2(s)$ decomposes as

$Ca(HCO_3)_2(s) \longrightarrow CaCO_3(s) + H_2O(g) + CO_2(g)$ Total pressure at equilibrium is found to be 0.12 bar. Thus, K_p is
(a) 0.24 (b) 0.06 (c) 0.0036 (d) 0.0144

7. Super cooled water is liquid water that has been cooled below its normal freezing point. This state is thermodynamically
(a) unstable and tends to freeze into ice spontaneously
(b) stable and tends to freeze into ice spontaneously
(c) stable and tends to fuse into liquid spontaneously
(d) unstable and tends to fuse into liquid spontaneously

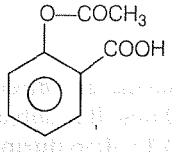
8. For the reactions,

I. $CH_4(g) \longrightarrow C(g) + 4H(g)$; $\Delta H = x_1$
II. $C_2H_6(g) \longrightarrow 2C(g) + 6H(g)$; $\Delta H = x_2$

from I and II, bond energy of C—C bond is
(a) $x_1 - x_2$ (b) $x_2 - x_1$
(c) $x_2 + 1.5\ x_1$ (d) $x_2 - 1.5\ x_1$

9. The heat of formation of CO_2 is – 95 kcal. The amount of carbon which on burning will evolve 1000 kcal is
(a) 12.63 g (b) 17.95 g (c) 126.3 g (d) 179.5 g

10. % ionisation of a weak acid is 1% at 1M, hence % ionisation at 4M will be
(a) 0.2% (b) 0.5% (c) 4% (d) 5%

11. 
Aspirin is a pain reliever with $pK_a = 2$. Two tablets each containing 0.09 g of aspirin are dissolved in 100mL solution. pH will be
(a) 0.5 (b) 1.0 (c) 0.8 (d) 2.0

12. When the following five anions are arranged in order of decreasing ionic radius, the correct sequence is
(a) $Se^{2-}, I^-, Br^-, O^{2-}, F^-$ (b) $I^-, Se^{2-}, Br^-, O^{2-}, F^-$
(c) $I^-, Se^{2-}, O^{2-}, Br^-, F^-$ (d) $Se^{2-}, I^-, Br^-, F^-, O^{2-}$

13. Which one of the following statement is incorrect?
(a) Ti^{3+} salts are better oxidising agents
(b) Ga^+ salts are better reducing agents
(c) Pb^{4+} salts are better oxidising agents
(d) As^{5+} salts are better oxidising agents

14. Hydrogen is produced by the reaction
(a) Na_2O_2 + 2HCl (b) Mg + H_2O
(c) BaO_2 + HCl (d) $H_2S_4O_8$ + H_2O

15. There is loss in weight when mixture of Li_2CO_3 and $Na_2CO_3 \cdot 10H_2O$ is heated strongly. This loss is due to

(a) Li_2CO_3 (b) $Na_2CO_3 \cdot 10H_2O$
(c) Both (a) and (b) (d) None of these

16. The absorption of UV radiation by O_3

(a) protects the inhabitants of our planet from injurious radiation
(b) maintains an equilibrium between the concentrations of O_2 and O_3
(c) makes both the function effective
(d) makes no function effective

17. Pyrolusite in MnO_2 is used to prepare $KMnO_4$. Steps are

$$MnO_2 \xrightarrow{I} MnO_4^{2-} \xrightarrow{II} MnO_4^-$$

I and II are

(a) fuse with KOH/air, electrolytic oxidation
(b) fuse with KOH/air, electrolytic reduction
(c) fuse with conc HNO_3/air, electrolytic reduction
(d) All of the above

18. The ability of *d*-block elements to form complexes is due to

(a) small and highly charged ions
(b) vacant low energy orbitals to accept lone pair of electrons from ligands
(c) Both (a) and (b)
(d) None of the above

19. Which one of the following species has maximum conductance in their aqueous solutions?

(a) K_2PtCl_6 (b) $PtCl_4 \cdot 2NH_3$
(c) $PtCl_4 \cdot 3NH_3$ (d) $PtCl_4 \cdot 5NH_3$

20. The coordination of Pt in the complex ion $[Pt(en)_2Cl_2]^{2+}$ is

(a) 3 (b) 4 (c) 5 (d) 6

21. The ratio between the root mean square velocity of H_2 at 50K and that of O_2 at 800 K is

(a) 0.25 (b) 1 (c) 2 (d) 4

22. Consider the following statements

I. Repulsive forces are significant when the molecules are close together on average.
II. Attractive intermolecular forces are important when the molecules are fairly close together but not necessarily touching.
III. Attractive forces are ineffective when the molecules are for apart.

Select correct statements.

(a) I, II and III (b) I and III
(c) II and III (d) I and II

23. Energy equivalent to 10.00 cm^{-1} is

(a) 2.0×10^{-22} J per atom
(b) 28.6×10^{-3} kcal mol^{-1} photon
(c) 12.0×10^{-2} kJ mol^{-1} photon
(d) All of the above

24. The radius of hydrogen atom in the ground state is 0.53Å. The radius of Li^{2+} ion (atomic number = 3) in a similar state is

(a) 0.17 Å (b) 0.265 Å (c) 0.53 Å (d) 1.06 Å

25. How many mL of 0.125 M Cr^{3+} must be reacted with 12.0 mL of 0.200 M MnO_4^- if the redox products are $Cr_2O_7^{2-}$ and Mn^{2+}?

(a) 32 mL (b) 24 mL (c) 16 mL (d) 8 mL

26. 10g of hydrogen and 64 g of oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be

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

27. A group of 13 element if added in small amounts to Ge, then the type of semiconductor formed is

(a) *n*-type semiconductor
(b) *p*-type semiconductor
(c) super semiconductor
(d) Both (a) and (b)

28. The density of solid argon is 1.65 g per cc at – 233°C. If the argon atom is assumed to be a sphere of radius 1.54×10^{-8} cm, the percentage of empty space in solid argon is

(a) 32% (b) 54% (c) 68% (d) 62%

29. What is not true regarding free radical polymerisation of propene?

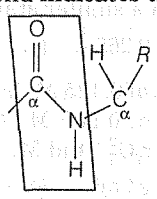
(a) Without proper control, atactic polypropylene is formed
(b) Use of Ziegler-Natta catalyst results in isotactic polypropylene
(c) During polymerisation, a linear unbranched, crystalline polymer is usually obtained
(d) During polymerisation, a secondary free radical is produced in every step

(b) it has β-1, 4-glycosidic linkage
(c) it is used for making rayon fibre
(d) it can be obtained by polymerisation of D-glucose

31. A glycoside is the carbohydrate form of an
(a) ether (b) acetal (c) aglycone (d) alcohol

32. When a carbohydrate reacts with $NaBH_4$, the product is an
(a) alditol (b) aldaric acid
(c) aldonic acid (d) aglycone

33. In the figure below, the plane drawn behind the peptide bond indicates the



(a) absence of rotation around C—N bond because of its partial double bond character
(b) plane of rotation around the C—N bond
(c) region of steric hindrance determined by the large C=O group
(d) None of the above

34. Which statement about aspirin is not true?
(a) Aspirin belongs to narcotic analgesics
(b) It is effective in relieving pain
(c) It has antiblood clotting action
(d) It is a neurologically active drug

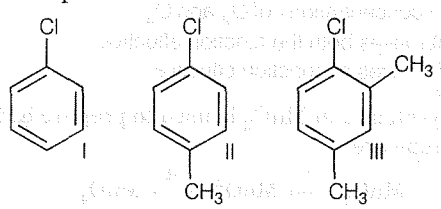
35. The correct decreasing order of basic strength of the following species is
(a) $OH^- > NH_2^- > H_2O > NH_3$
(b) $NH_2^- > OH^- > NH_3 > H_2O$
(c) $NH_3 > H_2O > NH_2^- > OH^-$
(d) $H_2O > NH_3 > OH^- > NH_2^-$

36. $CH_3CHO \xrightarrow{\text{dil. NaOH}} A \xrightarrow{\Delta,\ \text{dehydration}} B \xrightarrow{Ni/H_2} C \xrightarrow{Ni/H_2} D$

In the above sequence of reactions, compound *D* is
(a) $CH_3CH_2CH_2CH_2OH$ (b) $CH_3CH_2CH_2CHO$
(c) $CH_3CH_2CH_2\underset{\displaystyle OH}{\underset{|}{C}}H—CH_3$ (d) $CH_3\underset{\displaystyle CH_3}{\underset{|}{C}}HCHO$

benzoate?
(a) $NaHCO_3$ test
(b) Iodoform test
(c) $FeCl_3$ test
(d) Both (a) and (b)

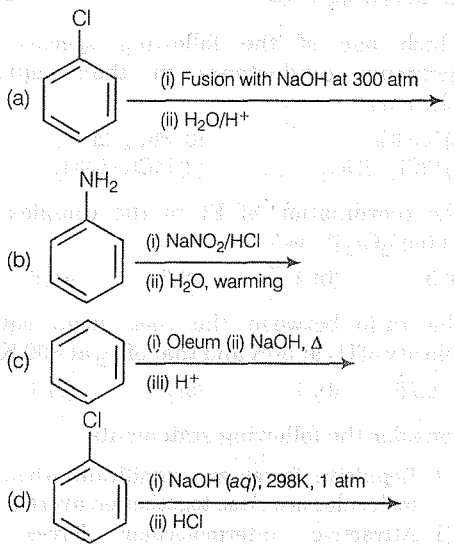
38. Arrange the following compounds in increasing order of rate of reaction towards nucleophilic shbstitution.



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

39. Which one of the following reagents can not be used to oxidise primary alcohols to aldehydes?
(a) CrO_3 in anhydrous medium
(b) $KMnO_4$ in acidic medium
(c) Pyridinium chlorochromate
(d) Heat in presence of Cu at 573K

40. Which of the following reactions will not yield phenol?



41. In qualitative analysis, when H_2S is passed through an aqueous solution of salt acidified with dil. HCl, a black precipitate is obtained. On boiling the precipitate with dil HNO_3, it forms a solution of blue colour. Addition of excess of aqueous solution of ammonia to this solution gives

(a) deep blue precipitate of $Cu(OH)_2$
(b) deep blue solution of $[Cu(NH_3)_4]^{2+}$
(c) deep blue solution of $Cu(NO_3)_2$
(d) deep blue solution of $Cu(OH)_2 \cdot Cu(NO_3)_2$

42. Which of the following acids forms three series of salts?

(a) H_3PO_2 (b) H_3BO_3 (c) H_3PO_4 (d) H_3PO_3

43. Which one of the following statements is incorrect?

(a) All halogens have weaker X—X bond than X — X′ bond in interhalogens (except F—F bond in fluorine)
(b) Radius ratio between iodine and fluorine (among halogens) is maximum
(c) Interhalogen compounds are more reactive than halogen compounds
(d) Among interhalogen compounds, maximum number of atoms are present in iodine fluoride

44. Stability of lyophilic colloids is due to

(a) same charge on all the colloidal particles
(b) solvation of the colloidal particles
(c) the fact that they are organic substances
(d) Both (a) and (b)

45. Hardening of leather in tanning industry is based on

(a) electrophoresis (b) electro-osmosis
(c) mutual coagulation (d) persistent dialysis

46. Oxidation states of the metal in the minerals haematite and magnetite, respectively are

(a) III in haematite and II and III in magnetite
(b) II and III in haematite and II in magnetite
(c) II and III in haematite and III in magnetite
(d) II in haematite and III in magnetite

47. Bauxite ore is treated with conc. NaOH solution at 500 K and 35 bar pressure for few hours and filtered hot. In the fittrate, the species present are,

(a) $NaAl(OH)_4$ and Na_2SiO_3
(b) $NaAl(OH)_4$ only
(c) Na_2SiO_3 and $Na_2Ti(OH)_6$
(d) Na_2SiO_3 only

48. The unit of rate constant for zero order reaction is

(a) s^{-1} (b) mol $L^{-1}s^{-1}$
(c) L $mol^{-1}s^{-1}$ (d) L^2 $mol^{-2}s^{-1}$

49. Collision theory is applicable to

(a) first order reactions
(b) zero order reactions
(c) bimolecular reactions
(d) intramolecular reactions

50. The rate constant for an isomerisation reaction, $A \longrightarrow B$ is 4.5×10^{-3} min^{-1}. If the initial concentration of A is 1M, calculate the rate of reaction after 1 h.

(a) 3.44×10^{-3} mol L^{-1} min^{-1}
(b) 3.44×10^{3} mol L^{-1} min^{-1}
(c) 1.86×10^{-3} mol L^{-1} min^{-1}
(d) 1.86×10^{3} mol L^{-1} min^{-1}

51. When 1 mole of Na_2CO_3 is heated, CO_2 lost is

(a) zero mole (b) one mole
(c) two moes (d) four moles

52. Which one of the following is paramagnetic?

(a) N_2 (b) NO (c) CO (d) O_3

53. In $TeCl_4$, the central atom tellurium involves

(a) sp^3 hybridisation (b) sp^3d hybridisation
(c) dsp^2 hybridisation (d) sp^3d^2 hybridisation

54. Which of the following salts of silver is insoluble in water?

(a) $AgClO_4$ (b) Ag_2SO_4
(c) AgF (d) $AgNO_3$

55. 25.6 g of sulphur in 100 g benzene shows depression in freezing point of 5.12°. K_f for benzene is 5.12°kg mol^{-1}. Molecular formula of sulphur in benzene is

(a) S_2 (b) S_6
(c) S_8 (d) S_{12}

56. $\Delta T_f / K_f$ is expressed in the unit of

(a) degree
(b) degree mol^{-1} kg
(c) degree mol kg^{-1}
(d) mol kg^{-1}

containing 1 mole of X and 3 moles of Y is 550 mm Hg. At the same temperature, if 1 mole of Y is further added to this solution, vapour pressure of the solution increases by 10 mm Hg. Vapour pressure (in mm Hg) of X and Y in their pure states will be respectively

(a) 200 and 300
(b) 300 and 400
(c) 400 and 600
(d) 500 and 600

58. For the following half cell reactions, $E°$ values are also given

$$Mn^{2+} + 2H_2O \longrightarrow MnO_2 + 4H^+ + 2e^-;$$
$$E° = -1.23 \text{ V}$$
$$MnO_4^- + 4H^+ + 3e^- \longrightarrow MnO_2 + 2H_2O;$$
$$E° = +1.70 \text{ V}$$

MnO_2
(b) $Mn(MnO_4)_2$ is stable in acid solution
(c) MnO_2 disproportionates to Mn^{2+} and MnO_4^- in acid solution
(d) None of the above

59. For the fuel cell reaction,

$$2H_2 + O_2 \longrightarrow 2H_2O$$
$$\Delta G^\circ = -475 \text{ kJ},$$

Hence, E°_{cell} is

(a) 1.23 V (b) 2.46 V (c) 0.615 V (d) 0.31 V

60. 1 mole each of $AgNO_3$, $CuSO_4$ and $AlCl_3$ is electrolysed. Number of faradays required are in the ratio of

(a) 1 : 1 : 1 (b) 1 : 2 : 3 (c) 3 : 2 : 1 (d) 1 : 3 : 1

Biology

1. Which term does not apply to human heart?

(a) Pacemaker (b) Four chambered
(c) Mitral value (d) Neurogenic

2. Specific redioactive identification of ribosomal RNA can be achieved by using ^{14}C labelled

(a) guanine (b) uracil
(c) thyonine (d) cytosine

3. How many mitotic divisions must occur in a cell of root tip to form 256 cells.

(a) 256 (b) 8
(c) 128 (d) 64

4. An operon unit consist of

(a) regulator, operator and recessive gene
(b) regulator, structural and operator gene
(c) regulator, structural, operator and promoter gene
(d) regulator, structural and promoter gene

5. Site of formation of ribosomal precursor or ribosomal sub-units in a cell

(a) nucleus (b) nucleolus
(c) nucleus body (d) stroma

6. Alzheimer's disease affects

(a) child (b) youth (adolescence)
(c) adult (d) old (elderly)

7. Lack of independent assortment of two genes A and B in fruit fly *Dorsophila* is due to

(a) linkage (b) repulsion
(c) crossing over (d) recombination

8. Which one pair/ set exhibit uricotelism?

(a) Bird, land reptiles and insect
(b) Fish, birds and amphibians
(c) Mammals, birds, and reptiles
(d) Amphibians, mammal and reptiles

9. Karyotaxonomy is the modern branch of classification which is bassed on

(a) number of chromosomes
(b) bands found on chromosomes
(c) organic evolution
(d) trinomial nomenclature

10. Periodic appearence of malaria symptoms occurs due to periodic

(a) entry of merozoites into erythrocytes
(b) attack of liver cells by merozoites
(c) formation of signet ring
(d) release of pyrogen in blood

11. Which antibiotic act on the cell wall of bacteria?

(a) β-lactum group (b) Tetracycline
(c) Neomycine (d) Streptomycin

12. The group 'amniota' includes
(a) birds and reptiles
(b) birds and mammals
(c) reptiles and mammals
(d) reptiles, birds and mammals

13. Edible part of tomato is
(a) epicarp (b) pericarp and plecenta
(c) mesocarp (d) thalamus

14. Interfascicular cambium is
(a) apical meristem (b) secondary meristem
(c) primary meristem (d) abnormal meristem

15. The first event in photosynthesis is
(a) synthesis of ATP
(b) photoexcitation of chlorophyll and ejection of electron
(c) photolysis of water
(d) release of oxygen

16. In water logged soil, plants generally are killed because of
(a) deficiency of minerals
(b) excessive absorption of water
(c) absense of air in the soil
(d) starvation

17. R.Q. for glucose (carbohydrates) is
(a) 1 (b) 0.5
(c) 2 (d) 0.05

18. Number of bones of face is
(a) 12 (b) 30
(c) 40 (d) 14

19. Reason of diversity in living being is
(a) mutation
(b) long term evolution
(c) gradual changes
(d) short term evolutionary changes

20. Constituent of gasonal is
(a) 90% petrol of + 10% alcohal
(b) 80% petrol of + 20% ethanol
(c) 60% petrol of + 40% ethanol
(d) 50% petrol of + 50% ethanol

21. The type of joint at atlanto axial joint
(a) pivot joint
(b) glinding joint
(c) saddle joint
(d) hinge joint

22. Pure fractions of cellular component can be isolated by
(a) chromatography
(b) scanning electron microscopy
(c) X-ray
(d) differential configuration

23. Lymph (nodes) glands form
(a) hormones (b) lymphs
(c) antigen (d) antibodies

24. Who has written the book 'Genera Plantarum'?
(a) Hutchinson
(b) Engler and Prantal
(c) Eichler
(d) Bentham and Hooker

25. Choanocytes are found in
(a) *Sycon* (b) *Proterospongia*
(c) Both (a) and (b) (d) None of these

26. Albinism is an
(a) autosomal recessive (b) autosomal dominant
(c) X-linked disease (d) None of these

27. According to Wilhelm Stern
IQ (Intelligence Quotient) is
(a) $IQ = \frac{\text{Mental age}}{\text{Actual age}} \times 100$
(b) $IQ = \frac{\text{Actual age}}{\text{Mental age}} \times 100$
(c) $IQ = \frac{100}{\text{Actual age} \times \text{Mental age}}$
(d) $IQ = \frac{\text{Actual age} \times \text{Mental age}}{100}$

28. A thin film of water, held by the soil particles under the influence of internal attractive force is called which of the following water
(a) capillary (b) combined
(c) hygroscopic (d) gravitational

30. Number of meiotic divisions necessary to produce 100 seeds in cyperus is
(a) 100 (b) 200
(c) 300 (d)100

30. In blood carboxyhaemoglobin forms by
(a) inhalation of CO
(b) inhalation of CO_2
(c) inhalation of SO_2
(d) inhalation of ozone

embryos but lack seeds and vascular tissues?

(a) Fungi (b) Bryophytes
(c) Pteridophytes (d) Gymnosperm

32. In a colony of honey bee, male drones are onginated by

(a) diploid parthenogenesis
(b) cyclic parthenogenesis
(c) arrhenotoky
(d) thelotoky

33. If the ovary is inferior, the outermost layer of fruit produced by this ovary will be formed by

(a) epicarp (b) mesocarp
(c) pericarp (d) thalamus

34. ATP synthesis occurs on the

(a) outer membrane of mitochondria
(b) inner membrane of mitochondria
(c) matrix
(d) None of the above

35. Repressible enzyme are formed

(a) in the absence of corepressor
(b) in the presence of corepressor
(c) in the pressence of apressor
(d) All of the above

36. A mature ligul having a prominent basal protion is called

(a) trrichocyst (b) heterocyst
(c) rhizophore (d) glossopodium

37. Number of criteria used as classifying organisms in five-kingdom classification is

(a) 5 (b) 4 (c) 3 (d) 1

38. Slit roots are reported from

(a) pandanus (b) radish
(c) mango ginger (d) *Bryophyllum*

39. Astela comprises consists

(a) xylem, phloem and pith
(b) endodermis, xylemand phloem
(c) vascular tissue, pericycle and pith
(d) vascular tissue, endodermis and pith

40. Which of the following is also called as 'root ripe'?

(a) *Umbiicaria esculenta* (b) *Cetraria islandica*
(c) *Cladonia rangiferina* (d) *Rocello*

(a) incomplete virus (b) slow virus
(c) gemini viruses (d) satellite virus

42. Agar-Agar is obtained from

(a) *Gigartina* (b) *Gelidium*
(c) *Gracillaria* (d) All of these

43. Life cycle of *Funaria* is not completed without water. Choose the correct statement.

(a) As *Funaria* is a bryophyte plant
(b) As branches will not develop
(c) As fertilization takes place in presence of water only
(d) As plant is delicate and will become dry and die without water

44. Which of the following is the pribnow box?

(a) 5′ TATAAT 3′ (b) 5′ TAATTA 3′
(c) 5′ AATAAT 3′ (d) 5′ ATATTA 3′

45. In human beings, lungs are divided into

(a) 3 right and 2 left lobes (b) 2 right and 3 left lobes
(c) 2 right and 2 left lobes (d) None of these

46. 'Extranuclear chromosomes are found in

(a) peroxysomes and mitochondria
(b) chloroplast and mitochondria
(c) mitochondria and ribosomes
(d) chloroplast and ribosome

47. Contractile vacuole of *Amoeba*

(a) burst (b) disappear (c) enlarge (d) multiply

48. A genetically engineered microbe utilised for cleaning oil spicl is

(a) *Bacillus subtilis*
(b) *Escherichia coli*
(c) *Pseudomonas putida*
(d) *Agrobacterium tumefaciens*

49. Enzyme hyaluronidase is synthesised in

(a) tail of sperm
(b) head of sperm
(c) golgi body of acrosome
(d) mitochondria of acrosome

50. Which one is not a correct match?

(a) Hirudinea — *Hirudo*
(b) Oligochaeta — *Pheretima*
(c) Nematoda — *Ascaris*
(d) Polychaeta — *Lumbricus*

51. Which of the following is the most primitive ancestor of man?
(a) *Ramapithecus*
(b) *Homohabilis*
(c) *Australopithecus*
(d) *Homo sapiens neanderthalencis*

52. The only mammal, other than man which suffer from leprosy
(a) *Dasypus* (b) *Desmodus*
(c) *Rhinolopus* (d) *Mus*

53. Protein is used as respiratory substrate only when
(a) carbohydrates are absent
(b) fats are absent
(c) both exhausted
(d) fats and carbohydrates are abundant

54. An example of vestigial organ is
(a) ear of cow
(b) hair of bear
(c) nail of monkey
(d) nictitating membrane of man

55. Sexual reproduction in which cells of two different *Spirogyra* filamants conjugate is known as
(a) lateral conjugation (b) scalariform conjugation
(c) parthenocarpy (d) azygospory

56. The condition under which transpiration would be most rapid
(a) high humidity
(b) excess of water in soil
(c) low humidity, high temperature, guard cells are turgid (open) and moist soil
(d) low velocity of wind

57. A rootless aquatic in which a portion of leaf is modified to from a bladder for catching small aquatic animal is
(a) *Dionaea* (b) *Drosera*
(c) *Utricularia* (d) *Nepenthese*

58. Electron from excited chlorophyll molecule of photosystem. II are accepted first by
(a) ferredoxin (b) cytochrome-*b*
(c) cytochrome-*f* (d) quinone

59. Sponges have evolved from
(a) ciliates (b) flagellates
(c) protozoans (d) choanoflagellates

60. Sella turcica is a
(a) covering of kidney
(b) covering of testis
(c) depression in brain
(d) depression is skull which lodges the pituitary body

61. Majority of the orchids are
(a) epizois (b) epiphytes
(c) saprophytes (d) parasites

62. Intra Ovarian Fertilisation (IOF) means fertilisation
(a) outside ovule
(b) outside embryo sac
(c) by putting pollens directly into ovary wall
(d) between male gamete and synergids

63. Which of the following carries gases as well as unused products in the human body?
(a) Blood (b) Lymph
(c) Blood and lymph (d) Haemocynin

64. The great barrier reef along the eastern coastal region of Australia can be categorised as
(a) ecosystem (b) biome
(c) community (d) population

65. The complementary synthetic and random DNA are used as
(a) transposons (b) passenger DNA
(c) cloning vectors (d) recombinant DNA

66. Mosses are indicator of
(a) air pollution (b) water pollution
(c) radiation pollution (d) soil pollution

67. Milk glands are characteristic of
(a) all vertebrates
(b) all mammals
(c) only placental mammals
(d) only primates and ruminants

68. Cybrids carry
(a) two similar genomes
(b) only one genomes
(c) several genomes
(d) only genomes and two plasmone

69. If heart of a mammal is injected with 2% $CaCl_2$ solution, then
(a) heart beat will increase
(b) heart beat will decrease
(c) heart beat will stop
(d) no effect

(c) viruses (d) cyanobacteria

71. *Homo habilis 'habilis'* refers to
(a) tool maker (b) modern man
(c) ancient man (d) wandering species

72. Graafian follicles posses
(a) theca externa (b) granulosa
(c) theca interna (d) All of these

73. The pH of acid rain water is
(a) 1.2 (b) 5.7 (c) 3.1 (d) 6.0

74. Light loving plants are known as
(a) heliophytes (b) xerophytes
(c) lithophytes (d) sosiophytes

75. The thread-like tendons of papillary muscles inserted upon the flaps of tricuspid and bicuspid value are
(a) chordae tendinae (b) yellow elastin fibre
(c) reticulate fibre (d) collagen fibre

(a) pheromones
(b) flame cells
(c) abdominal glands
(d) cervical glands

77. The main function of clitellum is
(a) coccon formation (b) locomotion
(c) excretion (d) copulation

78. Diaphragm is found in
(a) crocodile (b) kangaroo
(c) ostrich (d) snake

79. Last stable community in succession which depends on climate is
(a) seral community (b) climax community
(c) Both (a) and (b) (d) None of these

80. Which one is spindle-shaped mobile with microtubules?
(a) Sporont (b) Ookinete
(c) Cryptozoite (d) Sporozoite

English

Directions (Q. Nos. 1-5) *In the following questions, choose the word opposite in meaning to the given word.*

1. INDIGENOUS
(a) Native (b) Cheap (c) Foreign (d) Inferior

2. FRAIL
(a) Vigorous (b) Sturdy (c) Hardy (d) Strong

3. WITHIN
(a) Without (b) Past (c) Over (d) Beyond

4. BRAZEN
(a) Respectful (b) Innocent
(c) Delicious (d) Helpful

5. ADVERSITY
(a) Diversity (b) Affliction
(c) Prosperity (d) Catastrophe

Directions (Q. Nos. 6-10) *In the following questions, sentences are given with blanks to be filled in with an appropriate word. Four alternatives are suggested for each questions. Choose the correct alternative out of the four.*

6. She was compear sated ..... the loss of her belongings.
(a) over (b) for (c) against (d) at

7. He has bean entrusted ..... this work.
(a) to (b) on (c) with (d) by

8. Let's make ..... our quarrel and be friends again.
(a) off (b) up (c) out (d) with

9. She yelled ..... him and he hostily retreated.
(a) to (b) towards (c) on (d) at

10. I devote much of my time ..... writing.
(a) to (b) on
(c) at (d) in

Directions (Q. Nos. 11-15) *In the following questions, some of the sentences have errors and some have none. Find out which part of a sentence has an error. If there is no error, your answer is (d) i.e., 'No error'.*

11. The Ahujas (a)/are living in this colony (b)/for the last eight years. (c)/No error (d)

12. You will come (a)/to my party tomorrow (b)/ is ait it. (c)/No error (d)

13. This room would look much better (a)/if you put a furniture (b)/in that corner. (c)/ No error (d)

14. If I will have enough (a)/time tomorrow (b)/I will come and see you. (c)/No error (d)

15. My father is (a)/appreciated by his friends (b)/for his honestness. (c)/No error. (d)

Directions (Q. Nos. 16-20) *In the following questions, out of the four alternatives, choose the one, which best expresses the meaning of the given word.*

16. FILTHY

(a) Healthy (b) Ugly (c) Dirty (d) Angry

17. NOSTALGIC

(a) Soothing (b) Homesick
(c) Diseased (d) Indolent

18. COMBAT

(a) Quarrel (b) Fight
(c) Conflict (d) Feud

19. SUBSIDE

(a) Submit (b) Oppress
(c) Subdue (d) Surrender

20. ABSCOND

(a) Turn (b) Flee
(c) Manage (d) Avoid

Directions (Q. Nos. 21-25) *In the following questions a part of the sentence is printed in bold. Below are given alternatives to the bold part at (a), (b) and (c) which may improve the sentence. Choose the correct alternative. In case no improvement is needed your answer is (d).*

21. I wish I **was** with him.

(a) have been
(b) were
(c) am
(d) No improvement

22. **Upto** the time the last vote was recorded it was difficult to decide whether victory lay with the ruling party or the opposition.

(a) To (b) Until
(c) Till (d) No improvement

23. **Having had** in the Foreign Service for a long time, Mr Verma has met many prominent personalities.

(a) Having (b) He has been
(c) Having been (d) Had he been

24. Who does not know that this **was broadcasted** ten days ago?

(a) Had broadcast (b) Was broadcast
(c) Was broadcasting (d) No improvement

25. Since 1986, there **is** no earthquakes here.

(a) were being (b) have been
(c) are (d) No improvement

Directions (Q. Nos. 26-30) *In the following questions, out of the four alternatives, choose the one which canbe substituted for the given words / sentence.*

26. One who speaks or understands many languages?

(a) Scholar (b) Grammarian
(c) Linguist (d) Polyglot

27. To talk without respect of something sacred or holy

(a) blasphemy (b) obscenity
(c) rudeness (d) vulgarity

28. Land so surrounded by water as to be almost an island

(a) archipelago (b) isthmus
(c) peninsula (d) lagoon

29. A place adjoining kitchen, for washing dishes etc.

(a) Cellar (b) Wardrobe (c) Scullery (d) Pantry

30. Incapable of being wounded

(a) Invulnerable (b) Invincible
(c) Infallible (d) Impregnable

Directions (Q. Nos. 31-35) *In the following questions, groups of four words are given. In each group, one word is correctly spelt. Find the correctly spelt word.*

31. (a) Posesion (b) Possesion
(c) Possession (d) Posession

32. (a) Liesure (b) Leisure
(c) Leasure (d) Lesiure

33. (a) Bouquete (b) Boquet
(c) Bouquet (d) Bouquette

35. (a) Ocasion (b) Ocassion
(c) Occasion (d) Occassion

Directions (Q. Nos. 36-40) *In the following questions four alternatives are given for the idiom/phrase printed in bold in the sentence. Choose the alternative which best expresses the meaning of the idiom/phrase.*

36. The robbery was committed **in the wee hours** of the day.
(a) after midnight (b) at dawn
(c) at noontime (d) in the evening

37. Harassed by repeated acts of injustice, he decided **to put his foot down**.
(a) resign
(b) not to yield
(c) withdraw
(d) accept the proposal unconditionally

(a) unwell
(b) lonely
(c) penniless
(d) depressed

39. The doctor says the patient **has turned the corners**.
(a) completely recovered
(b) become worse
(c) passed the crisis
(d) died

40. He is in the habit of **fishing in troubled waters.**
(a) putting others in trouble
(b) indulging in evil conspirancies
(c) aggravating the situation
(d) taking advantage of troubled conditions for personal profit

Answers

Physics

1. (a)	**2.** (c)	**3.** (d)	**4.** (a)	**5.** (a)	**6.** (a)	**7.** (a)	**8.** (a)	**9.** (d)	**10.** (d)
11. (b)	**12.** (a)	**13.** (a)	**14.** (d)	**15.** (a)	**16.** (b)	**17.** (c)	**18.** (c)	**19.** (c)	**20.** (a)
21. (b)	**22.** (d)	**23.** (d)	**24.** (a)	**25.** (a)	**26.** (c)	**27.** (c)	**28.** (c)	**29.** (d)	**30.** (b)
31. (c)	**32.** (c)	**33.** (a)	**34.** (a)	**35.** (a)	**36.** (a)	**37.** (a)	**38.** (b)	**39.** (b)	**40.** (c)
41. (b)	**42.** (a)	**43.** (b)	**44.** (b)	**45.** (d)	**46.** (c)	**47.** (c)	**48.** (b)	**49.** (b)	**50.** (a)
51. (c)	**52.** (a)	**53.** (d)	**54.** (b)	**55.** (a)	**56.** (b)	**57.** (c)	**58.** (d)	**59.** (d)	**60.** (b)

Chemistry

1. (d)	**2.** (c)	**3.** (c)	**4.** (a)	**5.** (b)	**6.** (c)	**7.** (a)	**8.** (d)	**9.** (c)	**10.** (b)
11. (d)	**12.** (b)	**13.** (d)	**14.** (b)	**15.** (c)	**16.** (c)	**17.** (a)	**18.** (c)	**19.** (d)	**20.** (d)
21. (b)	**22.** (a)	**23.** (d)	**24.** (a)	**25.** (a)	**26.** (b)	**27.** (b)	**28.** (d)	**29.** (c)	**30.** (d)
31. (b)	**32.** (a)	**33.** (a)	**34.** (a)	**35.** (b)	**36.** (a)	**37.** (d)	**38.** (c)	**39.** (b)	**40.** (a)
41. (b)	**42.** (c)	**43.** (a)	**44.** (d)	**45.** (c)	**46.** (a)	**47.** (a)	**48.** (b)	**49.** (c)	**50.** (a)
51. (a)	**52.** (b)	**53.** (b)	**54.** (b)	**55.** (c)	**56.** (d)	**57.** (c)	**58.** (a)	**59.** (a)	**60.** (b)

Biology

1. (d)	**2.** (b)	**3.** (b)	**4.** (c)	**5.** (b)	**6.** (d)	**7.** (a)	**8.** (a)	**9.** (b)	**10.** (d)
11. (a)	**12.** (c)	**13.** (b)	**14.** (b)	**15.** (b)	**16.** (c)	**17.** (a)	**18.** (d)	**19.** (b)	**20.** (a)
21. (a)	**22.** (d)	**23.** (d)	**24.** (d)	**25.** (b)	**26.** (a)	**27.** (a)	**28.** (c)	**29.** (b)	**30.** (a)
31. (b)	**32.** (c)	**33.** (d)	**34.** (b)	**35.** (a)	**36.** (d)	**37.** (a)	**38.** (a)	**39.** (c)	**40.** (a)
41. (b)	**42.** (d)	**43.** (c)	**44.** (a)	**45.** (a)	**46.** (b)	**47.** (b)	**48.** (c)	**49.** (c)	**50.** (d)
51. (a)	**52.** (a)	**53.** (c)	**54.** (d)	**55.** (b)	**56.** (c)	**57.** (c)	**58.** (d)	**59.** (d)	**60.** (d)
61. (b)	**62.** (c)	**63.** (c)	**64.** (a)	**65.** (b)	**66.** (a)	**67.** (b)	**68.** (d)	**69.** (c)	**70.** (a)
71. (a)	**72.** (d)	**73.** (b)	**74.** (a)	**75.** (a)	**76.** (a)	**77.** (a)	**78.** (b)	**79.** (b)	**80.** (d)

English

1. (c)	**2.** (d)	**3.** (d)	**4.** (a)	**5.** (c)	**6.** (b)	**7.** (c)	**8.** (b)	**9.** (d)	**10.** (a)
11. (b)	**12.** (c)	**13.** (b)	**14.** (a)	**15.** (c)	**16.** (c)	**17.** (b)	**18.** (b)	**19.** (c)	**20.** (b)
21. (b)	**22.** (c)	**23.** (c)	**24.** (b)	**25.** (b)	**26.** (d)	**27.** (a)	**28.** (c)	**29.** (c)	**30.** (a)
31. (c)	**32.** (b)	**33.** (c)	**34.** (b)	**35.** (c)	**36.** (b)	**37.** (b)	**38.** (d)	**39.** (c)	**40.** (d)

Hints & Solutions

Physics

1. Here, initial velocity of the body

$$v_1 = v$$

Initial height $h = hc$

Final velocity of the body $v_2 = 2v$

Now, from the equation of motion

$$v^2 = u^2 + 2gh$$

$$v^2 \propto h$$

So, $$\left[\frac{v_1}{v_2}\right]^2 = \left[\frac{h_1}{h_2}\right]$$

or, $$\left[\frac{v}{2v}\right]^2 = \frac{h}{h_2}$$

or, $$\frac{h}{h_2} = \frac{1}{4}$$

or $$h_2 = 4h$$

2. Using the relation

$$\left[\frac{\Delta m}{\Delta t}\right] v - mg = ma$$

or $$\frac{\Delta m}{\Delta t} \times (800) = m(g + a)$$

or $$800 \times \frac{\Delta m}{\Delta t} = 5000(10 + 20)$$

or $$\frac{\Delta m}{\Delta t} = \frac{5000 \times 30}{800}$$

or $$\frac{\Delta m}{\Delta t} = \frac{1500}{8} = 187.5 \text{ kg/s}$$

3. Let mass and speed of man be M and v respectively.

Let speed of the boy be v, then

$$\frac{1}{2}Mv^2 = \frac{1}{2}\left[\frac{1}{2}\left(\frac{M}{2}\right)v^2\right] \quad \text{...(i)}$$

$$\frac{1}{2}M(v+1)^2 = \frac{1}{2}\left[\frac{M}{2}\right]v^2 \quad \text{... (ii)}$$

Dividing Eq. (i) by (ii) we obtain

$$\frac{v^2}{(v+1)^2} = \frac{1}{2}$$

or $$\frac{v}{v+1} = \frac{1}{\sqrt{2}}$$

or $$\sqrt{2}v = v + 1$$

or $$v(\sqrt{2} - 1) = 1$$

or $$v = \frac{1}{\sqrt{2} - 1} \text{ m/s}$$

4. Here, radius of cycle wheel

$$r = 4 \text{ m}$$

Frequency of revolution $f = \frac{1}{2}$ rad/s

The acceleration $a = r\omega^2 = r(2\pi f)^2$

$$= 4 \times \left(2\pi \times \frac{1}{2}\right)^2$$

$$= 4\pi^2 \text{ m/s}^2$$

5. Heat required by ice to raise its temperature to 100°C

$$Q_1 = m_i c_1 + m_i c_1 \Delta Q_1$$
$$= 5 \times 80 + 5 \times 1 \times 100$$
$$= 400 + 500 = 900 \text{ kcal}$$

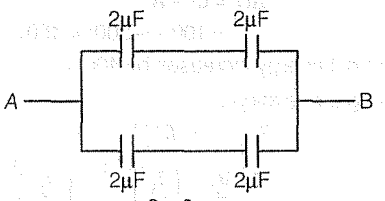
Heat given by steam when condensed

$$Q_2 = m \times L_2$$
$$= 5 \times 536 = 2680 \text{ cal}$$

As $Q_2 > Q_1$. So, that whole steam is not condensed.

Hence, temperature will remain at 100°C.

6. Equivalent capacitance of upper arms in series



$$C_1 = \frac{2 \times 2}{2 + 2} = 1 \mu\text{F}$$

In lowers arms $C_2 = 1 \mu\text{F}$

Now C_1 and C_2 are in parallel

$\therefore$ Equivalent capacitance $C = C_1 + C_2 = 2 \mu\text{F}$

7. Refractive index of prism

$$\mu = \frac{\sin\frac{A + \delta m}{2}}{\sin A/2}$$

$$= \frac{\sin\frac{60° + 30°}{2}}{\sin\frac{60}{2}}$$

$$= \frac{\sin 45°}{\sin 30°} = \frac{\frac{1}{\sqrt{2}}}{\frac{1}{2}} = 2$$

$$P_2 = I^2 R_2$$

$$= \left(\frac{E}{R_2 + r}\right)^2 R_2$$

Power delivered is same in the both cases

$$\left(\frac{E}{R_1 + r}\right)^2 R_1 = \left(\frac{E}{R_2 + r}\right)^2$$

$$R_1 (R_2^2 + r^2 + 2R_2 r) = R_2 (R_1^2 r^2 + r^2 + 2R_1 r)$$

$$R_1 R_2^2 + R_1 r^2 + 2R_1 R_2 r = R_2 R_1^2 r^2 + R_2 r^2 + 2R_1 R_2 r$$

$$R_1 R_2^2 - R_2 R_1^2 = R_2 R^2 - R_1 r^2$$

$$R_1 R_2 (R_2 - R_1) = R_2 r^2 - R_1 r^2$$

$$r = \sqrt{R_1 R_2}$$

9. Change in volume $\Delta V_2 - V_1 = 4 - 10 = -6\,m^3$

A volume decreases, work is done on the gas and so it is negative.

$$W = p\Delta V = 50 \times (-6)$$

$$= -300\,J$$

Additional heat supplied ($G = +100\,J$). So, for first law of thermodynamics change in external energy is given by

$$\Delta U = Q - W$$

$$= 100 - (-300) = 400\,J$$

Internal energy increases by 400 J.

10. Using the relation ,

$$T_1 V_1^{\gamma - 1} = T_2 V_2^{\gamma - 1}$$

$$\frac{V_2}{V} = \left(\frac{T_1}{T_2}\right)^{1-\gamma} = \left(\frac{T_1}{2T_1}\right)^{1-\gamma}$$

or $$\frac{1}{(2)^{1-\gamma}} > \frac{1}{2}$$

11. Here , $T_1 = 127°C = 400\,K$

$$E_2 = 16 \times 10^6\ J/sm^2$$

$$E_1 = 1 \times 10^6\ J/sm^2$$

Using the relation,

$$\frac{E_2}{E_1} = \left(\frac{T_2}{T_1}\right)^4$$

$$\frac{T_2}{T_1} = \frac{E_2}{E_1} = \left(\frac{16.0 \times 10^6}{1 \times 10^6}\right)^{1/4} = 2$$

$$T_2 = 2 \times T_1 = 2 \times 400 = 800K$$

$$T_2 = 527°C$$

The energy spend by the battery is given by

$$= qV = (C' V)V = C' V^2$$

$$= 25 \times 10^{-6} \times (100)^2$$

$$= 25 \times 10^{-2}$$

13. Using the releation

$$i = \frac{q}{t} = \frac{\text{electronic charge}}{\text{time period}} = \frac{e}{t}$$

Hence , $t = \frac{2\pi r}{v}$

So, $$i = \frac{e}{2\pi r v}$$

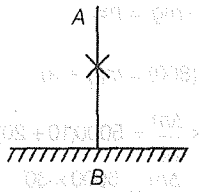
$$= \frac{ev}{2\pi r}$$

$$= \frac{(1.6 \times 10^{-19})(4 \times 10^6)}{2 \times 3.14 \times 1.0 \times 10^{-2}}$$

$$= 1 \times 10^{-11}\,\Omega$$

14. If ray is incident normally then it reflects back on the same path.

Reflection angle = 0



15. Due to weightless in artificial satellite, no pressure difference will be produced on ink and ink will not rise in pen.

16. According to Keplar's law

$$T^2 \propto R^3$$

$$\left(\frac{T_1}{T_2}\right)^2 = \left(\frac{R_1}{R_2}\right)^3$$

$$\left(\frac{1}{T_2}\right)^2 = \left(\frac{R}{2R}\right)^3$$

$$\frac{1}{T_2^2} = \frac{1}{8}$$

$$T_2 = 2\sqrt{2}\ yr$$

17. Limiting frictional force

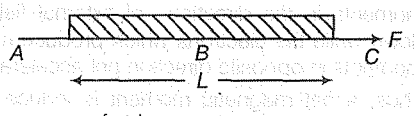
$$F_s = \mu_s R$$

$$= \mu_s mg$$

$$= 0.4 \times 2 \times 9.8 = 7.84\,N$$

18. Force F is applied

$\therefore$ Acceleration in string $= \frac{F}{M}$



m = mass of string

mass per unit length of string $= \frac{M}{L}$

Tension at a distance (l)

$= m \times a$ = mass of AB $\times a$

$$\frac{m}{L}(L-l)\times\frac{F}{M}=\left(1-\frac{l}{L}\right)F$$

19. Minimum velocity at the highest point of vertical circle

$$VA = \sqrt{gr}$$

20. Excess pressure as compared to atmosphere inside bubble A is

$$\Delta p_1 = 1.01 - 1 = 0.01 \text{ atm}$$

inside bubble B is

$$\Delta p_2 = 1.03 - 1 = 0.03 \text{ atm}$$

Also when radius of a bubble is r, formed from a solutiion whose surface tension is t, then excess pressure inside the bubble is given by

$$p = \frac{4t}{r}$$

Let r_1 be the radii of bubbles A and B respectively then

$$\frac{p_1}{p_2} = \frac{4T/r_1}{4T/r_2} = \frac{0.01}{0.03}$$

$$\frac{r_2}{r_1} = \frac{1}{3}$$

Since bubbles are spherical in shape their volume's are in the ratio

$$\frac{V_1}{V_2} = \frac{\frac{4}{2}\pi r_1^3}{\frac{4}{3}\pi r_2^3}$$

$$\left(\frac{r_1}{r_2}\right)^3 = \left(\frac{3}{1}\right)^3 = \frac{27}{1}$$

$$V_1 : V_2 = 27 : 1$$

21. Law of conservation of energy is valid.

Potential energy is the energy possesed by a body due to its weight. It is given by

$$PE = mgh$$

where, m is mass, g acceleration due to gravity and h is height

This potential energy is utilized in giving latent heat to ice $m'L = mgh$

Given $m = 3.5$ kg, $g = 10 \text{ m/s}^2$, $h = 2000$ m

$$L = 3.5 \times 10^5 \text{ J/s}$$

$$m = \frac{mgh}{L}$$

$$m = \frac{3.5 \times 10 \times 2000}{3.5 \times 10^5}$$

$m = 0.2$ kg of ice

Also, $1 \text{ kg} = 10^3 \text{ g}$

$m = 200$ g of ice

22. From Stefan's law, the total radiant energy emitted per second per unit surface area of a black body is proportional to the fourth power of the absolute temperature of the body.

That is $E = \sigma T^4$

where, σ is Stefan's constant .

When sphere cools from 600 K to 200 K, energy 400 K to 200 K then.

$$H' = \sigma[(600)^4 - (400)^4]$$

$$\frac{H}{H'} = \frac{[(600)^4 - (200)^4]}{[(600)^4 - (400)^4]}$$

Using $a^4 - b^4 = (a^2 - b^2)(a^2 + b^2)$, we have

$$\frac{H}{H'} = \frac{[(600)^2 - (200)^2]}{[(600)^2 - (400)^2]} \times \frac{[(600)^2 + (200)^2]}{[(600)^2 + (400)^2]}$$

$$\frac{H}{H'} = \frac{32}{12} \times \frac{40}{20} = \frac{16}{3}$$

$$H' = \frac{3}{16}H$$

23. It is given that acceleration due to gravity on plane. A is 9 times the acceleration due to gravity on planet B *i.e.*,

$$g_A = 9\, g_B \quad \text{...(i)}$$

From third equation of motion

$$v^2 = 2gh$$

At planet A, $h_A = \frac{v_2}{2g_A}$ ...(ii)

At planet B, $H_B = \frac{v^2}{2g_B}$ ...(iii)

Dividing Eq. (ii) by Eq. (iii) we have

$$\frac{h_A}{h_B} = \frac{9g_B}{g_A}$$

From Eq. (i), $g_A = 9g_B$

$$\therefore \quad \frac{h_A}{h_B} = \frac{g_B}{9g_B} = \frac{1}{9}$$

or $h_B = 9h_B = 9 \times 2 = 18$ m $\quad (\because h_A = 2\text{m})$

$$\frac{U_1}{U_2} = \left(\frac{x_1}{x_2}\right)^2$$

Given $X_1 = 2\text{cm} = .02\text{m}$, $X_2 = 10\,\text{cm} = 0.1\,\text{m}$

Substituting the values

$$\frac{U_1}{U_2} = \left(\frac{0.02}{0.1}\right)^2 = \left(\frac{1}{5}\right)^2 = \frac{1}{25}$$

$$U_2 = 25\,U_1 = 2U$$

25. When an observer moves towards an stationary source of sound then apparent frequency heard by the observer increases. The the apparent frequency heard in this situation

$$f' = \left(\frac{v + v_0}{v - v_s}\right) f$$

As source is stationary hence $v_s = 0$

$$f' = \left(\frac{v + v_0}{v}\right) f$$

given $v_0 = \frac{v}{5}$

Substituting in the relation for f' we have

$$f' = \left(\frac{v + v/5}{v}\right) f = \frac{6}{5} = 1.2\,f$$

Motion of observer does not affect the wavelength reaching the observer hence wavelength remains λ.

26. Initially the focal length of equiconvex lens is

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \qquad \ldots(i)$$

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R} - \frac{1}{-R}\right) = \frac{2(\mu - 1)}{R}$$

Case I

When lens is cut along XOX, then each half is again equiconvex with

$$R_1 = +R, R_2 = -R$$

Thus $\frac{1}{f} = (\mu - 1)\left[\frac{1}{R} - \frac{1}{-(R)}\right] = (\mu - 1)\frac{2}{R} = \frac{1}{f'}$

$\Rightarrow \quad f' = f$

Case II

When lens is cut along XOY, then each half becomes plano - convex with .

$$R_1 = +R\,,\ R_2 = \infty$$

Thus $$\frac{1}{f''} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

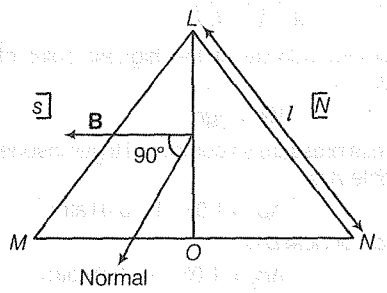
$$= \left(\frac{\mu - 1}{R}\right) = \frac{1}{2f}$$

Hence $f' = f, f'' = 2f$

moments in the direction of external field show down while the electrons which produce magnetic moments in opposite direction get accelerated.

Thus, a net magnetic moment is induced in the opposite direction of applied magnetic field. Hence the substance is magnetized opposite of the external field. Thus, it moves from stronger. Weaker parts of the magnetic .

28. Torque acting an equilateral triangle in magnetic field **B** is



$$\tau = iAB\sin\theta \qquad \ldots(i)$$

Area of triangle LMN

$$A = \frac{\sqrt{3}}{4} l^2$$

and $\theta = 90°$

$$\tau = i \times \frac{\sqrt{3}}{4} l^2 B \sin 90°$$

$$= \frac{\sqrt{3}}{4} i l^2 B \qquad (\because \sin 90° = 1)$$

$$l = 2\left(\frac{\tau}{\sqrt{3}Bi}\right)^{1/2}$$

29. Resistance of a conductor is given by

$$R = \frac{\rho l}{A}$$

When l is the length of conductor. A its area of cross-section and ρ its resistivity

$$\rho = \frac{RA}{l} \qquad \ldots(i)$$

Given $R = 0.072\Omega$

$A = (2 \times 2)\,\text{mm}^2$

$= 4 \times 10^{-6}\ \text{m}^2.$

$l = 12\ \text{m}$

Substituting the given values is Eq. (i) we get

$$\rho = \frac{0.072 \times 4 \times 10^{-6}}{12} = 2.4 \times 10^{-8}\,\Omega\text{m}$$

30. Electric line of forces constitute electric field. In an electric field electric line of force always flow form higher potential to lower potential. Hence, A and B are at same higher potential and B is at lower potential. Thus

$V_A = V_B > V_C$

31. Let $A = (0,3,-1)$ and $B = (-2,6,4)$

$$\mathbf{A} = 3\hat{\mathbf{j}} - \hat{\mathbf{k}}$$

and $$\mathbf{B} = -2\hat{\mathbf{i}} + 6\hat{\mathbf{j}} + 4\hat{\mathbf{k}}$$

The displacement vector from A to B

$$= \mathbf{B} - \mathbf{A}$$
$$= (-2\hat{\mathbf{i}} + 6\hat{\mathbf{j}} + 4\hat{\mathbf{k}}) - (3\hat{\mathbf{j}} - \hat{\mathbf{k}})$$
$$= -2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 5\hat{\mathbf{k}}$$

32. To just lift of the rocket from the launching pad,

Trust force $F = v_r\left(\frac{-dm}{dt}\right)$

where, v_r is exhaust speed and $\left(\frac{-dm}{dt}\right)$ is the rate at which mass is ejecting.

Also $$F = ma$$

$$ma = v_r\left(\frac{-dm}{dr}\right)$$

or a = acceleration

$$= \frac{1}{m}\left(\frac{-dm}{dt}\right)v_r$$

Given, $\frac{-dm}{dt} = \frac{1}{60}$ kg s^{-1}, $m = 1$ kg

$$v_r = 2400 \text{ ms}^{-1}$$

$$a = \frac{1}{1}\left(\frac{1}{60}\right) \times 2400 = 40 \text{ ms}^{-2}$$

33. The root mean square velocity of the gas is given by

$$v_{rms} = \sqrt{\frac{3RT}{M}}$$

where, R is gas constant, T is absolute temperature and m is the molecular weight of the gas.

$$T_1 = 27°C = 273 + 27 = 300 \text{ K}$$
$$T_2 = 227°C = 273 + 227 = 500 \text{ K}$$
$$\frac{v_1}{v_2} = \sqrt{\frac{300}{500}} = \sqrt{\frac{3}{5}}$$

Given $v_1 = 400$ m/s, $v_2 = v_s$

$$v_s = \sqrt{\frac{5}{3}} \times 400$$
$$= 1.29 \times 400$$
$$= 516.39 \text{ m/s} = 516 \text{ m/s}$$

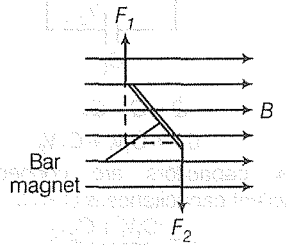
Note *If the absolute temperature of the gas become zero then the motion of molecules will cease.*

34. Torque is equal to instantaneous moment of deflecting couple .

The torque acting is given by

τ = force ($F_1 = F_2$) × perpendicular distance

$\tau = iBl \times b\sin\theta$

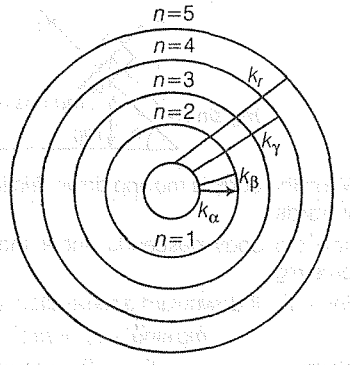


Where i is current, B is magnetic field, l the length and b the distance

the term $ilb = \mathbf{M}$ = dipole moment

$$\tau = \mathbf{MB}\sin\theta$$
$$\tau = \mathbf{M} \times \mathbf{B}$$

35. Electron transitions to lower atomic levels in heavy atoms have quantum energies which place them in the X-ray region of the electromagnetic spectrum. The X-ray emission associated with these transitions are characteristic X-rays. As it is clear from the diagram k_r is from $n = 4$ to $n = 1$.



36. If on changing current through the coil, the emf induced in the coil is e, then by Faraday's 2nd law, we have

$$e = -L\frac{\Delta i}{\Delta t}$$

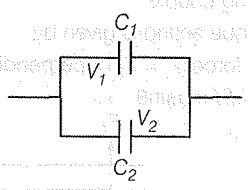
where, $\frac{\Delta i}{\Delta t}$ is rate of change of current.

Given, $L = 5$H, $\frac{\Delta i}{\Delta t} = -2$A/s (decreasing)

$\therefore$ $e = -5 \times (-2) = +10$V

capacitances.

Let the charge on the capacitors be q_1 and q_2. Then total charge



$$Q = Q + Q_2$$
$$CV = C_1V_1 + C_2V_2$$

Since, capacitors are connected in parallel equivalent capacitance is $C = C_1 + C_2$

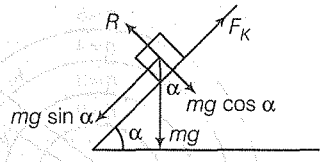
$$V = \frac{C_1V_1 + C_2V_2}{C_1 + C_2}$$

Given, $C_1 = 10\,\mu F$, $V_1 = 250\,V$, $C_2 = 5\mu F$, $V_2 = 100\,V$

$$\therefore \quad V = \frac{(10\times10^{-6}\times250)+(5\times10^{-6}\times100)}{(10\times10^{-6}+5\times10^{-6})}$$

$$\Rightarrow \quad V = \frac{3000\times10^{-6}}{15\times10^{-6}} = 200\,V$$

38. When a body descends, the frictional free acts upwards. The free body diagram given situation is as shown in the figure.



When the body is moving down, frictional force acts upwards.

Now the body descends under the action of the force mg.

$\sin\alpha - F_k$. If downward acceleration is a, then,

$$mg\sin\alpha - F_K = ma$$

Where $F_K = \mu R = \mu mg\cos\alpha$

$$\therefore \quad mg\sin\alpha - \mu\, mg\cos\alpha = ma$$
$$\Rightarrow \quad a = g\,(\sin\alpha - \mu\cos\alpha)$$

39. From Rutherford and Soddy law for radioactive decay, if N be the number of atoms of radioactive substance lift at some instant of time, then

$$N = N_0\left(\frac{1}{2}\right)^n$$

When N_0 is original number of atoms and n is number of half views

1600

$$N = \left(\frac{1}{2}\right)^3 \times 1$$
$$= \frac{1}{8} = 0.125\,kg$$

40. Let number of photons emitted per second be n.

Then intensity = 100 W/m^2

$$\frac{nhc}{\lambda} = 100$$
$$n = \frac{100\times\lambda}{hc}$$
$$= \frac{100\times4000\times10^{-10}}{hc}$$
$$= \frac{100\times4000\times10^{-10}}{6.6\times10^{-34}\times3\times10^8}$$
$$= 2.02\times10^{20}$$

41. Kinetic energy of photoelectron

$$KE = 500\,keV = 500\times10^3\,eV$$
$$KE = mc^2 - m_0c^2$$
$$\frac{KE}{m_0c^2} = \frac{mc^2 - m_0c^2}{m_0c^2}$$
$$= \frac{m - m_0}{m_0} = \frac{\Delta m}{m_0}$$
$$\frac{\Delta m}{m} = \frac{KE}{m_0c^2}$$

Hence % increase in mass is

$$= \frac{\Delta m}{m}\times100 = \frac{KE}{m_0c^2}\times100$$
$$= \frac{500\times10^3}{0.511\times10^6}\times100$$
$$= \frac{5}{5.11}\times100 = 97.85\%$$

42. $y = \dfrac{\cos\theta\, T^x\cdot\tau}{l^3}$

$$[y] = [ML^{-1}T^{-2}][T] = [T^2]$$
$$[T] = [ML^2T^{-2}]$$
θ = dimensionless
$(l) = [L]$
$$[ML^{-1}T^{-2}] = \frac{[T]^x\,[ML^2T^{-2}]}{[L^3]}$$

omparing the power, $-2 + x = -2$

$$x = 0$$

43. The volume of hydrogen and oxygen in a mixture is 4 : 1. So let V be the volume of oxygen. The volume of hydrogen will be $4V$ if ρ_m be the density of mixture, then

$$\rho_m = \frac{4V \times 1 + V \times 1s}{5m} = 4$$

$$V \propto \left(\frac{1}{\rho}\right)^{1/2}$$

$$\text{Velocity in mixture} = \frac{1270}{(4)^{3/2}} = 635 \text{ m/s}$$

44. $y = 4\cos^2(t/2)\sin(10\,\omega t)$

$= 2\,[2\cos^2(t/2)\sin(10\,\omega t)]$

$= 2\,[(1+\cos t)\sin(10\,\omega t)]$

$= 2\sin(10\,\omega t) + 2\sin(10\omega t)\cos t$

$= 2\sin(10\omega t) + \sin(10\omega t) + \sin(999\,t)$

45. $U = Pt$

$= 10^6 \times 24 \times 36 \times 10^{12}$

$= 24 \times 36 \times 10^8$ J

Energy released per fusion reaction

$= 20$ MeV

$= 20 \times 10^6 \times 1.6 \times 10^{-19}$

$= 32 \times 10^{-13}$ J

Energy released per atom of $_1H^2 = 32 \times 10^{-13}$ J

Number of $_1H^2$ atom of used

$$= \frac{24 \times 36 \times 10^8}{32 \times 10^{-13}}$$

$$= 27 \times 10^{21}$$

Mass of 6×10^{23} atom $= 2$ g

$$= \frac{2}{6 \times 10^{23}} \times 27 \times 10^{21}$$

$90 \approx 100\,g$

46. $W = h\nu_0 = \dfrac{hc}{\lambda_0}$

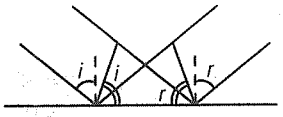
Wave function in electron volt W_0 (eV)

$$W_0 = \frac{12400}{\lambda_0(\text{Å})} = eV$$

$$4.0 = \frac{12400}{\lambda_0}$$

$$\lambda_0 = 310 \text{ nm}$$

47. The reflection of light wave is shown



The change of phase of reflected wave is 180°

48. $P = \dfrac{1}{f_1} + \dfrac{1}{f_2} - \dfrac{d}{f_1 f_2}$

$$= \frac{1}{l} + \frac{1}{-0.25} - \frac{0.75}{(1)(-0.25)}$$

$= 1 - 4 + 3 = -3 + 3 = 0$

49. Initial frequency of vibration

$\nu \propto \sqrt{T}$

When the tension in one of the instruments is increased by %, then

$$\nu \propto \sqrt{1 + \frac{1}{100}}$$

$$\frac{\nu'}{\nu} = \left(1 + \frac{1}{100}\right)^{1/2}$$

$$= 1 + \frac{1}{200}$$

$$\frac{\nu' - \nu}{\nu} = \frac{1}{200}$$

$$\frac{3}{2\nu} = \frac{1}{200}$$

$$\nu = 300 \text{ Hz}$$

50. For a solenoid $L = \mu_0 N^2 \dfrac{A}{l} \cdot 2yx$ is the length of the wire and a is the area of cross-section, then

$$R = \frac{\rho x}{a}$$

and $m = axD$

$$R_m = \rho\frac{x}{a} = axD$$

$$x = \sqrt{\frac{R_m}{\rho D}}$$

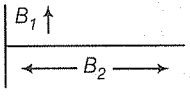
$$x = 2\pi r N,\ N = \frac{x}{2\pi r}$$

$$L = \mu_0\left(\frac{x^2}{2\pi r}\right)^2 \frac{\pi r^2}{l}$$

$$= \frac{\mu_0}{4\pi l} \cdot \frac{Rm}{\rho D}$$

$r = 2\text{cm} = 0.02$ m

51.



Magnetic field induction at point P due to current carrying wire is

$$B_2 = \frac{\mu_0 i}{2\pi r} \cdot \frac{4\pi \times 10^{-7} \times 30}{2\pi \times 0.02}$$

$$= \sqrt{(4)^2 + (2)^2} \times 10^{-7}$$

$$B_2 = 3 \times 10^{-4}\,T$$

$$B = \sqrt{B_1^2 + B_2^2}$$
$$= \sqrt{(4)^2 + (3)^2 \times 10^{-4}}$$
$$= 5 \times 10^{-4}\ \text{T}$$

52. $W = \text{KE}_f - \text{KE}_i$

$$W = \text{KE}_f - \frac{1}{2}mv^2$$
$$F - dx = \text{KE}_f - \frac{1}{2} \times 10 \times 10^2$$
$$-0.1\, xdx = \text{KE}_f - 500$$
$$0.1\int_{20}^{30} xdx = \text{KE}_f - 500$$
$$0.1\left[\frac{x^2}{2}\right]_{20}^{30} = \text{KE}_f - 500$$
$$= \frac{0.1}{2}[(30)^2 - (20)^2] = \text{KE}_f - 500$$
$$-25 = \text{KE}_f - 500$$
$$KE_F = 475\,\text{J}$$

53. Intensity cannot change the cut off frequency or stopping potential. High intensity means more number of photons, so chances of hitting to electron by them increase and hence more photoelectron are emitted *i.e.*, photocurrent increases.

54. $h = \frac{1}{2}gt^2$

$$\frac{h}{2} = \frac{1}{2}g(t-1)^2$$
$$t = 2 \pm \sqrt{2}s$$
$$t = 2 + \sqrt{2}s$$

55. $\mathbf{A} \times \mathbf{B} = AB\sin\theta$

$$\mathbf{A} \cdot \mathbf{B} = AB\cos\theta$$
$$|\mathbf{A} \times \mathbf{B}| = \sqrt{3}\,\mathbf{A} \cdot \mathbf{B}$$
$$|\mathbf{A} \times \mathbf{B}| = |A|\,|B|\sin\theta$$
$$= AB\sin\theta$$

$\tan\theta = \sqrt{3},\ \theta = 60°$

Now $(\mathbf{A} + \mathbf{B})^2 = \mathbf{A}^2 + \mathbf{B}^2 + 2\mathbf{A} \cdot \mathbf{B}$

$$= \mathbf{A}^2 + \mathbf{B}^2 + 2\mathbf{AB}$$
$$= \mathbf{A}^2 + \mathbf{B}^2 + \mathbf{AB}\,\frac{1}{2}$$
$$= \mathbf{A}^2 + \mathbf{B}^2 + 2\mathbf{AB}^2$$

or $|\mathbf{A} + \mathbf{B}| = (\mathbf{A}^2 + \mathbf{B}^2 + \mathbf{AB}^{1/2})$

56. Distance between successive nods
= distance between successive antinodes
$= \frac{\lambda}{2}$

57. Apparent change in frequency due to motion of source and observe relative to the medium along the line of sight is called Doppler effect.

58. $P = E_{\text{rms}} \times i_{\text{rms}} \times \cos\phi$

$$\phi = \frac{\pi}{2}$$
$$\cos\phi = 0$$
$$P = E_{\text{rms}} \times i_{\text{rms}} \times (0) = 0$$

59. Interactive spacing for fcc lattice

$$r = \left[\left(\frac{q}{2}\right)^2 + \left(\frac{q}{2}\right)^2 + (0)^2\right]^{1/2}$$
$$= \frac{q}{\sqrt{2}}$$

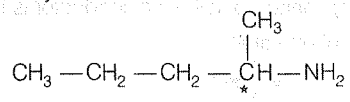
Being lattice contact
$a = \sqrt{2}r = \sqrt{2} \times 2.84$
$= 3.5\text{Å}$

60. $\lambda = \frac{c}{V} = \frac{3 \times 10^8}{1 \times 10^6}$

$$= 3 \times 10^2$$
$$= 300\,\text{m}$$

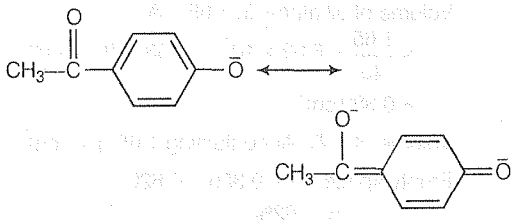
Chemistry

1. 1-methyul butanamine,



has one chiral carbon so, it can exist in enantiomeric forms.

2. In option (c) The bond order of C—N bond is exactly 1. All bonds has bond order greater than one.

3. 

Compound *A* is more acidic than *B* because of the delocalisation of the charge in its conjugate base due to resonance.

4. Lindlar's catalyst gives *cis*-hydrogenation product.

5. $CH_3CH_2COOK \xrightarrow{\text{Electrolysis}} \underset{\text{I}}{CH_3CH_2COO^{\bullet}}$

$\longrightarrow \underset{\text{II}}{CH_3^{\bullet}CH_2}$

2 II $\longrightarrow$ Butane; I + II $\longrightarrow$ ethyl propanoate

II $\xrightarrow{\text{disproportionation}}$ ethene + ethane.

6. $Ca(HCO_3)_2(s) \longrightarrow CaO(s) + CO_2(g) + H_2O(g)$

Total pressure is due to $CO_2(g)$ one $H_2O(g)$ molar ratio being equal.

Thus, $p_{CO_2} = p_{H_2O}$

$p_{CO_2} = p_{H_2O} = 0.06$ bar

$K_p = p_{CO_2} \times p_{H_2O}$

$= 0.06 \times 0.06$

$= 0.0036$

7. The state is thermodynamically unstable and tends to freeze into ice spontaneously.

8. (I) $CH_4(g) \longrightarrow C(g) + 4H(g)$;

$\Delta H = x$ for four C—H bonds.

$\therefore$ BE of (C—H) bond $= \frac{x_1}{4}$

(II) $C_2H_6(g) \longrightarrow 2C(g) + 6H(g)$

$\Delta H = x_2 = (BE)_{C-C} + 6(BE)_{C-H}$

$x_2 = BE_{C-C} + 6 \times \frac{x_1}{4}$

$(BE)_{C-C} = x_2 - 1.5\, x_1$

9. $C(s) + O_2(g) \longrightarrow CO_2(g)$

$\Delta H_f^{\circ}(CO_2) = -95$ kcal mol^{-1}

$= -95$ kcal/12g of carbon

Thus, carbon required for 1000 kcal of heat

$= \frac{12 \times 1000}{95}$

$= 126.3$ g

10. $x_1 = \sqrt{K_a}/C_1$ or $x_2 = \sqrt{K_a}/C_2$

$\frac{x_2}{x_1} = \sqrt{\frac{C_1}{C_2}}$ or $x_2 = x_1\sqrt{\frac{C_1}{C_2}} = 1 \times \frac{1}{2} = 0.5\%$

11. Aspirin is a weak acid = 0.09×2 g/100 mL

$= 1.8\, gL^{-1}$

$\frac{1.8}{180}$ mol $L^{-1} = 0.01$ M

pH (weak acid) $= \frac{1}{2}[pK_a - \log C] = \frac{1}{2}(2 + 2) = 2$

12. $\begin{vmatrix} O & F \\ S & Cl \\ Se & Br \\ & I \end{vmatrix}$ Thus, $F < O$, $F^- < O^{2-}$; $I > Br > F$,

$I^- > Br^- > F^-$; $Se > O$, $Se^{2-} > O^{2-}$; $I > Se$, $I^{-1} > Se^{2-}$

Therefore, the order is $I^- > Se^{2-} > Br^- > O^{2-} > F^-$

13. $Ti^{3+} + 2e^- \longrightarrow Ti^+$ (more stable); Ti^{3+} is an oxidising agent. (correct) $Ga^+ \xrightarrow{-2e^-} Ga^{3+}$ (more stable); Ga^+ is a reducing agent. (Correct) $Pb^{4+} + 2e^- \rightarrow Pb^{2+}$ (more stable) Pb^{4+} is an oxidising agent (correct)

$As^{5+} + 2e^- \longrightarrow As^{3+}$ (less stable); Thus, As^{5+} cannot be reduced. As^{5+} salts are not oxidising agent.

14. $Mg + H_2O \xrightarrow{\Delta} Mg(OH)_2 + H_2$; other are for H_2O_2

15. $Li_2CO_3 \longrightarrow Li_2O + CO_2 \uparrow$

$Na_2CO_3 \cdot 10H_2O \longrightarrow Na_2CO_3 + 10H_2O \uparrow$

16. Ozone protects the inhabitants of our planet from injurious radiation. It also maintains an equilibrium between the concentrations of O_2 and O_3.

17. $MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$ Step I

$MnO_4^{2-} \xrightarrow{\text{Electrolytic oxidation}} MnO_4^-$ Step II

18. Transition metals form a large number of complex compounds due to the comparatively smaller sizes of the metal ions, their high ionic charges and the availability of *d*-orbitals for bond formation.

(a) $K_2[Pt\,Cl_6] \rightleftharpoons 2K^+ + [Pt\,Cl_6]^{2-}$ (3 ions)

(b) $[Pt(NH_3)_2Cl_4]$ (No ions)

(c) $Pt(NH_3)_3Cl_3]Cl \rightleftharpoons [Pt(NH_3)_3Cl_3] + Cl^-$ (two ions)

(d) $[Pt(NH_3)_5Cl]Cl_3 \rightleftharpoons [Pt(NH_3)_5Cl] + 3Cl^-$

(4 ions), It has maximum electrolytic conductance.

20. Coordination no. – 6

en is bidentate ligand.

21. $u = \sqrt{\frac{T}{M}}$ or $\frac{u(H_2)}{u(O_2)} = \sqrt{\frac{50}{2} \times \frac{32}{800}} = 1$

22. All the given statements are correct.

23. $\nu = \frac{1}{\lambda}$

$10 cm^{-1} = \frac{1}{\lambda}$ or $\lambda = \frac{1}{10}$ cm = 0.1 cm = 0.001 m

$E = \frac{hc}{\lambda} = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{0.001} = 19.878 \times 10^{-23}$

$\approx 2.0 \times 10^{-22}$ J/atom $= 12.04 \times 10$ J/mol

$= 12.04 \times 10^{-2}$ kJ $mol^{-1} = 28.6 \times 10^{-3}$ kcal mol^{-1}

24. $r_n = \frac{n^2 a_0}{Z}$

$r_1(H) = \frac{a_0}{Z} = a_0 = 0.53$ Å

$r_1(Li^{2+}) = \frac{a_0}{3} = \frac{0.53}{3} = 0.17$Å

25. $Cr^{3+} + \overset{+7}{MnO_4^-} \longrightarrow Mn^{2+} + \frac{1}{2}\overset{+6}{Cr_2O_7^-}$

Reduction

Oxidation

Equivalents of $Cr^{3+} = 3 \times$ moles of Cr^{3+}

Equivalents of $MnO_4^- = 5 \times$ moles of MnO_4^-

Amount of $Cr^{3+} = 0.125 \times V$ millimol

$= 0.125 \times V \times 3$ millequiv.

Amount of $MnO_4^- = 0.200 \times 12.00 \times 5$ milliequiv

$\therefore \quad 0.125 \times V \times 3 = 0.200 \times 12.00 \times 5$

$V = 32.0$ mL

26. $H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$

1 mol 0.5 mol 1 mol

$\frac{10}{2} = 5$ mol $\frac{64}{32} = 2$ mol 4 mol

Because oxygen is the limiting reagent, hence 4 moles of H_2O formed.

charge (p) hence p-type semiconductor is formed.

28. Volume of one atom

$= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times (1.54 \times 10^{-8})^3$ cm^3

$= 1.53 \times 10^{-23}$ cm^3

Volume of all atoms in 1.65 g Ar

$= \frac{1.65}{40} \times 6.02 \times 10^{23} \times 1.53 \times 10^{-23}$ cm^3

$= 0.380\,cm^3$

Volume of solid Ar containing 1.65 g = $1\,cm^3$

Empty space = 1 – 0.380 = 0.620

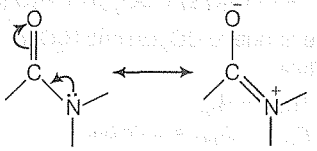
% = 62%

29. Chain branching always occur during olefenic polymerisation due to abstraction of some H-radical from the growing polymer chain.

30. Cellulose is a natural polymer of D–glucose and it has not yet been synthesised in laboratory or industry.

31. Acetal form of carbohydrates are known as glycoside.

32. —CHO or $>C=O$ is reduced to alcohol group giving alditol.

33. 

This resonance restricts the rotation around C—N bond.

34. Aspirin belongs to the class of non-narcotic analgesics.

35. NH_3 is more basic than H_2O, therefore, NH_2^- is a stronger base than OH^-.

Thus, the decreasing order of basic strength is $NH_2^- > OH^- > NH_3 > H_2O$

36. $CH_3CHO \xrightarrow[\text{aldol condensation}]{\text{Dil NaOH}} \underset{(A)}{CH_3CHOHCH_2CHO}$ 3-hydroxy butanal

$\xrightarrow{\Delta \text{ dehydration}} \underset{(B)}{CH_3CH=CHCHO}$ crotonaldehyde $\xrightarrow[\text{hydrogenation}]{Ni/NH_2}$

$CH_3CH_2CH_2CHO \xrightarrow{Ni/H_2} CH_3CH_2CH_2CH_2OH$

1-butanal (C) butan-1-ol (D)

37. (i) $C_6H_5COOH + NaHCO_3 \longrightarrow \underset{\text{Benzoic acid}}{C_6H_5COONa} + CO_2 + H_2O$

$C_6H_5COOC_2H_5 \xrightarrow{NaHCO_3 \text{ solution}} \text{no reaction}$

(ii) $C_6H_5COOH + NaOH + I_2 \longrightarrow \text{no reaction}$

$C_6H_5COOC_2H_5 + NaOH \xrightarrow{\text{Boil}} \underset{\text{sod. benzoate}}{C_6H_5COONa} + CH_3CH_2OH$ (ethanol)

$CH_3CH_2OH + 4I_2 + 6NaOH \xrightarrow{\Delta} HCOONa + \underset{\text{iodoform}}{CHI_3} + \underset{\text{(yellow ppt.)}}{5NaI} + 5H_2O$

38. More the number of electron donating groups *i.e.*, CH_3 at *o*–and *p*-position wrt Cl atom, less reactive is the compound, therefore, correct arrangement is III < II < I.

39. $KMnO_4$ will oxidise initially formed aldehydes to carboxylic acids. Remaining all the three reagents can be used to oxidise primary alcohols to aldehydes.

40. Chlorobenzene does not undergo hydrolysis on treatment with *aq* · NaOH at 298 K. All the remaining three reactions will give phenol.

41. $\underset{\text{salt}}{CuSO_4} + H_2S \longrightarrow \underset{\text{black ppt}}{CuS} + H_2SO_4;$

$CuS + 2HNO_3 \longrightarrow \underset{\text{blue solution}}{Cu(NO_3)_2} + H_2S;$

$Cu(NO_3)_2 + 4NH_3 \longrightarrow \underset{\text{deep blue solution}}{[Cu(NH_3)_4]^{2+}} + 2NO_3^-$

42. H_3PO_4 has three–OH groups *i.e.*, has three ionisable H–atoms and hence forms three series of salts.

43. All interhalogens have weaker $X — X'$ bonds and not X—X bonds. Hence, option (a) is incorrect.

44. The stability of lyophilic colloids is both due to same charge and solvation.

45. Hardening of leather in tanning industry is based on mutual coagulation.

46. Haematite (Fe_2O_3) ; Fe = + 3

Magnetite ($Fe_3O_4 = FeO + Fe_2O_3$);

Fe = + 2 and + 3

47. Both Al_2O_3 and SiO_2 dissolve in NaOH as $NaAl(OH)_4$ and Na_2SiO_3 respectively.

48. Rate $= \frac{dx}{dt} = k[R_0]^0 = k$ or $k = \frac{dx}{dt} = \frac{\text{conc.}}{\text{time}}$

$= \frac{\text{mol L}^{-1}}{\text{s}} = \text{mol L}^{-1}\text{s}^{-1}.$

49. Collision theory is applicable to bimolecular reaction.

50. Rate constant in min^{-1} indicates that, the reaction is of 1st order. Hence, $k = \frac{2.303}{t}\log\frac{[R]]_0}{[R]}$

$4.5 \times 10^{-3}\ \text{min}^{-1} = \frac{2.303}{60\ \text{min}}\log\frac{1}{[R]}$

$\log [R] = -0.1172 = \bar{1}.8828$

or $[R]$ = antilog $\bar{1}.8828$

$[A] = 0.7635\ \text{mol L}^{-1}$; this is the concentration after 60 min or one hour.

51. Na_2CO_3 is thermally stable, no effect of heating.

52. NO is paramagnetic in nature as it has unpaired electron.

53. Number of hybrid orbitals $= \frac{1}{2}$ (no. of eloectrons in valence shell of atom + no. of monovalent atoms – charge no cation + charge on anion

Number of hybrid orbitals $= \frac{1}{2}(6 + 4 + 0 + 0) = 5$

Hence, $TeCl_4$ shows sp^3d hybridisation.

54. The solubility of a compound depends upon its hydration enthalpy. If hydration enthalpy exceeds the lattice enthalpy than it is soluble in water. For Ag_2SO_4, hydration enthalpy is lower than lattice enthalpy. So, it is insoluble in water.

55. $\Delta T_f = \frac{1000\,K_f w_2}{M_2 \times w_1} = \frac{1000 \times 5.12 \times 25.6}{M_2 \times 100} = 5.12$

$M_2 = \frac{1000 \times 5.12 \times 25.6}{5.12 \times 100} = 256\ \text{gmol}^{-1}$

But atomic mass of sulphur = 32 g mol^{-1}

If molecular formula is S_x then, $32x = 256$

$x = 8$

Hence, sulphur exists as S_8 in benzene.

56. $\Delta T_f / K_f$ is expressed in mol kg^{-1}

57. $p_{\text{total}} = p_A^\circ \cdot x_A + p_B^\circ \cdot x_B$

$550 = p_A^\circ \times \frac{1}{4} + p_B^\circ \times \frac{3}{4}$

$p_A^\circ + 3p_B^\circ = 2200$ ...(i)

When 1 mole of *y* is further added to the solution

$560 = p_A^\circ \times \frac{1}{5} + p_B^\circ \times \frac{4}{5}$

$p_A^\circ + 4p_B^\circ = 2800$ ...(ii)

On subtraction, (ii) – (i)

$p_B^\circ = 2800 - 200 = 600$

On putting the value of p_B° in Eq. (i)

$p_A^\circ + 3 \times 600 = 220$

$p_A^\circ = 2200 - 1800 = 400$

$p_{A_0} = 2200 - 1800 = 400$

58. $2MnO_4^- + 3Mn^{2+} + 2H_2O \longrightarrow 5MnO_2 + 4H^+$; $E° = 0.47$ V

Thus, cell reaction in which Mn^{2+} on reaction with MnO_4^- forms MnO_2 in acidic medium.

59. $2H_2 + O_2 \longrightarrow 2H_2O$

Total electrons involved = 4

$E° = 1.23$ V

60. $Ag^+ + e^- \longrightarrow Ag$

$Cu^{2+} + 2e^- \longrightarrow Cu$

$Al^{3+} + 3e^- \longrightarrow Al$

Thus, number of faradays required by 1 mol each of Ag^+, Cu^{2+} and Al^{3+} = 1 : 2 : 3

Biology

1. Human heart is myogenic. Myogenic heart has contraction initiated by a special node of modified heart muscle called Sino-Atrial node (SA node). This is reason that even if the nerve supply of the myogenic heart (present in vertebrate) is cut off or even removed from the body. It continues to heast beat.

In neurogenic heart, contraction is initiated by nerve ganglion situated in the vicinity of heart. *e.g.,* Invertebrate like arthropods (cockroach).

2. The thymine and the sugar deoxyribose are incorporated into DNA, not in RNA. Adenine, cytosine and guanine are incorporated into both RNA and DNA. Ribose sugar and the base uracil are specific to all the forms of RNA.

3. $1 \xrightarrow{2} 2 \xrightarrow{2} 4 \xrightarrow{3} 8 \xrightarrow{4} 16 \xrightarrow{5} 5$

$\downarrow 5$

$32 \xrightarrow{6} 64 \xrightarrow{7} 128$

$\downarrow 2$

256

It can be done with a simple formula

$(2)^n$, where n is the number of mitotic division

$(2)^n = 256$

$(2)^8 = 256 (2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 256)$

So, 8 mitotic division.

4. Jacob and Monod (1961) observed that genetic material in prokaryotes has some regulated units called operons; operon is consists of operator gene, promotor gene, regulator gene one or more structural gene, a repressor and an inducers.

5. The *r*-RNA present in a ribosomes are synthesized in the nucleolus from their own DNA.

6. Alzheimer's disease, named after the German neurologist Alois Alzheimer (1864-1915), is a degenerative brain disease characterised by memory loss, confusion, restlessness, speech disturbance erosion of personality, judgement, and in ability to perform the functions of daily living. It mainy affect individual over age of 65.

Amyloid β-protein is a typical sign of Alzheimer's disease.

7. Linkage is the tendency for alleles of different genes to be passed together from one generation to the next. Only genes situated on the same chromosome can show linkage. Gene on non-homologous chromosome are unlinked. They always show linkage.

William Bateson, ER Saunders and RC Pennett (1905) Working with *Lathyrus odoratus* (sweet pea) were the first to discover linkage, an exception to the law of independent assortment.

8. Uricotelism means uric acid is present in excretion. This type of excretion is present in organism which develop in an enclosed egg or, which withstand with a very dry terrestrial environment as adult organism. uric acid is discharged as a solid pallet or as a thick paste. It is most commonly found in birds, terrestrial reptiles, insects, gastropods and in some molluscs etc.

9. Karyotaxonomy is based upon nucleus and band on chromosomes.

10. Paroxysm is the actual attack of malaria, which initially begins after a few earlist erythrocytic cycles but it is, then repeated after every cycle. Obviously paroxysm result due to sufficient accumulation of haemozoin and other toxins in blood.

11. Tetracyclin, neomycin and streptomycin are aminolglycosides and act on Gram negative bacteria (having no cell wall) where as β-lactum antibiotics (amoxyllin, penicillin) acts on Gram positive bacteria having cell wall.

12. The characteristic feature of amniota is the development of amnion and other foetal membrances during development. Amnion and other foetal membranes are developed in reptiles and mammals.

13. Berry type of simple succulent fruits the pericarp divided into three layers-a thin delicate outer epicarp, a soff middle mesocarp and an inner layer known as endocarp. Both endocarp and mesocarp are fleshy. The slippery oval, orange coloured seeds attached by stalks to the placenta, *e.g.,* tomato, brinjal.

14. Interfascicular cambium is a secondary meristem which originates from parenchymatous cell through differentiation fascicular cambuim on the other hand is primary in nature as it origintes form the embryonal tissue.

15. When photon of light energy falls on chlorophyll molecule, one of the electron pairs form ground or singlet state passes into higher energy level called excited singlet state.

16. Water absorption is done more efficiently in well aerated soil. Any deficiency of O_2 stops the respiration of roots and causes accumulation of CO_2 thus, the protoplasm become viscous and permeability of plasma membrane decreses. Due to all these factors the rate of water absorption is reduced. This is the reason for death of planty in flooded area.

17. $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

$$RQ = \frac{\text{Value of } CO_2}{\text{Volume of } O_2} = \frac{6}{6} = 1$$

18. No. of bones of face is 14. *These are following*

Nasal	2
Maxillae	2
Zygomatic	2
Mandible	1
Lacrimal	2
Palatine	2
Inferior chochae	2
Vomer	1
Total	14

19. Though mutation provides the source of variation, the diversity in living beings is due to natural selection of variations and consequent evolutionary change overs long periods of time.

20. Gasohol programme of USA uses mixture of alcohol (ethanol), 10-15% and petrol (85-90%).

In Brazil alcohol is obtained from sugar cane, while in USA, its source is maize.

21. Pivot joint is also known as rotatoria and helps in turning movement. One bone is fixed and second articulate.

Example Atlas and axial of skull rotate with axis vertebra also known as attan to axial joint.

22. **Differential centrifugation** It is a mechanical separation of individual subcellular component from homogenate in centrifuge at different low speeds large/heavy/denser particles settle down first at lower speeds while the lighter/smaller/less denses particles do so at higher speeds in centrifuge.

23. No hormones is formed by lymph node.

Lymph is fluid filterated at the capillaries level.

Antigen is external bodies entered into the body.

Lymph (nodes) glands form antibodies.

24. 'Genera plantarum' a monumental work, was written by Bentham and Hooker. They have provided an elabrote keys for easy identification of 202 natural orders and genera.

Engler and Prantal wrote *Die naturlechen pflanzen familien.*

The book "The families of flowering plants" was written by John Hutchinson.

25. Choanocytes also called collar cell are found in sponges and proterospongia. It is a choanoflagellate which is a connecting link between Protozoa and Porifera.

26. Albinism an autosomal recessive mutation which is occured due to deficiency of tyrosinase deficiency. The enzyme tyrosinage normally converts the amino acid tyrosine to melanin through an intermediate product DOPA.

27. $IQ = \frac{\text{Mental age}}{\text{Actual age}} \times 100$

This formula works fairly well for children but not for adults.

Different levels of IQ are

Idiot	O-24	Imbecile	25-49
Moron	50-69	Dull	70-79
Ordinary	80-89	Average	90-109
Superior	110-119		
Most superior	120-139		
Geniues	140 or more		

28. The water is need tightly around the soil particles due to forces. Hygroscopic water can not be easily removed by the plants. This type of water in soil is not available to plants.

29. In Cyperaceae, one microspore mother cell produces only one pollen grain (microspore) as the three microspores degenerate. Thus, for producing 100 seeds 100 division 100 microspone mother cell and 100 divisions in 100 megaspore mother cells will take in place. Thus, in all 200 meiotic divisions are required to produce 100 seeds.

31. The vascular tissue (*i.e.*, xylem and phloem) are completely asent water and nutrients enter the cell by diffusion. Sporangium produces spores by meiosis. The zygote develops to form an embryo which produces the sporophytes.

32. Drones are male honey bees. They are developed from unfertilised female eggs, This phenomenon is called arrhenotoky.

Parthenogenesis means development of unfertilised eggs or haploid eggs into young ones as development of drones female bee develops from diploid fertilised ovum.

33. The outermost layer in fruits derived from inferior ovary is always thalamus. Thalamus forms a hollow cup-like structure to enclose entire portion of ovary in epigynous flowers.

34. ATP synthesis is endothermic (endergonic) oxidative process that occurs on the inner membrane including the cristae of mitochondria in eukaryotes and innerside of cell membranes mesosome is prokaryotes.

35. Some enzymes are normally present in cell but their synthesis is ceased when the concentration of their and product become high. Such enzymes are called repressible enzymes, whereas the end product is called corepressor. A regulator gene produces the aporepressor, while unites with corepressor to form a functional repressor molecule. This repressor molecule inhibit *m*RNA synthesis by all genes specifying enzymes.

36. At the base of ligule there is present a sheath of elongated cells called glossopodium (secretory). Ligule is secretes as well as protective It secretes water/mucilage to keep growing point of stem and young leaves moist. It also protect young leaves.

37. The main criteria for classifying organism into five kingdoms are complexity of cells structure, body organisation, the mode of nutrition. Life style and phylogenetic relationship.

38. In some plants roots arise from cower nodes of stem and enter the soil to provide extra support. They behave as ropes of a tent. Such roots are called slit or brace roots, e.g. pandanus.

39. According to concept/hypothesis of stele, proposed by Van Tiegham an Doulrt the primary body of root and stem are anatomically same, *i.e.*, consist of a central stele surrounded by cortex. The stele was originated in **first vascular plant** (pteridophytes) and consist of vascular tissue, pericycle and pith. Pericycle surround the stele on outer side.

41. Protein infectious protein (prions) are also known as slow viruses. A prion doesnot replicate itself, it causes another protein to change its shape and thereby became a prion. Dr Carleton Gajdusek and Stanley Prusines did most of work on there infections proteins and was awarded Noble Prize in 1976 and in 1977 respectively.

42. Agar-agar is a jelly like substance. It is a non-nitrogenous carbohydrate consisting of two polysaccharides namely agarose and agaropectin. It is obtained from several red algae. *e.g., Gracillaria, Gelidium, Gigartinia.*

It was discovered by Lady Hesse and used by Robert Koch to solidify culture medium.

43. Life cycle of *Funaria* is not completed without water because antherozoids swim across the film of water and antherozoids fuse with the single egg to produce zygote (2*n*).

44. The promoters in bacterial and viral genes usually contain a consenus sequence of 5′ TATAAT-3′ forming RNA polymerase binding site or the pribnow box, after it discover. Pribnow boxllies within the promotor about 10 base pair before the staring point of transcription.

45. In man the left lungs has two lobes, superior lobe and inferior lobe, the right lungs has three lobes superior lobes, middle and inferior lobes.

46. The matrix of mitochonaria and stroma of chloroplast contain a circular double stranded molecule very similar to bacterial chromosome in shape.

47. If an *Amoeba* is placed in salt water, its contractile vacuole will disappear because endosmosis will not occur due to isotonic condition.

48. Genetically engineered bacterium *Pseudomonas putida* is used for scavenging of 0:1 spills by digesting hydrocarbons of crude oil. AM Chakarabarty in 1947 created and patented superbung, which had on increased capability of hydrocarbon degradation.

49. The follicular cells of corona radiata covering the egg are held together by an adhesive substance called hyaluronic acid. The enzyme hyaluronidase released by acrosome dissolves the cement facilitating the penetration of the sperm.

50. (a) Hirudinea — Hirudo and *Hirudinaria*
(b) Oligochaeta — *Pheretima lubricous*
(c) Namatoda — *Ascaris* (roundworm)
(d) Polychaets — *Nereis, Aphrodeta*

51. *Ramapithecus* was the most primitive hominid; the fossils were from Africa and Asia, belonging to late. Miocene and Pilocene. Only jaws, teeth and fragments of the skull have been found.

The extinct apes, genus *Ramapithecus*, have features suggesting that they were beginning of the linkage leading to humans.

52. Leprosy is also known as Hansen's disease. ***Dasypus novemcinctns*** primitive mammal can also be infected with ***Mycobacterium leprae***.

The bacterium mainly infects on the cooler tissues, the foot pads.

53. Primary respiratory substrate is carbohydrate, secondory respiratory substrate is fat, tertiary respiratary substrate is protein.

54. Nictitating membrane of man also called as ' place semilunars' is is vestigial organ present in the nasal corner of eye.

55. In scalariform conjugation, two filament come to lie parallal and depressed. Their opposite cells develop conjugation fuse. The conjugation these between the two filaments look like a ladder.

56. Increase in the temperature of the air decrease the humidity of the air and therefore are water is vapourised and lost from transpiring surface. When soil is moist means availability of water are sufficient, stomata will open thus rate of transpiration increase.

57. *Utricularia* a carnivorous plant, catches small aquatic animals (insect). These insects die in bladder and are decomposed in due course of time. After decomposition the nitrogenons substances are absorbed through the hair of bladder.

58. In photosystem-II. Some electron carriers are located in grana of thyllakoids. Photochrome has a densers of special chlorophyll-*a* molecule called P_{680}, which absorb light energy gets excited and transfer its electron to acceptor molecule phaeophytin.

Now reducing phaephytin donote electron to donw stream component of ETS, *i.e.*, quinone cytochrome-*b*, cytochrome-*f* complex, plastocyanin.

59. The sponges closely resemble to colonial choanoflagellates belonging to the phylum Protozoa. Both posses colloured and amoeboid cells.

60. Sella trucica or 'Turkish saddle' is a depression in the floor of the memmalian skull in the sphenoid (Basi sphenoid) bone in which the pituitary body is lodged.

61. Epiphytic roots develop in some orchids, which grow as epiphytes upon theru or brancles of trees. They absorb moisture with the help of special sponges like tissue called velamen.

62. Intra-ovarian fertilisation is used when the stigma create barrier for germination of pollens of other species. The pollens are then put directly into ovary wall giving small cut and hormonal stimulus.

63. Haemocyanin is not present in the human being. Blood and lymph both carries CO_2 (blood also carry O_2) and unused product.

64. It is categorised as an ecosystem. The great barrier reef is very special place. It in not one continuous reef, about made up of over 2900 reefs and about 900 islands. This is the largest reef structure and marine partin the world.

65. Foreign/passeger DNA is a fragment of DNA molecule which is enzymatically isolated and cloned. The gene is identified on a genome and pulled out from it eithual before or after cloning. The cloning foreign DNA fregment expresses normally as in parental cell.

66. SO_2 does the most wide spread damage to lower plants. Since mosses lack roots, surface absorption of rainfall is the only means of obtaining vital nutrients which are dissolved in rain water. Many mosses lack pretective surfaces that can selectively block out elements inclulding pollutants that are dissolved in rain water.

67. Milk gland also called as mammory gland is found in all mammals.

68. Cybrids are cytoplasmic hybrids in which genome of only one parents survive.

69. Because of excess of Ca^{2+} will increase the force of contraction, which finally will lead to the sparm and acystolic arrest of the heart.

70. Due to the absence of cell wall, mycoplasm are highly elastic and readily change the shape, hence the mycoplasmas are irregular and quite variable in shape. This nature is called pleomorphism.

71. Because of the association with tools, this early human wax called *Homo habilis* meaning "handy man". He appeared in Africa about 1.5 million year age.

72. A matured grafian follicle posseses three layers of cells namely, Theca extrna, theca interna and granulosa. The cells of the Ica interna are primary source of oestrogen.

73. Most rain water has a pH of 5.6 to 5.8. Simply due to the pressence of carboric acid (H_2CO_3). The latter is formed from dissolved CO_2 gas and H_2O. The source of the CO_2 is the atmosphere, which presently contains about 380 ppm CO_2. Value of pH bellow 5.6 or so are considered "acid rain" value above are "basic rain".

74. Helio mens sun : so heliophytes is a plant that live in full exposure to sunlight.

75. The chordae tendineae or heart strings are cord like tendons that connect the papillary muscles to the tricuspid value and the mitral value is the heart. The chordae tendinons prevents the flaps from being everted upto the right atrium, these cord like tendons hold in position other flaps such as bicuspid or mitral value.

76. Pheromones are the secretion of small amount of chemical substances landing to specific physiological or behaviour response in other members of the same species. Pheram one also used to induce mating.

77. During breeding season, glandular cells of citellus become very active and secrete a slimy substance that forms a girdle like covering around the clitellum. In air, this gradually dries and harden to form a tough but elastic, ring-like egg capsule or cocoon.

78. Diaphragm a muscular structure, which divide abdomen and thorax, is commonly found in only mammals (kangaroo) except- crocodile.

79. A climax community is a stable community of a diverse number of species. The repetitive replacements of serial community's eventually leads to a establishment known as a climax community.

80. Sporozoites are spindle or sickle-shaped and uninucleated organism cacapabc of wriggling movement.

Each has a covering form but elastic pellicle containing longitudinal contractile microtubules.

English

1. **Indigenous** means belonging to a particular place rather than from somewhere else.

2. **Frail** means physically weak and thin.

3. **Within** means inside the range or limits of something; before a particular period of time has passed. **Beyond** means later than a particular time.

4. **Brazen** means open and without shame.

5. **Adversity** means a difficult or unpleasant situation.

11. Use 'have been' in place of 'are'.

12. Use 'won't you' in place of 'isn't it'.

13. Remove 'a'.

14. Remove 'will'.

15. Use 'honesty' in place of 'honestness'.

16. **Filthy** means very dirty and unpleasant.

17. **Nostalgic** means homesick.

18. **Combat** means a fight.

19. **Subside** means to become calmer or quieter.

20. **Abscord** means to escape from a place that you are not allowed to leave.