ALIGARH MUSLIM UNIVERSITY

AMU Medical
2012 Sample Paper

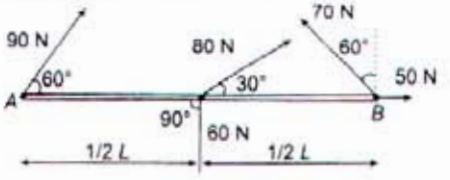
AMU

Medical Entrance Exam

Solved Paper 2012

Physics

1. The total torque about pivot A provided by the forces shown in the figure, for $L = 3.0$ m, is

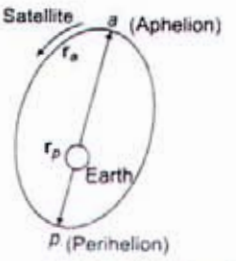


(a) 210 N-m (b) 140 N-m
(c) 95 N-m (d) 75 N-m

2. A wheel turning with angular speed of 30 rev/s is brought to rest with a constant acceleration. It turns 60 rev before it stops, the time that elapses before it stop, is
(a) 2 s (b) 4 s
(c) 5 s (d) 6 s

3. A rod of length L is composed of a uniform length $1/2\ L$ of wood whose mass is m_w and a uniform length $1/2\ L$ of brass whose mass is m_b. The moment of inertia I of the rod about an axis perpendicular to the rod and through its centre is equal to
(a) $(m_w + m_b)L^2 / 12$
(b) $(m_w + m_b)L^2 / 6$
(c) $(m_w + m_b)L^2 / 3$
(d) $(m_w + m_b)L^2 / 2$

4. Consider a satellite orbiting the earth as shown in the figure below. Let L_a and L_p represent the angular momentum of the satellite about the earth when at aphelion and perihelion respectively. Consider the following relations.



(i) $\mathbf{L}_a = \mathbf{L}_p$ (ii) $\mathbf{L}_a = -\mathbf{L}_p$
(iii) $\mathbf{r}_a \times \mathbf{L}_a = \mathbf{r}_p \times \mathbf{L}_p$
Which of the above relation(s) is/are true?
(a) (i) only (b) (ii) only
(c) (iii) only (d) (i) and (iii)

5. A body is projected vertically upward from the surface of the earth with a velocity equal to half the escape velocity. If R is radius of the earth, the maximum height attained by the body is
(a) $R/6$ (b) $R/3$
(c) $2R/3$ (d) R

6. The imaginary angular velocity of the earth for which the effective acceleration due to gravity at the equator shall be zero is equal to
(a) 1.25×10^{-3} rad/s (b) 2.50×10^{-3} rad/s
(c) 3.75×10^{-3} rad/s (d) 5.0×10^{-3} rad/s
(Take $g = 10$ m/s^2 for the acceleration due to gravity if the earth were at rest and radius of earth equal to 6400 km.)

7. If an anisotropic solid has coefficients of linear expansion α_x, α_y and α_z for three mutually perpendicular directions in the solid, its coefficient of volume expansion will be

(a) $(\alpha_x \alpha_y \alpha_z)^{1/3}$

(b) $\alpha_x + \alpha_y + \alpha_z$

(c) $(\alpha_x^2 + \alpha_y^2 + \alpha_z^2)^{1/2}$

(d) $(\sqrt{\alpha_x} + \sqrt{\alpha_y} + \sqrt{\alpha_z})^2$

8. The terminal speed attained by an aluminium sphere of radius 1 mm falling through water at 20°C will be close to

(a) 9.2 m/s (b) 6.9 m/s

(c) 4.6 m/s (d) 2.3 m/s

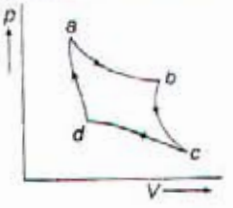
(Assume laminar flow, specific gravity of Al = 2.7 and $\eta_{water} = 8 \times 10^{-4}$ Pl.)

9. 100 mol of an ideal gas is heated from 10 to 20°C keeping its (a) volume constant (b) pressure constant. Let ΔU_a and ΔU_b denote the change in the internal energy of the gas due to process (a) and (b) respectively. Then which of the following shall be true?

(a) $\Delta U_a = \Delta U_b$ (b) $\Delta U_a > \Delta U_b$

(c) $\Delta U_a < \Delta U_b$ (d) $\Delta U_a = \Delta U_b = 0$

10. Refer to the Carnot cycle of an ideal gas shown in the figure. Let $W_{a\to b}, W_{b\to c}, W_{c\to d}$ and $W_{d\to a}$ represent the work done by the system during the processes $a \to b$, $b \to c$, $c \to d$ and $d \to a$ respectively. Consider the following relations



(i) $W_{a\to b} + W_{b\to c} + W_{c\to d} + W_{d\to a} > 0$

(ii) $W_{a\to b} + W_{b\to c} + W_{c\to d} + W_{d\to a} < 0$

(iii) $W_{a\to b} + W_{c\to d} > 0$

(iv) $W_{b\to c} + W_{d\to a} = 0$

Which of the above relation(s) is/are true?

(a) (i) and (iii) (b) (iii) and (iv)

(c) (i) (iii) and (iv) (d) (ii), (iii) and (iv)

11. An ideal gas undergoes a reversible isothermal expansion from a state i to f. The change in entropy $\Delta S(i \to f)$ is

(a) 0

(b) > 0

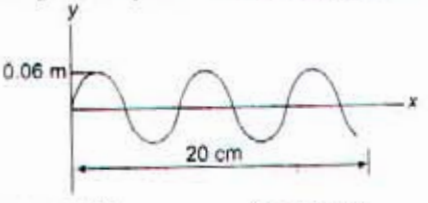
(c) < 0

(d) not defined for the process

12. Water flows in a streamlined manner through a capillary tube of radius a the pressure difference being p and the rate of flow Q. If the radius is reduced to $a/2$ and the pressure increased to $2p$. The rate of flow becomes

(a) $4Q$ (b) Q (c) $\frac{Q}{4}$ (d) $\frac{Q}{8}$

13. Figure given shows a sinusoidal wave on a string. If the frequency of the wave is 150 Hz and the mass per unit length of the string is 0.2 g/m, the power transmitted by the wave is



(a) 2.34 W (b) 3.84 W

(c) 4.80 W (d) 5.78 W

14. Two closed organ pipes sounded simultaneously given 5 beats per second between the fundamentals. If the shorter pipe is 1.10 m long, the length of the longer pipe is

(a) 1.22 m (b) 1.18 m (c) 1.14 m (d) 1.12 m

(Velocity of sound in air = 340 m/s.)

15. The electric field in a certain region is given by $\mathbf{E} = 5\mathbf{i} - 3\mathbf{j}$ kV/m. The potential difference $V_B - V_A$ between points A and B, having coordinates (4, 0, 3) m and (10, 3, 0) m respectively, is equal to

(a) 21 kV (b) – 21 kV (c) 39 kV (d) – 39 kV

16. A rod lies along the x-axis with one end at the origin and the other at $x \to \infty$. It carries a uniform charge λ C/m . The electric field at the point $x = -a$ on the axis will be

(a) $\mathbf{E} = \frac{\lambda}{4\pi\varepsilon_0 a}(-\mathbf{i})$ (b) $\mathbf{E} = \frac{\lambda}{4\pi\varepsilon_0 a}(\mathbf{i})$

(c) $\mathbf{E} = \frac{\lambda}{2\pi\varepsilon_0 a}(-\mathbf{i})$ (d) $\mathbf{E} = \frac{\lambda}{2\pi\varepsilon_0 a}(\mathbf{i})$

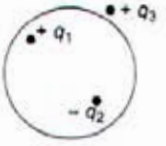
17. In a parallel-plate capacitor with plate area A and charge Q, the force on one plate because of the charge on the other is equal to

(a) $\frac{Q^2}{\varepsilon_0 A^2}$ (b) $\frac{Q^2}{2\varepsilon_0 A^2}$

(c) $\frac{Q^2}{\varepsilon_0 A}$ (d) $\frac{Q^2}{2\varepsilon_0 A}$

18. Two capacitors, 3 μF and 4 μF, are individually charged across a 6 V battery. After being disconnected from the battery, they are connected together with the negative plate of one attached to the positive plate of the other. What is the final total energy stored
(a) 1.26×10^{-4} J (b) 2.57×10^{-4} J
(c) 1.26×10^{-6} J (d) 2.57×10^{-6} J

19. The given figure shows a spherical Gaussian surface and a charge distribution. When calculating the flux of electric field through the Gaussian surface, the electric field will be due to

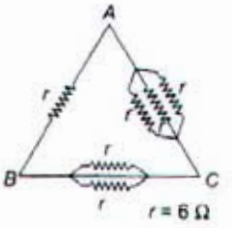


(a) + q_3 alone
(b) + q_1 and + q_3
(c) + q_1, + q_3 and – q_2
(d) + q_1 and – q_2

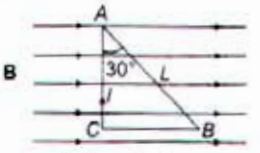
20. A voltmeter of resistance 280Ω reads the voltage across the terminals of an old dry cell to be 1.40 V, while a potentiometer reads its voltage equal to 1.55 V. To draw maximum power from the battery, the load resistance must have the value
(a) 60 Ω (b) 45 Ω
(c) 35 Ω (d) 30 Ω

21. The electron of a hydrogen atom revolves round the proton in a circular n^{th} orbit of radius $r_n = \varepsilon_0 n^2 h^2 / (\pi m e^2)$ with a speed $v_n = \dfrac{e^2}{2\varepsilon_0 nh}$
The current due to the circulating charge is proportional to
(a) e^2 (b) e^3
(c) e^5 (d) e^6

22. Six resistances each of value $r = 5$ Ω are connected between points A, B and C as shown in the figure. If R_1, R_2 and R_3 are the net resistances between A and B, between B and C and between A and C respectively, then $R_1 : R_2 : R_3$ will be equal to
(a) 6 : 3 : 2 (b) 1 : 2 : 3
(c) 5 : 4 : 3 (d) 4 : 3 : 2



23. Consider the inferences given below in respect of the following current loop of wire kept in a magnetic field **B**

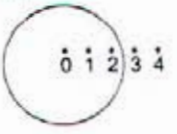


(i) The magnitude and direction of force on the element AC of the wire is $\dfrac{\sqrt{3}}{2} ILB$ directed into the page
(ii) The magnitude and direction of force on the element AB of the wire is $\dfrac{\sqrt{3}}{2} ILB$ directed into the page
(iii) The total force on the loop $ABCA$ is zero
Which of the above is/are not true?
(a) (i) and (ii) (b) (ii) only
(c) (i) and (iii) (d) (ii) and (iii)

24. The magnetic field in a certain region of space is given by $\mathbf{B} = 8.35 \times 10^{-2}\,\mathbf{i}$ T. A proton is shot into the field with velocity $\mathbf{v} = (2 \times 10^5\,\mathbf{i} + 4 \times 10^5\,\mathbf{j})$ m/s. The proton follows a helical path in the field. The distance moved by proton in the x-direction during the period of one revolution in the yz-plane will be
(a) 0.053 m (b) 0.136 m
(c) 0.157 m (d) 0.236 m
(Mass of proton = 1.67×10^{-27} kg)

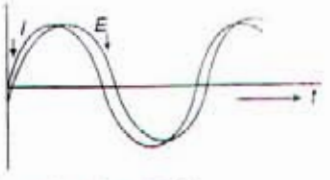
25. A planar coil having 12 turns carries 15 A current. The coil is oriented with respect to the uniform magnetic field $\mathbf{B} = 0.2\,\mathbf{i}$ T such that its directed area is $\mathbf{A} = 0.04\,\mathbf{i}$ m^2. The potential energy of the coil in the given orientation is
(a) 0 (b) + 0.72 J
(c) +1.44 J (d) – 1.44 J

26. The adjacent figure shows the cross-section of a long rod with its length perpendicular to the plane of the paper. It carries a constant current flowing along its length. B_1, B_2, B_3 and B_4 respectively represent the magnetic fields due to the current in the rod at points 1, 2, 3 and 4 lying at different separations from the centre O, as shown in the figure. Which of the following shall hold true?



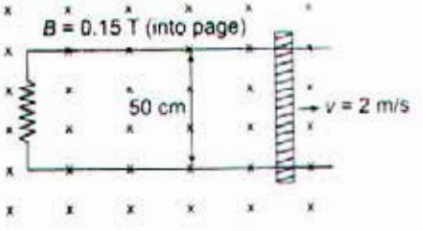
(a) $B_1 > B_2 \neq 0$ (b) $B_2 > B_3 \neq 0$
(c) $B_1 = B_2 = B_3 = 0$ (d) $B_3 > B_4 \neq 0$

27. When an AC source of emf $E = E_0 \sin(100\,t)$ is connected across a circuit, the phase difference between the emf E and the current I is observed to be $\pi/4$, as shown in the figure. If the circuit consists possibly only of R–C or R–L in series, which of the following combinations is possible?



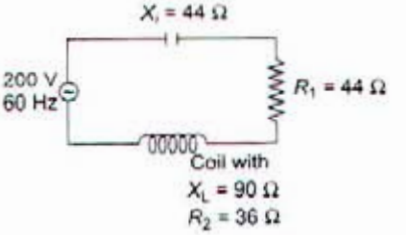
(a) $R = 1\ \text{k}\Omega$, $C = 10\ \mu\text{F}$
(b) $R = 1\ \text{k}\Omega$, $C = 1\ \mu\text{F}$
(c) $R = 1\ \text{k}\Omega$, $L = 10\ \text{H}$
(d) $R = 1\ \text{k}\Omega$, $L = 1\ \text{H}$

28. As shown in the figure, a metal rod makes contact with a partial circuit and completes the circuit. The circuit area is perpendicular to a magnetic field with $B = 0.15\ \text{T}$. If the resistance of the total circuit is $3\ \Omega$, the force needed to move the rod as indicated with a constant speed of 2 m/s will be equal to



(a) 3.75×10^{-3} N (b) 2.75×10^{-3} N
(c) 6.57×10^{-4} N (d) 4.36×10^{-4} N

29. As given in the figure, a series circuit connected across a 200 V, 60 Hz line consists of a capacitor of capacitive reactance $30\ \Omega$, a non-inductive resistor of $44\ \Omega$ and a coil of inductive reactance $90\ \Omega$ and resistance $36\ \Omega$. The power dissipated in the coil is



(a) 320 W (b) 176 W
(c) 144 W (d) 0

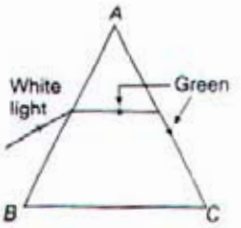
30. The wave function (in SI unit) for a light wave is given as
$\Psi(x,t) = 10^3 \sin \pi(3 \times 10^6 x - 9 \times 10^{14} t)$
The frequency of the wave is equal to
(a) 10^{14} Hz (b) 3.5×10^{14} Hz
(c) 3.5×10^{10} Hz (d) 2.5×10^{10} Hz

31. A short linear object of length L lies on the axis of a spherical mirror of focal length f at a distance u form the mirror. Its image has an axial length L' equal to

(a) $L\left[\frac{f}{u-f}\right]^{1/2}$ (b) $L\left[\frac{u+f}{f}\right]^{1/2}$
(c) $L\left[\frac{u-f}{f}\right]^{2}$ (d) $L\left[\frac{f}{u-f}\right]^{2}$

32. An object is placed at a distance of 10 cm from a co-axial combination of two lenses A and B in contact. The combination forms a real image three times the size of the object. If lens B is concave with a focal length of 30 cm. The nature and focal length of lens A is
(a) convex, 12 cm (b) concave, 12 cm
(c) convex, 6 cm (d) convex, 18 cm

33. White light is incident on face AB of a glass prism. The path of the green component is shown in the figure. If the green light is just totally internally reflected at face AC as shown, the light emerging form face AC will contain



(a) yellow, orange and red colours
(b) violet, indigo and blue colours
(c) all colours
(d) all colours except green

34. A parallel beam of monochromatic light is incident normally on narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of the incident beam. At the first minimum of the diffraction pattern, the phase difference between the rays coming from the two edges of the slit is
(a) zero (b) $\pi/2$
(c) π (d) 2π

35. The de-Broglie wavelength of an electron moving with a velocity 1.5×10^8 m/s is equal to that of a photon. The ratio of the kinetic energy of the electron to the energy of the photon is
(a) $\frac{1}{4}$ (b) $\frac{1}{2}$
(c) 2 (d) 4

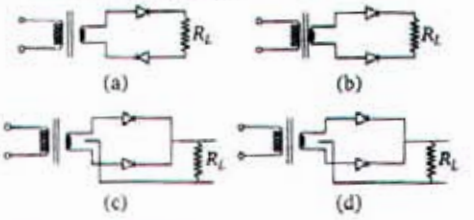
36. The threshold frequency for a certain photosensitive metal is v_0. When it is illuminated by light of frequency $v = 2v_0$, the maximum velocity of photoelectrons is v_0. What will be the maximum velocity of the photoelectron when the same metal is illuminated by light of frequency $v = 5v_0$?
(a) $\sqrt{2}\,v_0$ (b) $2v_0$ (c) $2\sqrt{2}\,v_0$ (d) $4v_0$

37. A nucleus of mass number 220, initially at rest, emits an α-particle. If the Q value of the reaction is 5.5 MeV, the energy of the emitted α-particle will be
(a) 4.8 MeV (b) 5.4 MeV
(c) 5.5 MeV (d) 6.8 MeV

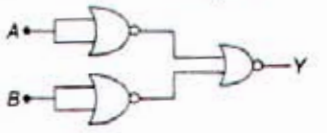
38. A radioactive substance emits n beta particles in the first 2 seconds and 0.5 n beta particles in the next 2 seconds. The mean life of the sample is
(a) 4 s (b) 2 s
(c) $\frac{2}{(\ln 2)}$ s (d) 2 (ln 2) s

39. Which of the following equations correctly represents the temperature variation of energy gap between the conduction and valence bands for Si?
(a) $E_g\,(T) = 0.70 - 2.23 \times 10^{-4}\ T$ eV
(b) $E_g\,(T) = 0.70 + 2.23 \times 10^{-4}\ T$ eV
(c) $E_g\,(T) = 1.10 - 3.60 \times 10^{-4}\ T$ eV
(d) $E_g\,(T) = 1.10 + 3.60 \times 10^{-4}\ T$ eV

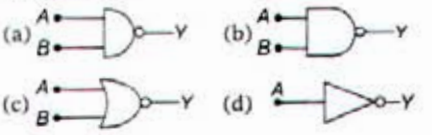
40. Which of the following is not a rectifier circuit?



41. The following network of gates



is equivalent to



42. A physical quantity X is given by

$$X = \frac{2k^3l^2}{m\sqrt{n}}$$

The percentage error in the measurements of k, l, m and n are 1%, 2%, 3% and 4% respectively. The value of X is uncertain by
(a) 8% (b) 10%
(c) 12% (d) None of these

43. A man runs at a speed of 4.0 m/s to overtake a standing bus. When he is 6.0 m behind the door (at $t = 0$), the bus moves forward and continues with a constant acceleration of 1.2 m/s^2. The man shall gain the door at time t equal to
(a) 5.2 s
(b) 4.3 s
(c) 2.3 s
(d) The man shall never gain the door

44. One end of a string of length 1.0 m is tied to a body of mass 0.5 kg. It is whirled in a vertical circle with angular frequency 4 rad/s. The tension in the string, when the body is at the lower most point of its motion, will be equal to (Take $g = 10\ m/s^2$)

(a) 3 N (b) 5 N
(c) 8 N (d) 13 N

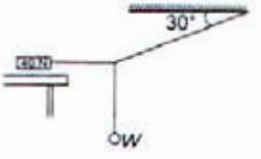
45. Let $\mathbf{r}_1(t) = 3t\,\mathbf{i} + 4t^2\,\mathbf{j}$ and $\mathbf{r}_2(t) = 4t^2\,\mathbf{i} + 3t\,\mathbf{j}$ represent the positions of particles 1 and 2, respectively, as function of time t, $\mathbf{r}_1(t)$ and $\mathbf{r}_2(t)$ are in metre and t in second. The relative speed of the two particles at the instant $t = 1$ s, will be

(a) 1 m/s (b) $3\sqrt{2}$ m/s
(c) $5\sqrt{2}$ m/s (d) $7\sqrt{2}$ m/s

46. A particle moves in a circular orbit of radius r under a central attractive force $F = -\frac{k}{r}$, k is constant. The time period of its motion shall be proportional to

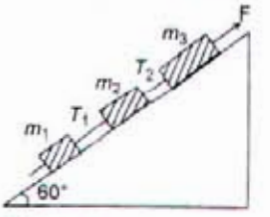
(a) $r^{1/2}$ (b) r
(c) $r^{3/2}$ (d) $r^{2/3}$

47. In the figure given, the system is in equilibrium. What is the maximum value that W can have if the friction force on the 40 N block cannot exceed 12.0 N?



(a) 3.45 N (b) 6.92 N
(c) 10. 35 N (d) 12. 32 N

48. Three blocks, of masses $m_1 = 2.0$, $m_2 = 4.0$ and $m_3 = 6.0$ kg are connected by strings on a frictionless inclined plane of 60°, as shown in the figure. A force $F = 120$ N is applied upward along the incline to the uppermost block, causing an upward movement of the blocks. The connecting cords are light. The values of tensions T_1 and T_2 in the cords are



(a) $T_1 = 20$N, $T_2 = 60$N
(b) $T_1 = 60$N, $T_2 = 60$N
(c) $T_1 = 30$N, $T_2 = 50$N
(d) $T_1 = 20$N, $T_2 = 100$N

49. A particle in a certain conservative force field has a potential energy given by $U = 20\,xy/z$. The force exerted on it is

(a) $(20y/z)\,\mathbf{i} + (20x/z)\,\mathbf{j} + (20xy/z^2)\,\mathbf{k}$
(b) $-(20y/z)\,\mathbf{i} - (20x/z)\,\mathbf{j} + (20xy/z^2)\,\mathbf{k}$
(c) $-(20y/z)\,\mathbf{i} + (20x/z)\,\mathbf{j} - (20xy/z^2)\,\mathbf{k}$
(d) $(20y/z)\,\mathbf{i} + (20x/z)\,\mathbf{j} - (20xy/z^2)\,\mathbf{k}$

50. A sphere P of mass m and velocity $\mathbf{vi}$ undergoes an oblique and perfectly elastic collision with an identical sphere Q initially at rest. The angle θ between the velocities of the spheres after the collision shall be

(a) 0 (b) 45°
(c) 90° (d) 180°

Chemistry

1. The E° values of the following reduction reactions are given;

$Fe^{3+}(aq) + e^- \longrightarrow Fe^{2+}(aq)$, $E^\circ = 0.771$ V

$Fe^{2+}(aq) + 2e^- \longrightarrow Fe(s)$, $E^\circ = -0.447$ V

What will be the free energy change for the reaction?

$$Fe^{3+}(aq) + 3e^- \longrightarrow Fe(s)$$

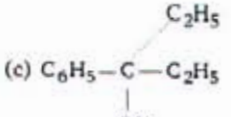
($1F = 96485\,C\ mol^{-1}$)

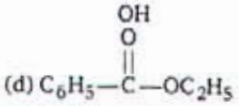
(a) $+18.51\ kJ\ mol^{-1}$ (b) $+11.87\ kJ\ mol^{-1}$
(c) $-8.10\ kJ\ mol^{-1}$ (d) $-10.41\ kJ\ mol^{-1}$

2. Which is the product of the following reaction?

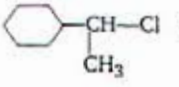
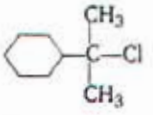
$$C_6H_5-\overset{\overset{O}{\|}}{C}-OCH_3 \xrightarrow[(ii)\ H^+/H_2O]{(i)\ C_2H_5MgBr\ (2\ mol)}]$$

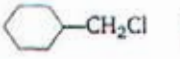
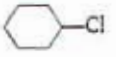
(a) $C_6H_5-CH_2-OH$
(b) $C_6H_5-\underset{\underset{OH}{|}}{CH}-C_2H_5$

(c) 

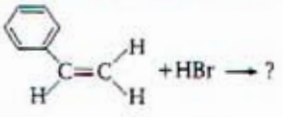
(d) 

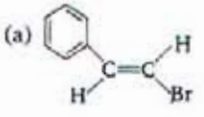
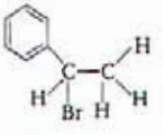
3. The acid which do not contain carboxylic acid group is
   (a) glutaric acid (b) picric acid
   (c) stearic acid (d) terephthalic acid
4. The aldol condensation reaction is given by
   (a) acetophenone
   (b) benzaldehyde
   (c) benzophenone
   (d) trichloroacetaldehyde
5. Which will undergo S_N2 reaction faster?

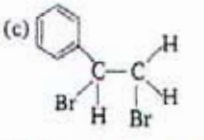
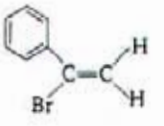
   (a)  (b) 

   (c)  (d) 

6. The main product of the reaction is

   (a)  (b) 

   (c)  (d) 

7. The gas that is adsorbed to a larger extent on charcoal is
   (a) H_2 (b) CO_2 (c) CO (d) NH_3
8. Consider two half-cells based on the reaction

   $$Ag^+(aq) + e^- \longrightarrow Ag(s)$$

   The left half-cell contains Ag^+ ions at unit concentration, and the right half-cell initially had the same concentration of Ag^+ ions, but just enough NaCl (aq) had been added to completely precipitate the Ag^+ (aq) as AgCl. If the emf of the cell is 0.29 V, the $\log_{10} K_{sp}$ would have been
   (a) 9.804 (b) – 9.804 (c) – 4.902 (d) 10.004
9. Consider the cell,

   $Pt | H_2(g, 1\text{ atm}) | H^+(aq, 1M) || Fe^{3+}(aq), Fe^{2+}(aq) | Pt(s)$

   Given that $E^\circ_{Fe^{3+}/Fe^{2+}} = 0.771$ V, the ratio of concentration of Fe^{2+} (aq) to Fe^{3+} (aq) is, when the cell potential is 0.830 V.
   (a) 0.101 (b) 0.924
   (c) 0.120 (d) None of these
10. If the rate constant of a reaction has the value $k = 1.63 \times 10^{-4} (\text{mol})^{-2} \text{s}^{-1}$, the order of the reaction is
    (a) one (b) two
    (c) zero (d) None of these
11. The following molecule has a linear shape
    (a) H_3^+ (b) LiH
    (c) NH_2 (d) OH_2
12. Henry's law constants for aqueous solution of CO, O_2, CO_2 and C_2H_2 gases are respectively at 25° C as 58×10^3, 43×10^3, 1.61×10^3 and 1.34×10^3. The solubility of these gases decreases in the order
    (a) $CO > O_2 > CO_2 > C_2H_2$
    (b) $O_2 > CO_2 > CO > C_2H_2$
    (c) $C_2H_2 > CO_2 > O_2 > CO$
    (d) $O_2 > CO_2 > C_2H_2 > CO$
13. Ammonia undergoes self dissociation according to the reaction,

    $$2NH_3(l) \longrightarrow NH_4^+(am) + NH_2^-(am)$$

    where *am*, stands for ammoniated.

    When 1 mole of NH_4Cl is dissolved in 1 kg of liquid ammonia, the b. p. at 760 torr is observed at – 32.7°C (Normal b.p. of $NH_3(l)$ is –33.4°C). What conclusions are reached about the nature of the solution?
    (a) NH_4Cl is completely dissociated in NH_3
    (b) NH_4Cl is partially dissociated in NH_3
    (c) NH_4Cl is not dissociated in NH_3
    (d) Boiling point is not raised

14. *A* reacts to form *P*. A plot of the reciprocal of the concentration of *A* *vs* time is a straight line. When the initial concentration of *A* is 1.0×10^{-2} M, its half-life is found to be 20 min. When initial concentration of *A* is 3.0×10^{-3} M, the half-life will be
(a) 20 min (b) 40 min (c) 56 min (d) 67 min

15. The following is the correct increasing order of the ionic radii
(a) $Li^+ < Mg^{2+} < K^+ < Al^{3+}$
(b) $Al^{3+} < Li^+ < Mg^{2+} < K^+$
(c) $Al^{3+} < Mg^{2+} < K^+ < Li^+$
(d) $K^+ < Al^{3+} < Mg^{2+} < Li^+$

16. In the reaction,
$$3Br_2 + 6CO_3^{2-} + 3H_2O \longrightarrow 5Br^- + BrO_3^- + 6\,HCO_3^-$$
Choose the correct statement.
(a) Bromine is oxidised and carbonate is reduced
(b) Bromine is reduced and carbonate is oxidised
(c) Bromine is neither oxidised nor reduced
(d) Bromine is both oxidised and reduced

17. The normality of 20 volume hydrogen peroxide solution is
(a) 3.57 N (b) 0.68 N (c) 5.60 N (d) 5.35 N

18. The work done by the gas liberated when 50 g of iron (molar mass 55.85 g mol^{-1}) reacts with hydrochloric acid in an open beaker at 25°C
(a) zero (b) – 2.3 kJ
(c) 2.2 kJ (d) 0. 22 kJ

19. When zeolite is treated with hard water, the sodium ions are exchanged with
(a) H^+ ions
(b) H^+ and Ca^{2+} ions
(c) OH^- and Mg^{2+} ions
(d) Ca^{2+} and Mg^{2+} ions

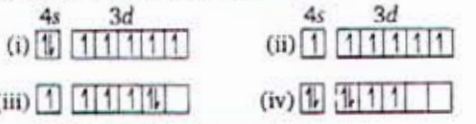
20. The decomposition temperature is the lowest for
(a) $BeCO_3$ (b) $MgCO_3$
(c) $SrCO_3$ (d) $BaCO_3$

21. $Fe(OH)_3$ sol is a
(a) macromolecular colloid
(b) multimolecular colloid
(c) micelles
(d) negative colloid

22. The chief component of cement that has property of setting quickly and acquiring considerable strength within a few days is
(a) tricalcium silicate, $3\,CaO \cdot SiO_2$
(b) dicalcium silicate, $2CaO \cdot SiO_2$
(c) tricalcium aluminate, $3\,CaO \cdot Al_2O_3$
(d) All of the above

23. All the four sigma bonds in perchlorate ion are
(a) $sp^3 - sp^3$ bond (b) $sp^3 - p$ bond
(c) $sp^2 - sp^2$ bond (d) $sp^2 - p$ bond

24. Out of the following electronic arrangements for outer electronic configurations



the most stable arrangement is
(a) (i) (b) (ii) (c) (iii) (d) (iv)

25. The acid strength of the following oxoacids of chlorine is highest
(a) $HClO_4$ (b) $HClO_3$
(c) $HClO_2$ (d) HClO

26. A current of 10.0 A is passed through 1.0 L of 1.0 M HCl solution for 965 s. pH of the solution at the end of the experiment is
(a) 0 (b) 0.20
(c) 0.8 (d) None of these

27. Given that the radius of Na^+ ion is 0.95 Å and that of Cl^- ion is 1.81 Å, hence in the close packed lattice of Cl^- ions, Na^+ ions prefer to occupy
(a) tetrahedral site (b) octahedral site
(c) cubic site (d) trigonal site

28. In $XeOF_2$ molecule, the hybridisation of Xe orbitals is
(a) sp^3d^3 (b) sp^3d^2
(c) sp^3d (d) sp^3

29. Equivalent weight of potassium permanganate in alkaline solution is equal to
(a) $\frac{1}{5}$th of the molar mass of $KMnO_4$
(b) $\frac{1}{6}$th of the molar mass of $KMnO_4$
(c) $\frac{1}{3}$rd of the molar mass of $KMnO_4$
(d) $\frac{1}{10}$th of the molar mass of $KMnO_4$

30. The defect that is more likely to occur in almost all types of ionic crystals is
(a) non-stoichiometric defects
(b) Schottky defect
(c) Frenkel defect
(d) All of the above

31. Effective atomic number of the central metal ion, Pt, in the complex $[Pt(NH_3)_6]^{4+}$ is;
(The atomic no. of Pt is 78)
(a) 74 (b) 90 (c) 86 (d) 84

32. Compounds, $[PtCl_2(NH_3)_4]Br_2$ and $[PtBr_2(NH_3)_4]Cl_2$, shows the following type of isomerism
(a) hydrate isomerism
(b) ionisation isomerism
(c) linkage isomerism
(d) coordination position isomerism

33. $[Co(CN)_6]^{3-}$, a complex ion of cobalt (III), absorbs radiations in violet region of the visible light. Its aqueous solution, therefore, appears
(a) pink (b) orange
(c) blue (d) yellow

34. A metal crystallizes into a lattice containing a sequence of layers of atoms of *ABABAB*... What percentage by volume of this lattice has empty space?
(a) 74 (b) 26 (c) 20 (d) 16

35. The decreasing order of the first ionisation energy (in kJ mol^{-1}) of He, Mg and Na is He > Mg > Na. The increasing order of the 2nd ionisation energy (in kJ mol^{-1}) of these elements will be
(a) Na < Mg < He (b) Mg < Na < He
(c) Mg < He < Na (d) Na < He < Mg

36. To coagulate gelatin sol, which one of the following is most effective?
(a) NaCl (b) Na_3PO_4
(c) $AlCl_3$ (d) Alcohol

37. The most important buffer in the blood consists of
(a) HCl and Cl^- (b) H_2CO_3 and HCO_3^-
(c) H_2CO_3 and Cl^- (d) HCl and HCO_3^-

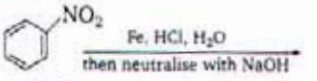
38. Which of the following is not a π bonded complex?
(a) Zeise's salt
(b) Ferrocene
(c) Dibenzene chromium
(d) Tetramethyl lead

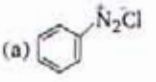
39. The correct order of basicities of $PhNH_2$ (*A*), Ph_2NH (*B*)and Cyclohexyl– NH_2 (*C*) is
(a) $A > B > C$ (b) $A > C > B$
(c) $C > A > B$ (d) $C > B > A$

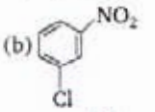
40. Out of following alkenes,
(I) *cis*-2-butene (II) *trans*-2-butene (III) propene (IV) ethene.
Which is the most stable?
(a) I (b) II
(c) III (d) IV

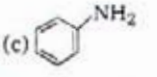
41. Which of these methods can be used to prepare alcohols?
I : Hydrolysis of cyanides
II : Hydration of olefins
III : Reduction of carbonyl compounds
(a) I, II and III (b) I and II
(c) II and III (d) I and III

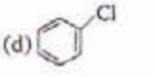
42. What is the major product of the following reaction?



(a) 

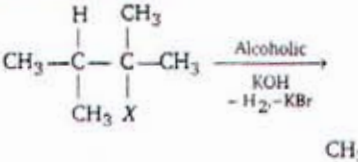
(b) 

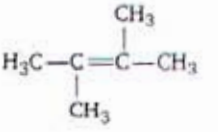
(c) 

(d) 

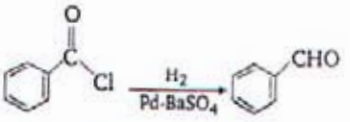
43. The ozonolysis of an olefin gives only propanone. The olefin is
(a) but-1-ene
(b) but-2-ene
(c) 2, 3-dimethylbut-2-ene
(d) propene

44. The following reaction





is an example of
(a) α-elimination
(b) β-elimination
(c) Hofmann elimination
(d) None of the above

45. 

This reaction is called
(a) Etard's reaction
(b) Stephen reaction
(c) Rosenmund's reaction
(d) Gattermann-Koch reaction

46. Reduction of acetone in the presence of sodium borohydride gives
(a) 1-propanol (b) 2-propanol
(c) propene (d) *n*-propane

47. Which one of the following compounds cannot be used for the preparation of Grignard reagent?
(a) C_2H_5Br
(b) $HO-CH_2CH_2Cl$
(c) $C_6H_5CH_2Cl$
(d) $CH_2=CH-CH_2Cl$

48. Which one among the following alcohols will give iodoform on treatment with iodine and sodium hydroxide?
(a) $C_6H_5-\underset{\displaystyle OH}{\underset{|}{CH}}-C_6H_5$
(b) H_3C-OH
(c) $C_6H_5-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$
(d) $H_3C-CH_2\underset{\displaystyle OH}{\underset{|}{CH}}-C_6H_5$

49. Reaction of propene with diborane followed by alkaline hydrolysis in the presence of hydrogen peroxide gives
(a) 1-propanol
(b) 2-propanol
(c) 1,2-dihydroxypropane
(d) *n*-propane

50. Acylation of benzene to produce aliphatic aromatic ketones is known as
(a) benzoin condensation
(b) hydroformylation
(c) Clemmensen reduction
(d) Friedel-Crafts reaction

Biology

1. India has only 2.4% of the world's land area, its share of the global species diversity is
(a) 1.8% (b) 3.1 %
(c) 5.1% (d) 8.1 %

2. Total number of identified biodiversity hot spots in the world are
(a) 25 (b) 24
(c) 40 (d) 34

3. Kanha National Park is located in .....and is famous for.....
(a) Madhya Pradesh, elephant
(b) Madhya Pradesh, tiger
(c) Odhisa, tiger
(d) Asom, elephant

4. Loop of Henle is found in
(a) lung (b) liver
(c) neuron (d) nephron

5. One of the following greenhouse gases contributes about 20% of the global warming
(a) CH_4 (b) CFCs
(c) CO_2 (d) N_2O

6. Biogenetic law as given by Haeckel states that
(a) ontogeny recapitulates phylogeny
(b) phylogeny recapitulates ontogeny
(c) ontogeny and phylogeny go together
(d) there is no relationship between phylogeny and ontogeny

7. An evolutionary pattern characterized by a rapid increase in the number and kinds of closely related species is called
(a) convergent evolution
(b) divergent evolution
(c) adaptive radiation
(d) parallel evolution

8. The origin of mammal like reptiles occurred in
(a) Triassic period (b) Permian period
(c) Jurassic period (d) Tertiary period

9. Stanley Miller had put the Oparin-Haldane theory to test in 1953 by creating in the laboratory, the probable conditions on the primitive Earth. In the experiment, simple amino acids were synthesized from the following mixtures as observed after 18 days
(a) H_2, O_2, N and H_2O
(b) CH_4, CN, H_2 and O_2
(c) H_2, NH_3, CH_4 and water vapour
(d) NH_3, CH_4 and O_2

10. Xenograft means
(a) a graft between two genetically identical individuals
(b) a graft in which a tissue is grafted from one individual to another individual of the same species
(c) a graft between individuals of different species
(d) tissue grafted from one area to another of the same individual

11. The restriction enzyme(s) used in recombinant DNA technology making staggered cuts in DNA leaving sticky ends is/are
(a) *Eco* RI (b) *Hind* III
(c) *Bam* HI (d) All of these

12. If haemoglobin (Hb) of a normal individual and a sickle-cell patient are run in electrophoretic field, they will show
(a) same mobilities
(b) different mobilities
(c) Hb of patient will not move at all
(d) Hbs are immobile

13. Depending upon the distance between any two genes which is inversely proportional to the strength of linkage, cross overs will vary from
(a) 50-100% (b) 0-50%
(c) 75-100 % (d) 100-150%

14. Inhibition of acetylcholine by DFP (Di-isopropyl-fluorophosphate) is an example of
(a) competitive inhibition
(b) non-competitive inhibiton
(c) non-competitive irreversible inhibition
(d) allosteric inhibition

15. When both alleles of a pair are fully expressed in a heterozygote, they are called
(a) lethals (b) co-dominants
(c) semi-dominants (d) recessive allele

16. Nitrogen base + Pentose sugar + Phosphate group is
(a) nucleoside (b) nucleotide
(c) nucleic acid (d) pyrimidine base

17. ..... is a globular protein of ~6 kDa consisting of 51 amino acids, arranged in a 2 polypeptide chains held together by disulphide bridge
(a) insulin (b) keratin
(c) glucagon (d) fibrinogen

18. Which of the following fatty acid is liquid at room temperature?
(a) Palmitic acid (b) Stearic acid
(c) Oleic acid (d) Linoleic acid

19. The energy content in kcal/g of carbohydrate: Protein: triglycerol respectively is approximately in the ratio of
(a) 1 : 2 : 2 (b) 1 : 2 : 1
(c) 2 : 1 : 1 (d) 2 : 2 : 1

20. The cell membranes of adjacent cells are fused at this cell junction
(a) macula adherens (b) zonula adherens
(c) zonula occludens (d) nexus

21. One of the following salts predominates in bone matrix
(a) sodium chloride
(b) magnesium phosphate
(c) calcium phosphate
(d) sodium carbonate

22. Which one of the following species of bee is used for the commercial production of honey?
(a) *Apis dorsata* (b) *Apis indica*
(c) *Apis florae* (d) *Apis mellifera*

23. Which one of the following is a breed of cattle?
(a) Ayreshire (b) Ghagus
(c) Kadakanath (d) Scampi

24. The falciform ligament in man connects
(a) liver with diaphragm
(b) lungs with diaphragm
(c) stomach with diaphragm
(d) liver with stomach

25. Dark adaptation in human eye involves
(a) Conversion of 11 *cis*-retinene to *trans*-retinene
(b) Conversion of *trans*-retinene into 11-*cis*-retinene
(c) Decomposition of rhodopsin into retinene
(d) Decomposition of rhodopsin to scotopsin

26. The optic lobes in humans are represented by the corpora
(a) bigemina (b) arenacea
(c) allata (d) quadrigemina

27. The animals that rely on the heat from environment than metabolism to raise their body temperature are, in strict sense, called
(a) ectothermic (b) poikilothermic
(c) homeothermic (d) endothermic

28. 'Lub' sound produced during heart beat is caused by
(a) ventricular diastole (b) ventricular systole
(c) atrial diastole (d) atrial systole

29. which is correct for Turner's syndrome?
(a) It is a monosomy
(b) It causes sterility in females
(c) Absence of Barr body
(d) All of the above

30. Argentaffin cells in human beings are found in
(a) small intestine (b) stomach
(c) large intestine (d) liver

31. In human beings, the three pair of salivary glands and numerous buccal glands produce about
(a) 1.0 dm^3 of saliva per day
(b) 1.5 dm^3 of saliva per day
(c) 2.0 dm^3 of saliva per day
(d) 2.5 dm^3 of saliva per day

32. This gastrointestinal hormone stimulates insulin secretion
(a) gastrin (b) CCK
(c) secretin (d) GIP

33. This is the common passage for bile and pancreatic juices
(a) ampulla of Vater
(b) ductus Cholidochus
(c) duct of Wirsung
(d) duct of Santorini

34. In the gastro-intestinal tract the Meissner's plexus and the Auerbach's plexus occur respectively in the
(a) lamina propria and muscularis mucosa
(b) submucosa and muscularis externa
(c) submucosa and mucosa
(d) mucosa and muscularis externa

35. The important muscle proteins that help in movement are
(a) actin and myosin (b) tropomyosin
(c) troponin (d) All of these

36. It is a disease which mainly affects mucous membrane of urinogenital tract. In males, burning feeling on passing urine, after a yellow discharge occurs, that is accompanied by fever, headache and feeling of illness
(a) syphilis (b) gonorrhoea
(c) AIDS (d) None of these

37. 'Athlete's foot' is caused by
(a) *Tinea pedis* (b) *Tinea capitis*
(c) *Candida albicans* (d) *Rickettsia*

38. Hepatitis B virus is a
(a) hepadnavirus (b) variolavirus
(c) retrovirus (d) picornavirus

39. Immunoglobulins serving as mediators in allergic response are
(a) IgE (b) IgD (c) IgM (d) IgA

40. One of the group include all sexually transmitted diseases
(a) AIDS, syphilis, cholera
(b) HIV, Malaria, trichomoniasis
(c) Gonorrhoea, hepatitis-B, Chlamydiasis
(d) Hepatitis-B, Haemophilia, AIDS

41. The carrying capacity of environment for a given population can be represented by the following equation
(a) $dN = rN - \frac{N}{K}$ (b) $\frac{dN}{dt} = rN - \frac{N}{K}$
(c) $\frac{dN}{dt} = rN - \frac{1}{K}$ (d) $\frac{dN}{dt} = rN\left(1 - \frac{N}{K}\right)$

42. It is normally a rare cancer but became a marker for AIDS/HIV patients
(a) squamous cell carcinoma
(b) retinoblastoma
(c) Kaposi's sarcoma
(d) lukaemia

43. In fish, *Catla catla* the specific name is identical with the generic name, Such condition is referred to as
(a) autonymy (b) tautonymy
(c) synonymy (d) homonymy

44. Jaws of shark contain
(a) thecodont teeth (b) acrodont teeth
(c) pleurodont teeth (d) None of these

45. The nerve chord in earthworm originates from
(a) supra-pharyngeal ganglia and has a fused pair of ganglia in each segment from the 3rd to the last
(b) supra-pharyngeal ganglia and has fused pair of ganglia in each segment from the 4th to the last
(c) sub-pharyngeal ganglia and has a fused pair of ganglia in each segment from the 5th to the last
(d) sub-pharyngeal ganglia and has a fused pair of ganglia in each segment from the 6th to the last

46. In the mouth parts of cockroach, the goba and lacinia form parts of the
(a) mandibles (b) maxilla
(c) labium (d) labrum

47. An aquatic living fossil with ancient origin and many primitive characters, which respires through book gills, is
(a) *Limulus* (b) Cancer
(c) *Lucifer* (d) *Daphnia*

48. Which is the only phylum in the animal kingdom without any nerve cell?
(a) Porifera (b) Coelenterata
(c) Annelida (d) Nematoda

49. Which of the following animal belongs to the phylum-Mollusca?
(a) Devil fish (b) Dog fish
(c) Silver fish (d) Jelly fish

50. If a water body is contaminated with a toxicant, its biomagnification will be more marked in
(a) water (b) planktons
(c) small fishes (d) birds

51. Radial conduction of water takes place by
(a) vessels
(b) vessels and tracheids
(c) phloem
(d) ray parenchymatous cells

52. Plant cells normally lack
(a) ribosomes (b) Golgi bodies
(c) centrioles (d) cell membrane

53. Detailed structure of the membrane was studied after the advent of electron microscope during
(a) 1930s (b) 1950s
(c) 1970s (d) 1990s

54. The usual axonemal arrangement of microtubules is
(a) 6 pairs of doublets radially arranged at periphery with a pair of centrally located microtubules
(b) 6 pairs of doublets radially arranged at periphery with a single centrally located microtubule
(c) 9 pairs of doublets radially arranged at periphery with a pair of centrally located microtubules
(d) 9 pairs of doublets radially arranged at periphery with a single centrally located microtubule

55. When the chromosome has a centromere nearer to one end of the chromosome resulting into one shorter and one longer arm, the chromosome is termed as
(a) metacentric (b) sub-metacentric
(c) acrocentric (d) telocentric

56. Yeast cell can progress through the cell cycle in about
(a) 30 min (b) 60 min
(c) 90 min (d) 120 min

57. The chromosome becomes gradually visible with compaction of chromosomes during the meiotic stage
(a) diplotene (b) leptotene
(c) zygotene (d) pachytene

58. Melvin Calvin was professor of
(a) botany (b) plant physiology
(c) chemistry (d) biochemistry

59. Micronutrients are
(a) Mn, Ni and Zn (b) O, Cu and B
(c) Mg, Mn and Mo (d) Ca, S and Fe

60. Phloem sap is mainly made up of
(a) Water and sucrose
(b) Water and minerals
(c) Oligosaccharides and hormones
(d) None of the above

61. Forces generated by transpiration can create pressure sufficient to lift water even upto height of
(a) 130 feet (b) 130 metre
(c) 230 feet (d) 230 metre

62. The essential element needed for water splitting in photosynthesis leading to O_2 evolution is
(a) Mo (b) Mn (c) Mg (d) K

63. In the overall process of photosynthesis, the number of CO_2, water, sugar and O_2 molecules utilized and produced is
(a) 12 (b) 13 (c) 19 (d) 31

64. During Calvin cycle the total number of CO_2, ATP and NADPH molecules utilized and glucose, ADP and NADP generated is
(a) 31 (b) 36
(c) 61 (d) 67

65. When fats are respiratory substrate, the value of R.Q. would be about
(a) 0.7 (b) 1.0
(c) more than 1.0 (d) None of these

66. To speed up the malting process in brewing industry, the growth hormone used is
(a) auxin (b) gibberellic acid
(c) kinetin (d) ethylene

67. Glycolysis term has originated form Greek words
(a) glycose and lysis (b) glycos and lysis
(c) glyco and lysis (d) glucose and lysis

68. Banana is vegetatively propagated by
(a) tuber (b) rhizome
(c) bulb (d) sucker

69. The innermost wall layer of microsporangium nourishing the developing pollen grains is known as
(a) endodermis (b) endothecium
(c) tapetum (d) sporogenous tissue

70. The type of pollination when different pollen grains are brought to stigma is
(a) geitonogamy (b) cleistogamy
(c) xenogamy (d) chasmogamy

71. Among the seven pairs of contrasting traits in pea plant, studied by Mendel, the number of traits related to flower, pod and seed respectively was
(a) 2, 2, 2 (b) 2, 2, 1
(c) 1, 2, 2 (d) 1, 1, 2

72. Crick, one the discoverer of DNA double helical structure, was the man of
(a) Physics (b) Chemistry
(c) Zoology (d) Botany

73. Some of the dominant traits studied by Mendel were
(a) round seed shape, constricted pod shape and axial flower position
(b) green pod colour, inflated pod shape and axial flower position
(c) yellow seed colour, violet flower colour and yellow pod colour
(d) axial flower position, green pod colour and green seed colour

74. In a dihybrid cross where two parents differ in two pairs of contrasting traits like seed colour yellow (YY) and seed colour green (yy) with seed shape round (RR) and seed shape wrinkled (rr), the number of green coloured seeds (yy) among sixteen products of F_2 generation will be
(a) 2 (b) 4 (c) 6 (d) 8

75. The number of codons that code different amino acids is
(a) 16 (b) 31 (c) 61 (d) 64

76. Some amino acids are coded by more than one codon hence, the code is
(a) unambiguous (b) degenerate
(c) universal (d) initiator

77. The colour based contrasting traits in seven contrasting pairs studied by Mendel in pea were
(a) 1 (b) 2
(c) 3 (d) 4

78. Out of 64 codons, the number of codons with GGG, is
(a) 1 (b) 2 (c) 4 (d) 6

79. Black rot of crucifers is caused by a
(a) fungus (b) bacterium
(c) virus (d) None of these

80. Pusa Komal variety of cow pea is resistant to disease
(a) hill bunt (b) white rust
(c) leaf curl (d) bacterial blight

81. Lactic acid bacteria (LAB) grow in milk and convert it to curd and also improved its nutritional quality by increasing
(a) Vitamin-A (b) Vitamin-B_{12}
(c) Vitamin-B_6 (d) Vitamin-C and A

82. Cohen and Boyer isolated an antibiotic resistance gene, by cutting out a piece of DNA form a plasmid which was responsible for conferring antibiotic resistance, in the year
(a) 1962 (b) 1965 (c) 1972 (d) 1982

83. Restriction enzyme *Eco* RI cuts the DNA between bases G and A only when the sequence in DNA is
(a) GATATC (b) GAATTC
(c) GATTCC (d) GAACTT

84. Amplification of gene of interest by using DNA polymerase may go upto
(a) 0.1 million times (b) 1.0 million times
(c) 1.0 billion times (d) 1.0 trillion times

85. The important steps in the process of decomposition are
(a) fragmentation and mineralization
(b) leaching and catabolism
(c) humification and mineralization
(d) All the above

86. In an ecosystem, at a particular time, standing crop includes
(a) total living material
(b) total detritus
(c) both (a) and (b)
(d) total nutrients present in the crop

87. In a pyramid of biomass, if the total dry weight (kgm^{-2}) of primary producers is about 809 it will decrease at tertiary consumer level upto
(a) 37 kgm^{-2} (b) 11 kgm^{-2}
(c) 5 kgm^{-2} (d) 1.5 kgm^{-2}

88. Environment Protection Act, to protect and improve the quality of our environment (air, water and soil) was passed in the year
(a) 1971 (b) 1974 (c) 1981 (d) 1986

89. In domestic sewage, impurities in the form of suspended solids, colloidal materials and dissolved materials, are about
(a) 0.1 % (b) 2.1 % (c) 5.0 % (d) 10.0 %

90. The range of biomagnification of DDT in an aquatic food chain, if starting from 0.003 ppm level in water, may go at fish eating bird level upto
(a) 0.5 ppm (b) 5.0 ppm
(c) 15.0 ppm (d) 25.0 ppm

91. Some organisms are tolerant to a narrow range of salinity and are termed as
(a) euryhaline (b) stenohaline
(c) neither (a) nor (b) (d) saline

92. The biologist who has been called as the 'Darwin of the 20th century", was
(a) Linnaeus (b) Ernst Mayr
(c) Diener (d) Whittaker

93. The hierarchial arrangement of taxonic categories in descending order is
(a) Kingdom, phylum, class, order, family, genus, species
(b) Kingdom, division, phylum, order, family, genus, species
(c) Kingdom, class, phylum, order, family, genus
(d) Division, kingdom, class, phylum, order, family, genus, species

94. The shape of the cocci bacteria is
(a) rod (b) spherical
(c) comma (d) spiral

95. The beautiful diatoms and desmids are placed under
(a) chrysophytes (b) dianoflagellates
(c) euglenoids (d) slime moulds

96. The major pigments in Rhodophyceae are
(a) chlorophyll-*a* and *b*
(b) chlorophyll-*a*, *c* and fucoxanthin
(c) chlorophyll-*a*, *d* and phycoerythrin
(d) None of the above

97. When margin of thalamus grows upward enclosing ovary completely and getting fused with it and the other parts of flower arise above the ovary, the flower is said to be
(a) hypogynous (b) perigynous
(c) epigynous (d) inferior

98. When placenta forms a ridge along the ventral suture of the ovary and the ovules are borne on this ridge forming two rows, the placentation is termed as
(a) axile (b) parietal (c) marginal (d) basal

99. The mesocarp in coconut is
(a) flashy (b) stony (c) fibrous (d) milky

100. K. Esau dominated the field of plant biology up to the age of 99 years. She contributed mainly in the field of
(a) Morphology of flowering plants
(b) Classification of flowering plants
(c) Anatomy of seed plants
(d) physiology of seed plants

Answers

Physics

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

Chemistry

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

Biology

1. (d)	2. (d)	3. (b)	4. (d)	5. (a)	6. (a)	7. (c)	8. (b)	9. (c)	10. (c)
11. (d)	12. (b)	13. (b)	14. (c)	15. (b)	16. (b)	17. (a)	18. (c,d)	19. (b)	20. (c)
21. (c)	22. (d)	23. (a)	24. (a)	25. (b)	26. (d)	27. (a)	28. (b)	29. (d)	30. (b)
31. (b)	32. (a)	33. (a)	34. (b)	35. (d)	36. (b)	37. (a)	38. (a)	39. (a)	40. (c)
41. (c)	42. (d)	43. (c)	44. (b)	45. (b)	46. (c)	47. (b)	48. (a)	49. (a)	50. (a)
51. (d)	52. (c)	53. (b)	54. (c)	55. (b)	56. (c)	57. (b)	58. (c)	59. (a)	60. (a)
61. (b)	62. (b)	63. (d)	64. (d)	65. (a)	66. (b)	67. (b)	68. (b)	69. (c)	70. (c)
71. (a)	72. (a)	73. (b)	74. (b)	75. (c)	76. (b)	77. (c)	78. (a)	79. (b)	80. (d)
81. (b)	82. (c)	83. (b)	84. (c)	85. (d)	86. (a)	87. (d)	88. (d)	89. (a)	90. (d)
91. (b)	92. (b)	93. (a)	94. (b)	95. (a)	96. (c)	97. (c)	98. (c)	99. (c)	100. (c)

Hints & Solutions

1. Moment of force about pivot A (80 N force)

$$= 80 \times \frac{3}{2} \times \sin 30^\circ$$

$$= 60 \text{ N-m (anticlockwise)}$$

Moment of force about pivot A (70 N force)

$$= 70 \times 3 \times \sin 30^\circ = 70 \times 3 \times \frac{1}{2}$$

$$= 105 \text{ N-m (anticlockwise)}$$

Moment of force about pivot A (60 N force)

$$= 60 \times \frac{3}{2} \times \sin 90^\circ$$

$$= 90 \text{ N-m (clockwise)}$$

Moment of force about pivot A (90 N force)

$$= 90 \times 0 \times \sin 60^\circ = 0$$

Moment of force about pivot A (50 N)

$$= 50 \times 3 \times \sin 180^\circ = 0$$

The total torque about pivot A

$$T = (60 + 105 - 90)$$

$$= 75 \text{ N-m}$$

2. $\text{Time} = \dfrac{\text{Revolution}}{\text{Angular speed}}$

$$= \frac{60}{30} = 2 \text{ s}$$

3. 

Moment of inertia

$$M_1 = m_w \times \frac{(L/2)^2}{3} = m_w \frac{L^2}{12}$$

Moment of inertia

$$M_2 = m_b \times \frac{(L/2)^2}{3} = m_b \times \frac{L^2}{12}$$

Moment of inertia

$$M = M_1 + M_2$$

$$= m_w \frac{L^2}{12} + m_b \times \frac{L^2}{12}$$

$$= (m_w + m_b) \frac{L^2}{12}$$

4. Using the law of conservation of angular momentum.

Angular momentum of planet at p

= Angular momentum of planet at a

i.e., $L_p = L_a$

But $r_a > r_p$

So, $r_a \times L_a > r_p \times L_p$

Hence, only option (a) is correct.

5. Maximum height attained by body

$$h = R\left[\frac{v^2}{v_e^2 - v^2}\right]$$

$$h = R\left[\frac{v_e^2/4}{v_e^2 - \frac{v_e^2}{4}}\right]$$

$$= R\left[\frac{v_e^2/4}{\frac{3v_e^2}{4}}\right]$$

$$h = \frac{R}{3}$$

6. Acceleration due to gravity

$$g' = g - \omega^2 R\cos^2\lambda$$

$$0 = g - \omega^2 R\cos^2 60°$$

$$0 = g - \frac{\omega^2 R}{4}$$

$$\omega = 2\sqrt{\frac{g}{R}} = 2\sqrt{\frac{10}{6400 \times 1000}}$$

Angular velocity $\omega' = \frac{1}{400}$

$= 2.5 \times 10^{-3}$ rad/s

7. For anisotropic solids

$$\rho = \alpha_x + \alpha_y + \alpha_z$$

where α_x, α_y and α_z represent the mean coefficient of linear expansion along three mutually perpendicular directions.

8. Specific gravity of Al = 2.7

Density of air = 2.7×10^3 kg/m^3

Terminal velocity

$$v = \frac{2r^2(\rho - \sigma)g}{9\eta}$$

$$v = \frac{2 \times (1 \times 10^{-3})^2 (2.7 \times 10^3 - 1000) \times 9.8}{8 \times 9 \times 10^{-4}}$$

Terminal velocity $v = 4.6$ m/s.

9. (i) Volume is constant

i.e., $\Delta V = 0$

$\Delta U = Q - p\Delta V$

$\Delta U_a = Q$

(ii) Pressure is constant,

i.e. $\Delta U_b = Q - p\Delta V$

$\therefore \quad \Delta U_a > \Delta U_b$

10. W_{a-b} is isothermal

W_{b-c} is adiabatic

W_{c-d} is isothermal (Negative)

W_{d-a} is adiabatic (Negative)

Net work done during the complete cycle

$$W = W_{a-b} + W_{b-c} + (-W_{c-d}) + (-W_{d-a})$$

$$W = W_{a-b} - W_{c-d} \qquad [\text{As } W_{b-c} = W_{d-a}]$$

i.e., $W_{a-b} + W_{c-d} > 0$

and $W_{a-b} + W_{b-c} + W_{c-d} + W_{d-a} > 0$

$\because \quad W_{b-c} = W_{d-a}$

$\therefore \quad W_{b-c} + (-)W_{d-a} = 0$

11. Change in entropy $dS = \frac{dQ}{T}$

Entropy remains constant for reversible process

$dS = 0$

12. $V = \frac{\pi P r^4}{8\eta l}$

$\therefore \quad V \propto pr^4 \qquad (\eta \text{ and } l \text{ are contants})$

$\therefore \quad \frac{V_2}{V_1} = \left(\frac{p_2}{p_1}\right)\left(\frac{r_2}{r_1}\right)^4$

$$= 2 \times \left(\frac{1}{2}\right)^4 = \frac{1}{8}$$

$$V_2 = \frac{Q}{8}$$

13. Velocity, $v = n\lambda$

$v = 150 \times 0.06$

$v = 9$ m/s

Power, $P = 2\pi^2 n^2 a^2 (m/l)\, v$

$= 2 \times (3.14)^2 \times (150)^2 \times (0.06)^2 \times 0.2 \times 10^{-3} \times 9$

$= 2.87$ W

14. We have $n_1 - n_2 = 5$

$$\frac{v}{2l_1} - \frac{v}{2l_2} = 5$$

$$\frac{1}{l_1} - \frac{1}{l_2} = \frac{5 \times 2}{v}$$

$$\frac{1}{1.10} - \frac{1}{l_2} = \frac{10}{340} - \frac{1}{1.10}$$

$$-\frac{1}{l_2} = -0.87 \text{ or } l_2 = \frac{1}{0.87}$$

$$l_2 = 1.14 \text{ m}$$

15. The electric field $\mathbf{E} = 5\mathbf{i} - 3\mathbf{j}$ kV/m

$$E = \sqrt{25+9}$$

$$= \sqrt{34} \text{ kV/m}$$

$$d = \sqrt{(10-4)^2 + (3-0)^2}$$

$$= \sqrt{(6)^2 + (3)^2}$$

$$= \sqrt{(36+9} = \sqrt{45}$$

Potential difference between points A and B

$$V = E \cdot d$$

$$= \sqrt{34} \times \sqrt{45}$$

$$= 39 \text{ kV}$$

16. The electric field at the point $x = -a$

$$E_{out} = \frac{\lambda}{2\pi\varepsilon_0 a}(-\mathbf{i})$$

17. Force between the plates of a parallel plate capacitor

$$|F| = \frac{V^2 A}{2\varepsilon_0} = \frac{Q^2}{2\varepsilon_0 A} = \frac{CV^2}{2d}$$

18. Store energy in capacitor of 3 μF

$$U_1 = \frac{1}{2} \times C_1 V^2 = \frac{1}{2} \times 3 \times (6)^2 \times 10^{-6}$$

$$= 54 \times 10^{-6} \text{ J}$$

Store energy in capacitor of 4 μF

$$U_2 = \frac{1}{2} C_2 V^2$$

$$= \frac{1}{2} 4 \times (6)^2 \times 10^{-6}$$

$$= 72 \times 10^{-6} \text{ J}$$

When both capacitors are connected in series

$$C_{eq} = \frac{C_1 C_2}{C_1 + C_2} = \frac{3 \times 4}{3+4} = \frac{12}{7} \mu\text{F}$$

Energy lost

$$= \frac{1}{2} C_{eq} (V_1 - V_2)^2 = \frac{1}{2} \times \frac{12}{7} \times (0)^2 \times 10^{-6}$$

Total energy $= U_1 + U_2$

$$= 1.26 \times 10^{-4} \text{ J}$$

19. The electric field is due to all charges present whether inside or outside the given surface. So option (c) is correct.

21. Time period of electron, $T = \frac{2\pi r}{v}$

$$= \frac{2\pi \times \varepsilon_0 n^2 h^2}{\frac{\pi m e^2}{e^2}}$$

$$2\varepsilon_0 nh$$

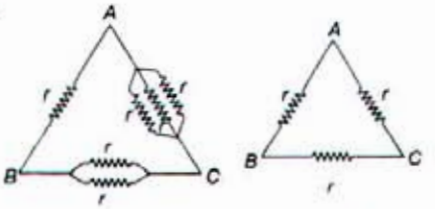
$$T = \frac{4\varepsilon_0^2 n^2 h^3}{me^4}$$

Current, $i = \frac{e}{T} = \frac{e}{\frac{4\varepsilon_0^2 n^2 h^2}{me^4}}$

$$i = \frac{me^5}{4\varepsilon_0^2 n^2 h^5}$$

i. e., $i \propto e^5$

22.



Resistance between points A and B

$$R_{AB} = r \| \left(\frac{r}{3} + \frac{r}{2}\right)$$

$$= \frac{r \times 5/6\, r}{r + 5/6 r} = \frac{5}{11} r$$

Resistance between points B and C

$$R_{BC} = \frac{r}{2} \| \left(r + \frac{r}{3}\right)$$

$$= \frac{\frac{r}{2} \times \frac{4r}{3}}{\frac{r}{2} + \frac{4r}{3}} = \frac{4}{11} r$$

Resistance between points C and D

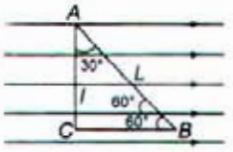
$$R_{CA} = \frac{r}{3} || \left(\frac{r}{2} + r\right)$$

$$= \frac{\left(\frac{r}{3} \times \frac{3r}{2}\right)}{\frac{r}{3} + \frac{3r}{2}}$$

$$= \frac{3}{11} r$$

$$P_{AB} : R_{BC} : R_{CA} = 5 : 4 : 3$$

23.



Force $F = BIl \sin\theta$

$= BIl \sin 60°$

$= \frac{\sqrt{3}}{2} BIl$

From Fleming left hand rule, the magnitude and direction of force on the element AB of the wire is $\frac{\sqrt{3}}{2}$ Bil directed into the page.

24. Given, $B = 8.35 \times 10^{-2}\,\mathbf{i}$ T

$v = (2 \times 10^5\,\mathbf{i} + 4 \times 10^5\,\mathbf{j})$

The distance covered by proton

$P = T\,(v)$

$= 2\pi \frac{m}{qB} (v)$

$$= 2 \times 3.14 \times \frac{1.67 \times 10^{-27}}{1.6 \times 10^{-19} \times 8.35 \times 10^{-2}\,\mathbf{i}} \times (2 \times 10^5 \mathbf{i} + 4 \times 10^5 \mathbf{j})$$

$P = 0.157$ m

25. Given $n = 12$ turns

$i = 15$ A

$B = 0.2\,\mathbf{i}$

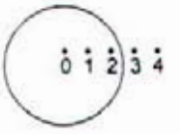
$A = -0.04\,\mathbf{i}\ \text{m}^2$

Potential energy, $V = NIAB$

$= 12 \times 15 \times (-0.04) \times 0.2$

$= -1.44$ J

26.



Magnetic field outside the long rod

$\because \quad B = \frac{\mu_0 i}{2\pi r}$

$\therefore \quad B_3 > B_4 \neq 0$

27. Emf of AC source $E = E_0 \sin(100t)$

We have $\omega = 100$ and $\phi = \frac{\pi}{4} = 45°$

$$\tan\phi = \frac{\omega L}{R}$$

$$1 = \frac{100 \times L}{R}$$

$$R = 100\ \text{L}$$

If $L = 10$ H then $R = 1$ kΩ

28. Given, $B = 0.15$ T, $l = 50 \times 10^{-2}$ cm

and $v = 2$ m/s

emf $= Bvl$

$e = 0.15 \times 2 \times 50 \times 10^{-2}$

Current, $i = \frac{e}{R}$

$= \frac{0.15}{3} = 5 \times 10^{-2}$

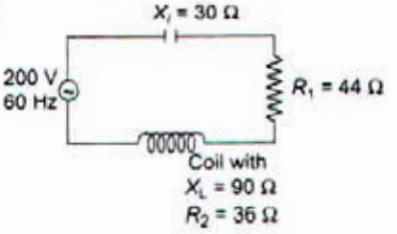
Force $F = Bil$

$= 0.15 \times 5 \times 10^{-2} \times 50 \times 10^{-2}$

$= 37.5 \times 10^{-4}$

$= 3.75 \times 10^{-3}$ N

29.



We have, $X_L = 90\,\Omega$, $X_C = 30\Omega$

and $R = R_1 + R_2 = 44 + 36 = 80\,\Omega$

Impedence $Z = \sqrt{R^2 + (X_L - X_C)^2}$

$= \sqrt{(80)^2 + (60)^2}$

$$Z = \sqrt{6400 + 3600} = 100$$

$$I = \frac{V}{Z} = \frac{200}{100} = 2\text{A}$$

$$P_{av} = I^2R$$

$$= (2)^2 \times 80 = 320\text{ W}$$

30. The wave function

$\psi(x, t) = 10^3 \sin \pi (3 \times 10^6 x - 9 \times 10^4 t)$

Here,

Angular frequency $\omega = 9 \times 10^4 \pi$

$$\omega = 2\pi n$$

$$n = \frac{\omega}{2\pi} = \frac{9 \times 10^4 \pi}{2\pi} = 4.5 \times 10^4 \text{ Hz}$$

31. From mirror formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \quad \ldots(\text{i})$$

Differentiating Eq. (i), we obtain

$$0 = \frac{1}{v^2} dv - \frac{1}{v^2} du$$

$$dv = -\left(\frac{v}{u}\right)^2 du \quad \ldots(\text{ii})$$

Also from Eq. (i)

$$\frac{v}{u} = \frac{f}{u - f} \quad \ldots(\text{iii})$$

From Eqs. (ii) and (iii), we get

$$dv = -\left(\frac{f}{u - f}\right)^2 \cdot L$$

Therefore size of image is $\left(\frac{f}{u - f}\right)^2 L$

32. Magnification $m = \frac{v}{-u} = -3$

$$v = 3u = 30 \text{ cm}$$

Focal length of co-axial combination

$$\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{v} - \frac{1}{u}$$

$$-\frac{1}{30} + \frac{1}{f_2} = \frac{1}{30} + \frac{1}{10} = \frac{4}{30}$$

$$\frac{1}{f_2} = \frac{4}{30} + \frac{1}{30}$$

$$\frac{1}{f_2} = \frac{4 + 1}{30} = \frac{5}{30}$$

$$f_2 = \frac{30}{5} = 6 \text{ cm}$$

Hence, lens A is convex lens.

33. White light is incident on face AB of a glass prism, the green light is just to tally internally reflected at face AC, the light emerging form face AC will contain all colour except green.

34. The phase difference (ϕ) between the wavelets from the top edge and bottom edge of the slit is

$$\phi = \frac{2\pi}{\lambda} (d \sin \theta)$$

where d is the width. The first minima of the diffraction pattern occurs at

$$\sin \theta = \frac{\lambda}{d}, \text{ so,}$$

$$\phi = \frac{2\pi}{\lambda} \left(d \times \frac{\lambda}{d}\right)$$

$$= 2\pi$$

35. $K_e = \frac{1}{2} mv^2$ and $\lambda = \frac{h}{mv}$

$$K_e = \frac{1}{2} \left(\frac{h}{\lambda v}\right) \cdot v^2 = \frac{vh}{2\lambda}$$

$$K_p = \frac{hc}{\lambda}$$

$$\therefore \quad \frac{K_e}{K_p} = \frac{v}{2c}$$

$$= \frac{1.5 \times 10^8}{2 \times 3 \times 10^8} = \frac{1}{4}$$

36. $v_{max} = \sqrt{\frac{2h(\nu - \nu_0)}{m}}$

$$\nu = 2\nu_0$$

$$\therefore \quad v_{max} = v_0 = \sqrt{\frac{2h(2\nu_0 - \nu_0)}{m}}$$

$$v_0 = \sqrt{\frac{2h\nu_0}{m}}$$

Again $\nu = 5\nu_0$

∴The maximum velocity of the photoelectron

$$v_{max} = \sqrt{\frac{2h(5\nu_0 - \nu_0)}{m}}$$

$$= \sqrt{\frac{2h4\nu_0}{m}}$$

$$= 2\sqrt{\frac{2h\nu_0}{m}} = 2v_0$$

37.

Q-value of the reaction is 5.5 MeV

i. e., $K_1 + K_2 = 5.5$ MeV ...(i)

By conservation of linear momentum

$$p_1 = p_2$$

$$\Rightarrow \sqrt{2(216)K_1} = \sqrt{2(4)K_2}$$

$$K_2 = 54K_1 \quad \text{...(ii)}$$

On solving Eqs. (i) and (ii), we get

The energy of emitted α-particle

$$K_2 = 5.4 \text{ MeV}$$

38. We have $\lambda = \dfrac{0.693}{t_{1/2}}$

Mean life $\tau = \dfrac{1}{\lambda}$

$$= \frac{t_{1/2}}{0.693} = \frac{2}{2.303 \log_2}$$

$$= \frac{2}{\ln 2}$$

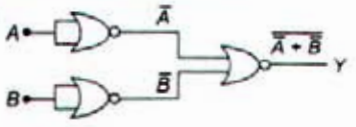
39. The energy band gap of Si = 1.1 eV

We have, $E_g(T) = 1.1 \times 10^4 + 3.60 \times 10^{-4}\, T$

$$= 1.1 \text{ eV}$$

So, this equation represents the temperature variation of energy gap between the conduction and valence band for Si.

41.



$\overline{\bar{A}+\bar{B}} = \overline{\bar{A}}\,\overline{\bar{B}} = A \cdot B$

AND gate

i. e.,

42. A physical quantity

$$X = \frac{2k^3l^2}{m\sqrt{n}}$$

Percentage error in X

$$= \left(3 \times 1 + 2 \times 2 + 3 \times 1 + 2 \times \frac{1}{2}\right) = 11\%$$

43. Kinetic energy acquired by the body = Force applied on it × Distance covered by body

$$\nu \cdot E = F \cdot d$$

If F and d both are same then KE acquired by the body will be same.

44. Tension $T = m\omega^2 r + mg$

$$= 0.5 \times (4)^2 \times 1 + 0.5 \times 10 = 13\,\text{N}$$

45. Given,

$$\mathbf{r}_1(t) = 3t\,\mathbf{i} + 4t^2\mathbf{j}$$

$$\therefore \quad \frac{d\mathbf{r}_1}{dt} = 3\mathbf{i} + 8t\mathbf{j}$$

At $t = 1$s

$$v_1 = \frac{d\mathbf{r}_1}{dt} = 3\mathbf{i} + 8\mathbf{j}$$

Again, $\mathbf{r}_2(t) = 4t^2\mathbf{i} + 3t\mathbf{j}$

$$\frac{d\mathbf{r}_2}{dt} = 8t\mathbf{i} + 3\mathbf{j}$$

At $t = 1$s

$$v_2 = \frac{d\mathbf{r}_2}{dt} = 8\mathbf{i} + 3\mathbf{j}$$

Relative velocity $= v_1 - v_2$

$$= -5\mathbf{i} + 5\mathbf{j}$$

$$= \sqrt{(5)^2 + (5)^2} = 5\sqrt{2}\ \text{m/s}$$

46. Central attractive force

$$F = -\frac{k}{r}$$

$$mr\omega^2 = -\frac{k}{r}$$

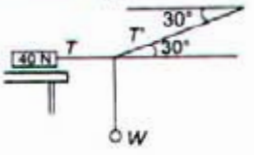
$$mr\left(\frac{2\pi}{T}\right)^2 = -\frac{k}{r}$$

$$\frac{mr4\pi^2}{T^2} = -\frac{k}{r}$$

$$T^2 = \frac{mr^2 4\pi^2}{k}$$

$$T^2 \propto r^2 \text{ or } T \sim r$$

47. For equilibrium at point P



$$T = T' \cos 30°$$

and $T' \sin 30 = W$

$$T = \mu R = 12\,N$$

$\therefore$ $12 = T' \cos 30°$

$$T' = \frac{12 \times 2}{\sqrt{3}}$$

$$T' = \frac{24}{\sqrt{3}}$$

$\therefore$ $T' \sin 30 = W$

$$W = \frac{24}{\sqrt{3}} \times \frac{1}{2}$$

$$W = 6.92\,N$$

48. $$T_2 = \frac{(m_1 + m_2)F}{(m_1 + m_2 + m_3)}$$

$$= \frac{(2+4) \times 120}{(2+4+6)}$$

$$= \frac{6 \times 120}{12}$$

$$T_2 = 60\,N$$

$$T_1 = \frac{m_1 F}{(m_1 + m_2 + m_3)}$$

$$= \frac{2 \times 120}{12}$$

$$= 20\,N$$

49. Potential energy

$$U = 20xy/z$$

$$F = \frac{dU}{dx} = \frac{dU_x}{dx} + \frac{dU_y}{dy} + \frac{dU_z}{dz}$$

$$= \frac{20y}{z}\,i + \frac{20x}{z}\,j - \frac{20xy}{z^2}\,k$$

50. The angle θ between the velocities of the spheres after the perfectly elastic collision of two bodies of equal masses (if the second body is at rest), would be 90°.

Chemistry

1. $Fe^{2+} + 2e^- \longrightarrow Fe$; $n_1 = 2$, $E_1^\circ = -0.447$ V

$Fe^{3+} + e^- \longrightarrow Fe^{2+}$; $n_2 = 1$, $E_2^\circ = 0.771$ V

$Fe^{3+} + 3e^- \longrightarrow Fe$; $n_3 = 3$, $E_3^\circ = ?$

$$\Delta G_3 = \Delta G_1 + \Delta G_2$$

$$3E_3^\circ = -2E_1^\circ + E_2^\circ$$

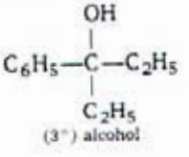
$$E_3^\circ = \frac{(-0.447 \times 2) + 0.771}{3} = -0.041\ V$$

$$\Delta G^\circ = -nFE^\circ$$

$$\Delta G^\circ = -3 \times 96485 \times (-0.041\ V)$$

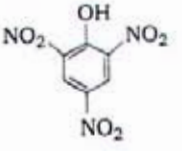
$$\Delta G^\circ = +11867.65\ J\ mol^{-1} = +11.87\ kJ\ mol^{-1}$$

2. $C_6H_5\overset{\overset{O}{\|}}{C}-OCH_3 \xrightarrow[\text{(ii) } H^+/H_2O \text{ (hydrolysis)}]{\text{(i) } C_2H_5MgBr \text{ (2 mol)}}$



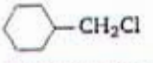
Note Firstly ketone $C_6H_5\overset{\overset{O}{\|}}{C}-C_2H_5$ is produced which on further reaction with C_2H_5MgBr gives tertiary alcohol.

3. Picric acid

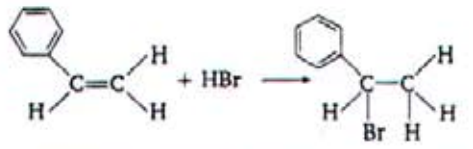


do not contain carboxylic acid group.

4. Acetophenone gives aldol condensation reaction. Benzaldehyde, benzophenone and trichloroacetaldehyde do not contain α-H atoms. Hence, do not undergo aldol condensation.

5.  $-CH_2Cl$

is a primary halide and therefore undergoes S_N2 reaction faster among the given.

6. 

(Addition of hydrogen halide to give alkene takes place in accordance with Markownikoff's rule).

7. In general easily liquefiable gases (with higher critical temperatures) are readily adsorbed, so NH_3 is adsorbed to a larger extent on charcoal.

8. **Anode half reaction**

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

Cathode half reaction

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

NaCl is added to precipitate Ag^+ and AgCl, thus

$$E_{cell} = E^\circ_{cell} - \frac{0.0591}{n} \log \frac{[Ag^+][Cl^-]}{[Ag^+]}$$

$$E_{cell} = 0 - \frac{0.0591}{2} \log K_{sp}$$

$$\because [Ag^+] = 1 \text{ (Given)}]$$

$$0.29 \times 2 = -0.0591 \log K_{sp}$$

$$\log_{10} K_{sp} = -\frac{0.29 \times 2}{0.0591} = -4.906 \times 2$$

$$= -9.804$$

9. The half-cell reactions of the given cell are as

At anode

$$\frac{1}{2} H_2 \longrightarrow H^+ + e^-;\ E^\circ_1 = 0.00 \text{ V}$$

At cathode

$$Fe^{3+} + e^- \longrightarrow Fe^{2+};\ E^\circ_2 = 0.771 \text{ V}$$

Net reaction

$$Fe^{3+} + \frac{1}{2} H_2 \longrightarrow Fe^{2+} + H^+;\ E^\circ_{cell}$$

$$= 0.771 \text{ V} - 0.00 \text{ V} = 0.771 \text{ V}$$

From Nernst equation,

$$E_{cell} = E^\circ_{cell} - \frac{0.0591}{n} \log \frac{[Fe^{2+}][H^+]}{[Fe^{3+}] + pH_2^{1/2}}$$

$$0.830 = 0.771 - \frac{0.0591}{1} \log \left[\frac{Fe^{2+}}{Fe^{3+}}\right]$$

$$-\frac{0.059}{0.0591} = \log \frac{[Fe^{2+}]}{[Fe^{3+}]}$$

$$\therefore \quad \frac{[Fe^{2+}]}{[Fe^{3+}]} = \text{antilog } (-0.998) = 0.101$$

10. Rate constant, $k = 1.63 \times 10^{-4}$ $(\text{mol})^{-1/2}$ s^{-1}

For nth order reaction,

$$k = \frac{\text{Rate}}{(\text{conc.})^n} = \frac{\text{Conc.}}{\text{time}} \times \frac{1}{(\text{Conc.})^n}$$

SI units of concentration is mol L^{-1} and time is s.

Therefore, the units of k = $\text{mol}^{-1/2}$ s^{-1} cannot be possible.

11. LiH-Linear shape.

12. $p = K_H X$; Higher the value of K_H at a given pressure, the lower is the solubility of the gas in the liquid.

Therefore, the solubility of the given gases decreases in the order

$$C_2H_2 > CO_2 > O_2 > CO$$

13. Vapour pressurs, $\pi \propto bp\,(T)$

$$\therefore \quad \frac{\pi_1}{\pi_2} = \frac{T_1}{T_2}$$

$$\Rightarrow \quad \frac{760}{\pi_2} = \frac{240.3 \text{ K}}{306.4 \text{ K}}$$

$$\pi_2 = \frac{760 \times 306.4}{240.3} = 969 \text{ torr}$$

$\because \pi_2 > \pi_1$ that means more gases are present or NH_4Cl gets completely dissociated into ammonia gas.

14. Since, the plot of the reciprocal of the concentration of A *versus* time is a straight line. It indicates that the given reaction is of second order.

For a second order reaction, $t_{1/2} = \frac{1}{ka}$

$$20 \text{ (min)} = \frac{1}{k \times 1.0 \times 10^{-2} \text{ M}} \qquad \ldots(i)$$

$$t_{1/2} = \frac{1}{k \times 3.0 \times 10^{-3} \text{ M}} \qquad \ldots(ii)$$

$$\frac{20}{t_{1/2}} = \frac{1 \times 3.0 \times 10^{-3}}{1.0 \times 10^{-2} \times 1} = 66.66 \approx 67 \text{ ..in}$$

15. $Li^+ = 60$ pm, $K^+ = 133$ pm, $Mg^{2+} = 65$ pm, $Al^{3+} = 53.5$ pm

The correct increasing order of ionic radii is

$$Al^{3+} < Li^+ < Mg^{2+} < K^+$$

In general, on moving from left to right, the ionic radii decreases due to increased effective nuclear charge. On moving down a group, the number of shells increases and that's why ionic radii increase.

16. $\overset{0}{3Br_2} + 6CO_3^{2-} + 3H_2O \rightarrow 5Br^- + \overset{+5}{BrO_3^-} + 6HCO_3^-$

reduction

oxidation

In the given reaction, bromine is oxidised as well as reduced.

17. Volume strength = 5.6 × Normality

$$20 \text{ vol} = 5.6 \times \text{Normality}$$

$$\text{Normality} = 20/5.6 = 3.57 \text{ N}$$

18. $\underset{55.85g}{Fe(s)} + 2HCl\,(aq) \longrightarrow FeCl_2\,(aq) + \underset{1 \text{ mol}}{H_2(g)}$

$$n = \frac{50}{55.85} = 0.895 \text{ mol}$$

$$W = -nRT = -0.895 \times 8.314 \times 10^{-3} \times 298$$

$$= -2217.42 \times 10^{-3} = -2.2 \text{ kJ}$$

The reaction mixture does − 2.2 kJ of work driving back the atmosphere.

19. When zeolite is treated with hard water, the sodium ions are exchanged with Mg^{2+} and Ca^{2+} ions.

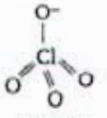
20. The thermal stability of alkaline earth metal carbonates increases down the group. Hence, decomposition temperature is lowest for $BeCO_3$.

$$\underset{523\text{ K}}{BeCO_3} < \underset{813\text{ K}}{MgCO_3} < \underset{1173\text{ K}}{CaCO_3} < \underset{1562\text{ K}}{SrCO_3} < \underset{1633\text{ K}}{BaCO_3}$$

21. $Fe(OH)_3$ is multimolecular colloid (positively charged sol).

22. All the given components of cement have property of setting quickly.

23.



ClO_4^- ion

In perchlorate ion, Cl is sp^3 hybridised therefore, all the four sigma bonds are $sp^3 - p$ bond.

24. The most stable electronic arrangement for outer electronic configuration is

25. Acidic strength of oxoacids of same halogen increases with increase in oxidation number of halogen atom.

$$\underset{(+1)}{HClO} < \underset{(+3)}{HClO_2} < \underset{(+5)}{HClO_3} < \underset{(+7)}{HClO_4}$$

26. Given, $i = 10$ A, $t = 965$ s

$$\therefore \quad Q = i \cdot t = 9650 \text{ C}$$

$$\underset{1 \text{ mol}}{HCl} \rightleftharpoons \underset{1 \text{ mol}}{H^+} + \underset{1 \text{ mol}}{Cl^-}$$

Moles of HCl = 1.0 × 1.0 = 1 mol

∵ 96500 C charge deposits H^+ = 1 mol

$$\therefore \quad 9650 \text{ C charge will deposite } H^+ = \frac{1 \times 9650}{96500}$$

$$= 0.1 \text{ mol}$$

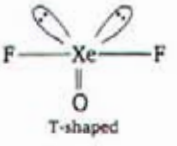
$$[H^+] = 0.1 \text{ mol/L}$$

$$pH = -\log [H^+] = -\log (0.1) = 1$$

27. Radius ratio, $\frac{r_+}{r_-} = \frac{0.95\,\text{Å}}{1.81\,\text{Å}} = 0.524$

Therefore, Na^+ ions prefer to occupy octahedral site (0.414 – 0.732).

28. In $XeOF_2$ molecule Xe is sp^3d hybridised. It has 3 *bp* and 2 *lp*.



T-shaped

29. In alkaline medium,

$$\overset{+7}{2KMnO_4} + 2KOH + H_2O \longrightarrow \overset{+4}{2MnO_2} + 4KOH + 3[O]$$

Decrease in oxidation number of

$$Mn = (+7) - (+4) = 3$$

So, eq. wt. of $KMnO_4 = \frac{\text{Mol. wt.}}{3}$

Note However, in strongly alkaline medium (rarely used) following conversion occurs.

$$2\,\overset{+7}{K}MnO_4 + 2KOH \longrightarrow 2K_2MnO_4 + H_2O + [O]$$

Change in oxidation number = 1

So, eq. wt. of $KMnO_4 = \frac{\text{Mol. wt.}}{1}$

30. In ionic solids stoichiometric defects are present as Frenkel and Schottky defects. However, large number of inorganic solids also contain non-stoichiometric defects.

31. EAN of Pt = $Z - ON + 2 \times L$

$$= 78 - (+4) + 2 \times 6 = 86$$

32. $[PtCl_2(NH_3)_4]Br_2$ and $[PtBr_2(NH_3)_4]Cl_2$ shows ionisation isomerism.

33. Yellow. The colour of the complex is complementary to that which is adsorbed.

34. In *ABAB* ..... pattern (hexagonal close packing, hcp) 74% space in the crystal is filled. Empty space = 100 − 74 = 26%.

35. $\underset{(1s^2, 2s^2, 2p^6, 3s^1)}{Na} \xrightarrow[\text{removal of } 3s e^-]{IE_1}$

$\underset{(1s^2, 2s^2, 2p^6)}{Na^+} \xrightarrow[\text{removal of } 2p e^-]{IE_2} \underset{(1s^2, 2s^2, 2p^5)}{Na^{2+}}$

unstable configuration

$\underset{(1s^2, 2s^2, 2p^6, 3s^2)}{Mg} \xrightarrow[\text{removal of } 3s e^-]{IE_1}$

stable configuration

$\underset{(1s^2, 2s^2, 2p^6 3s^1)}{Mg^+} \xrightarrow[\text{removal of second } 3s e^-]{IE_2} \underset{(1s^2, 2s^2\, 2p^6)}{Mg^{2+}}$

stable configuration

In case of sodium metal removal of 2nd electron takes place from 2*p* subshell which is more closer to nucleus and thus more energy is required to remove the electron, whereas removal of 2nd electron from magnesium takes place from 3s subshell.

$$\underset{(1s^2)}{He} \xrightarrow[\text{removal of } 1s^2 e^-]{IE_1} \underset{(1s^1)}{He^+} \xrightarrow[\text{removal of } 1s^1 e^-]{IE_2} \underset{(1s^0)}{He^{2+}}$$

Noble gases have the highest ionisation energies in their respective periods. In helium, removal of 2nd electron takes place from $1s^1$ subshell which is nearest to nucleus. Therefore, the increasing order of IE_2 (in kJ mol^{-1}) of these elements is as follows

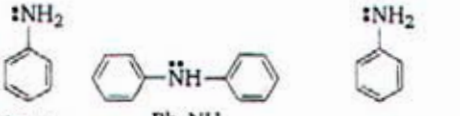
$$Mg < Na < He$$

36. Gelatin is a negatively charged sol. In the coagulation of a negative sol, Al^{3+} is most effective. Because higher the charge on the coagulating ion, more is the coagulation.

37. The most important buffer in the blood consists of H_2CO_3 and HCO_3^-.

38. Zeise's salt, ferrocene and dibenzene chromium are examples of pi-bonded organometallic compounds. Tetraethyl lead is an example of sigma bonded organometallic compound.

39. *C* > *A* > *B*



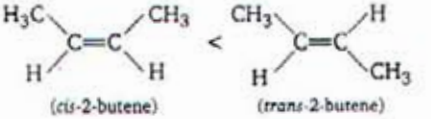
$PhNH_2$ (*A*) Ph_2NH (*B*) cyclohexylamine (*C*)

In diphenylamine, there are two electron withdrawing phenyl groups with *–I* effect while there is one such group in aniline. Therefore, diphenylamine is a weaker base than aniline which, in turn, is less basic than cyclohexyl amine in which the electron pair on nitrogen can be easily donated to a Lewis acid.

40. The heat of hydrogenation of an alkene is an index of its stability. The relative rate of hydrogenation decreases with increase of steric hindrance. Lower the heat of hydrogenation of an alkene, the more stable it is.

Trans-2-butene ($H_{hyd.}$ = 116 kJ mol^{-1}) is more stable than *cis*-2-butene ($\Delta H_{hyd.}$ = 120 kJ mol^{-1})

$H_2C{=}CH_2 < CH_3CH{=}CH_2 <$

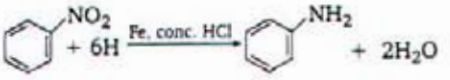


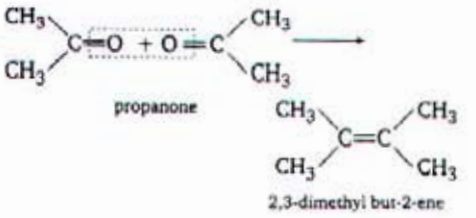
(*cis*-2-butene) (*trans*-2-butene)

41. I. cyanides on complete hydrolysis give either carboxylic acids or their salts.

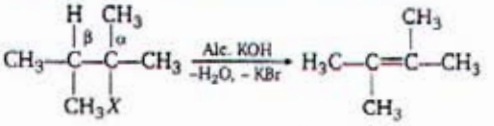
II. Olefins (alkenes) on hydration give alcohols (electrophilic addition mechanism).

III. Aldehydes, ketones, carboxylic acids can be reduced to alcohols.

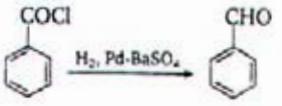
42. 

43. 

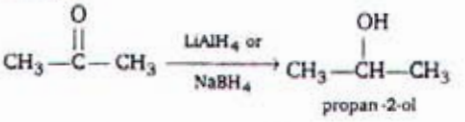
[Write the structures of propanone (products of ozonolysis) in such a way that their oxygen atoms pointing towards each other. Join the two ends through a double bond after removal of oxygen atoms to obtain structure of alkene].

44. 

The above reaction is an example of β-elimination.

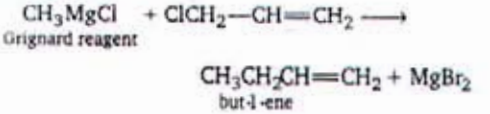
45. 

The above reaction is known as Rosenmund's reaction.

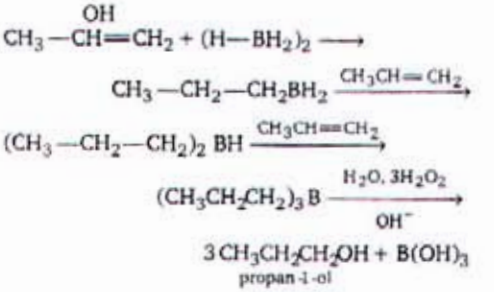
46. 

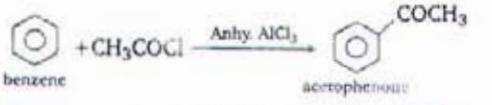
47. Grignard reagent readily reacts with compounds containing active hydrogen such as alcohols.

Unsaturated halides on reaction with Grignard reagent give alkens.



48. The compounds containing $CH_3-\overset{\overset{O}{\|}}{C}-$ and $CH_3-\overset{\overset{OH}{|}}{CH}-$ groups on heating with (*aq*) $NaOH + I_2$ gives iodoform test (yellow ppt of iodoform). Therefore, the compound, $C_6H_5-\underset{\underset{OH}{|}}{CH}-CH_3$ gives iodoform test.

49. 

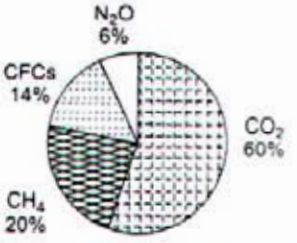
50. 

The reaction is known as Friedel-Crafts acylation reaction.

Biology

1. Although India has only 2.4 per cent of the world's land area, its share of the global species diversity is an impressive 8.1 per cent.
2. Hotspots are the areas that are extremely rich in species diversity, have high endemism and are under constant threat. Initially, the number of hot spots identified globally by ecologists is 25, with an approximate area of 1.4% of land. Subsequently, nine more have been added to the list, bringing the total number of biodiversity hot spots in the world to 34.
3. Kanha National Park is situated at Mandla and Balaghat, Madhya Pradesh. It is famous for tigers (*Panthera tigris*) and black buck (*Antelope cervicarpa*).
4. Loops of Henle lie in the renal medulla, where they join the collecting ducts.

5.



The above figure shows relative contribution of various greenhouse gases to the total global warming.

6. Ernst Haeckel (1866) called Baer's law as **Biogenetic law**. Biogenetic law states that 'Ontogeny (development of the embryo) is recapitulation of phylogeny (the ancestral sequence)'.

7. **Adaptive radiation** is a special evolutionary pattern characterised by rapid increase in the number of kinds of closely related species. It results in an evolutionary explosion of new species from a common ancestor. Darwin's finches represent one of the best examples of this phenomenon.

8. Permian period of Palaeozoic era is characterised by the rise of modern insects and land invertebrates, origin of primitive mammal like reptiles, evolution of conifers and decline of lycopods.

9. Miller (1953) set an experiment to test the Oparin-Haldane's theory. He created primitive atmosphere like conditions by sealing in a spark chamber, a mixture of water vapour (H_2O), methane (CH_4), ammonia (NH_3) and hydrogen gas (H_2). After eighteen days, significant amount of the simple major organic compounds (monomers), such as amino acids and peptide chains, began to appear in the aqueous sample of the experimental set.

10. **Xenografts** or **xenotransplants** involve transfer of tissue between different species. Pigs are currently the most suitable xenotransplant donors for humans.

11. In staggered cutting or cohesive end style or sticky end style cleavage, the cuts are made in two strands of DNA at two different sites few nucleotides away from each other, thus producing two strands with protruding ends. Enzymes *Eco* RI, *Hind* III, *Bam* HI, *Bgl* II, *Pst* I, etc, produce this type of ends.

12. On gel electrophoresis, the haemoglobin molecules of persons with sickle cell anaemia migrated at a different rate and thus, ended up at a different place on the gel, from the haemoglobin of normal persons.

13. Depending upon distance between any two genes which is inversely proportional to the strength of linkage, **non-crossovers** will vary from 50-100% (100% non-cross overs is a state where no crossing over takes place).

    The **crossovers** will similarly vary from 0-50% and will never exceed 50%.

14. In non-competitive inhibition, the inhibitor binds to an enzyme at a place other than substrate binding site. It results in destruction of enzyme activity. The substrate may combine with such an enzyme but product formation is inhibited. For example, DFP or di-isopropyl fluorophosphate (nerve gas) reacts with hydroxyl group of serine of acetylcholine-esterase. Inhibition of acetyl choline by DFP is an example of non-competitive irreversible inhibition.

15. In **co-dominance**, both the alleles of a pair express themselves fully in F_1 hybrid. The best example of co-dominance is seen in cattle. When cattle with red coat are crossed with the cattle having white coat, the F_1 hybrid possesses roan appearance.

16. A nucleotide is formed by the union of a phosphate group with a nucleoside. A nucleoside, infact, contains a sugar molecule along with an organic nitrogen base. Thus, a nucleotide contains an organic nitrogen base along with a sugar molecule and a phosphate group, *i. e.*,

    Nucleoside = Sugar molecule + organic nitrogenous base

    Nucleotide = Nucleoside + phosphate group.

17. Human insulin is a peptide hormone composed of 51 amino acids and has a molecular weight of 5805 Da (~6 Kda). In this molecule, there are two polypeptide chains (A and B) held together by disulphide bridge.

18. Oleic acid is a colourless, long chain, mono unsaturated 18-C fatty acid found in most animal fats and vegetable oils. It is a liquid at room temperature. Linoleic acid is a poly unsaturated N-6 fatty acid. It is also a colourless liquid at room temperature.

19. Carbohydrates supply energy at the physiological rate of 4 kcal/g (caloric value 4.1), fats are the source of energy with a physiological rate of 9 kcal/g (caloric value 9.45), while proteins may yield energy at 4.65 kcal/g caloric value or 4.0 kcal/g physiological fuel value.

20. At **tight junction** or **zonula occludens**, plasmalemmae of two cells fuse to form impermeable or occluding junctions, *e.g.*, epithelial cells or capillaries and brain cells.

21. The bone matrix has 60-70% mineral salts like calcium phosphate (main), calcium carbonate, magnesium phosphate, chloride and fluoride.

22. *Apis mellifera* is an exotic European bee and is the best species for commercial production of honey.

23. Ayreshire is a high performance breed of cattle (cow). Ghagus is a desi breed of poultry.

24. The falciform ligament connects the anterior abdominal wall and diaphragm to the liver.

25. Retinevne can exist in two forms, different in molecular shape, called *cis*-retinene and *trans*-retinene. In the dark *trans*-retinene changes into *cis*-retinene and joins opsin once more to form the rhodopsin.

26. The midbrain or mesencephalon consists of optic lobes and crura cerebri. In frog, there are two optic lobes (corpora bigemina) which are hollow but in man, there are four solid optic lobes lying behind the diencephalon. They collectively constitute the **corpora quadrigemina**.

27. An ectotherm (Greek *ectos* = outside, *thermos* = hot) is an organisms in which internal physiological sources of heat are of relatively small or quite negligible importance in controlling body temperature. Such animals (*e.g.*, frog) rely on environmental heat sources.

28. Lubb (S_1, first sound, systolic sound) is the first heart sound which is louder or low pitched, of long duration (0.16-0.19 seconds) and is produced due to closure of atrioventricular valves (tricuspid and bicuspid) during ventricular systole.

29. The Turner's syndrome is seen in a person due to the monosomy of one X-chromosome, *i. e.*, 45 chromosomes (22 pair autosomes + X-chromosome). The individual is phenotypically a female, characterised by short stature, webbed neck, underdeveloped breasts, small uterus and ovaries reduced to fibrous streaks. These females are sterile and menstruation does not seen in them. There is no sex-chromatin (Barr body) in these females.

30. Argentaffin cells are located in deep parts of principal (fundic) glands found in the fundus part of stomach. These cells secrete gastrin, motilin, serotonin, somatostatin, histamine and 5-hydroxytryptamine.

31. The saliva is a colourless, opalescent and sticky liquid produced by the salivary glands in the quantity about 1.5 dm^3 (cubic decimeter), *i.e.*, 1.5 L/ day.

32. Gastrin is one of the gastrointestinal polypeptide (GIP) hormones. It is secreted by the G-cells of intestinal wall and upper gastric wall. It stimulates the secretion of gastric juice and insulin.

33. The **Ampulla of Vater**, also known as the hepatopancreatic ampulla, is formed by the unionof the pancreatic duct and the common bile duct. It provides the common passage for bile and pancreatic juices.

34. Intestinal submucosa is a loose connective tissue layer which is richly supplied with blood and lymphatic blood vessels. This layer contains plexus of nerve cells and sympathetic nerve fibres called **Missiner's plexus** or **submucosal plexus**.

    The plexus having nerve cells and parasympathetic fibres, located in the muscularis externa is known as **Aurebach's** or **Myenteric plexus**.

35. In a muscle fibre, the thick filament constitutes mainly of myosin protein while the thin filament is composed of three different proteins actin, tropomyosin and troponin.

36. Gonorrhoea is a veneral bacterial disease caused by *Neisseria gonorrhoeae*. It spreads through sexual contact, common toilets and under clothes and also from infected mother to the newborn. The bacterium lives in genital tubes, produces pus-containing yellow discharge, pain around genitalia and burning sensation during urination.

37. Athlete's foot is a fungal disease caused by *Tinea pedis*. It is characterised by the sudden presence of peding and cracked skin between toes. Griseofulvin antibiotic is useful in this disease.

38. Hepatitis-B is caused by Hepatitis-B virus, an ortho-hepadnavirus that can cause both acute and chronic hepatitis.

39. IgE is present in mucous membranes, skin and lungs. It acts as a mediator in allergic response. It attaches to mast cells and basophils for releasing histamine and other substances that mediate hypersensitive response to allergens.

40. Gonorrhoea (caused by the bacterium *Neisseria gonorrhoeae*), chlamydiasis (caused by the bacterium *Chlamydia trachomatis*) and Hepatitis-B (caused by HBV, hepadnavirus) are sexually transmitted diseases (STDs).

41. The correct equation is

$$\frac{dN}{dt} = rN\left(1 - \frac{N}{K}\right)$$

where,

r = Intrinsic rate of increase of biotic potential

N = Number of individuals in the population

t = time

d = conventional mathematical symbol for instantaneous change

K = carrying capacity

42. **Kaposi's sarcoma** is a cancer that develops from the cells that line lymph or blood vessels (cancerous tumour of connective tissue) and is often associated with AIDS. It's a rare cancer that became a marker for AIDS/HIV patients.

43. **Tautonyms** are the scientific names with same generic and specific epithets, *e.g.*, *Ratus ratus*, *Catla catla*, etc. Tautonyms are not recognised by botanists, though, these are commonly used by zoologists.

44. The large sharks (*e.g.*, *Syllum*) commonly live in warm waters. They are characterised by sharp sight and smelling power, great muscular strength, agility, strong jaws with sharp acrodont teeth (modified placoid scales).

45. The ventral nerve cord in earthworm originated from the sub-pharyngeal ganglia and has fused pair of ganglia in each segment from the 5th to the last.

46. The **first maxillae** of cockroach has biramous structure with protopodite containing cardo as its basal portion along with stipes articulated at an angle of 90°. Stipes bear a five jointed exopodite or maxillary palp towards outside and endopodite towards inside, with two closely placed podomers called galea and lacinia.

47. *Limulus* or king crab is a large sized marine arthropod which represents a specialized group of chelicerate animals. It has remained almost unchanged since the last 200 million years. It is therefore, also called living fossil. Book gills serve the function of respiratory organs in *Limulus*.

48. In phylum–Porifera, nerves or nerve cells are completely absent.

49.

Common Name	Scientific Name	Belongs to
Devil fish	*Octopus*	Cephalopoda (Mollusca)
Dogfish	*Scoliodon*	Chondrichthyes (Pisces)
Silverfish	*Lepisma saccharina*	Insecta (Arthropoda)
Jellyfish	*Aurelia*	Scyphozoa (Coelenterata)

50. Biological magnification is the phenomenon where concentration of non-degradable pollutants gradually increases in oncoming organisms of higher trophic levels, *i.e.*, from herbivores to carnivores. Thus, if a water body is contaminated with a toxicant, its biomagnification will be more marked in birds which eat small fishes.

51. In plants, radial conduction of water takes place by ray parenchymatous cells.

52. Centrioles are minute submicroscopic, sub-cylindrical structures occurring in most animals cells but are absent in higher plants. These are required to form basal bodies, cilia, flagella and astral spindle poles.

53. The detailed structure of the membrane was studied only after the advent of the electron microscope in the 1950s.

54. The core of cilium or flagellum is called **axoneme** which possesses a number of microtubules running parallel to the long axis. The axoneme usually has nine pairs of doublets of radially arranged peripheral microtubules and a pair of centrally located microtubules. Such an arrangement of axonemal microtubules is referred to as the **9 + 2 array**.

55.

Type of Chromosome	Position of Centromere
Metacentric	Middle centromere forming two equal arms of chromosomes
Sub-metacentric	Centromere nearer to one end forming one shorter and one longer arm
Acrocentric	Centromere close to one end forming one extremely short and one very long arm
Telocentric	Terminal centromere

56. The duration of cell cycle can vary from organism to organism and also from cell type to cell type. For example, normal human cells in culture, divide once in approximately every 24 hours but yeast can progress through the cell cycle in only about 90 minutes.

57. During leptotene stage of prophase- I in meiosis I, the chromosomes become gradually visible under the light microscope. The compaction of chromosomes continues throughout leptotene.

58. Melvin Calvin born in Minnesota in April, 1911, received his Ph.D. in chemistry from the university of Minnesota. He served as Professor of Chemistry at the University of California, Berkeley.

59. The elements which are required by the plants in a very small amount (less than 10 m mole Kg^{-1} of dry matter) are called as micro elements or trace elements. These include iron, manganese, copper, molybdenum, zinc, boron, chlorine and nickel.

60. Phloem sap is mainly water and sucrose, but other sugars, hormones and amino acids are also transported (translocated) through phloem.

61. Transpiration pull results from the evaporationof water from the surfaces of cells in the leaves. This evaporation causes the surface of the water to recess into the pores of the cell wall. By capillary action the water forms concave menisci (meniscus = curved upper surface of a liquid in a tube) inside the pores. The high surface tension of water pulls the concavity outwards, generating enough force to lift water as high as 100-130 metres from ground level to a tree's highest branches.

62. When photosystem-II becomes excited, it splits a molecule of water to release oxygen, *i.e.*, photolysis of water takes pleace. Ions like manganese, chloride and calcium play an important role in splitting of water.

$$H_2O \xrightarrow[Ca^{+2}, Mn^{+2}, Cl^-]{\text{Light Energy} + P_{680}\ (PS\text{-}II)} 2H^+ + \frac{1}{2}O_2 + 2e^-$$

$\downarrow$

Passed to oxidised P_{680}

63. The overall reaction of photosynthesis is

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{light}} 6O_2 + 6H_2O + C_6H_{12}O_6$$

Hexose sugar

64. The net reaction of C_3-dark fixation of carbon dioxide (Calvin cycle) is

$$6RuBP + 6CO_2 + 18ATP + 12NADPH \longrightarrow 6RuBP + C_6H_{12}O_6 + 18ADP + 18P + 12NADP^+$$

65. When fats are the respiratory substrate, the value of R.Q. is less than one (0.7).

66. Gibberellic acid (GA_3) is used to speed up the malting process in brewing industry.

67. The term glycolysis has originated from the Greek words, *glycos* for sugar and *lysis* for splitting.

68. Banana (*Musa paradisiaca*) is vegetatively propagated by the root stock rhizomes.

69. Tapetum is the inner most layer of anther (microsporangium) wall and is generally comprised only a single layer of nutritive cells. It provides nourishment to the developing pollen grains.

70. In **xenogamy**, transfer of pollen grains from anther to the stigma of a different plant occurs. This is the only type of pollination, which brings genetically different types of pollen grains to the stigma.

71. Characters studied by Mendel are as follows

Characteristic	Chromosome Location	Parental Appearance	
		Dominant	Recessive
Length of stem	4	Tall	Dwarf
Shape of seed	7	Round	Wrinkled
Colour of seed	1	Yellow	Green
shape of pod	4	Inflated	Constricted
Colour of pod	5	Green	Yellow
Position of flower	4	Axial	Terminal
Colour of flower	1	Red/Violet	White

72. Francis Harry Compton Crick was born on 8th June 1916, at Northampton, England. He studied physics at University college, London and obtained a B.Sc. in 1937. He completed Ph.D in 1954 on a thesis entitled 'X-ray Diffraction : Polypeptides and proteins.'

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Colour of flower	1	Red/Violet	White

74. In the given dihybrid cross, phenotypes obtained in F_2 generation will be as follows

Yellow and round seeded plants = 9/16

Yellow and wrinkled seeded plants = 3/16

Green and round seeded plants = 3/16

Green and wrinkled seeded plants = 1/16.

75. The codon is triplet. 61 codons code for amino acids and 3 codons do not code for any amino acid, hence, they function as stop codons.

76. In genetic code, some amino acids are coded by more than one codon, hence, the code is **degenerate**.

77. The colour based contrasting traits in seven contrasting pairs studied by Mendel in pea were colour of seed (dominant yellow and recessive green), colour of pod (dominant green and recessive yellow) and colour of flower (dominant red/violet and recessive white).

78. Codons are always triplet, so out of 64 codons, the number of codons with GGG, is only one.

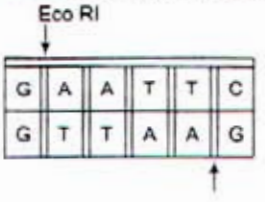
79. Black rot of crucifers is a seed borne as well as soil borne, bacterial disease caused by *Xanthomonas campestris*.

80. Pusa Komal is a crop variety of cowpea. It is resistant to bacterial blight.

81. Micro-organisms such as *Lactobacillus* an others commonly called Lactic Acid Bacteria (LAB) grow in milk and convert it to curd. It also improves its nutritional quality by increasing vitamin-B_{12}.

82. **Stanley Cohen** and **Herbert Boyer** isolated an antibiotic resistance gene by cutting out a piece of DNA from a plasmid which was responsible for conferring antibiotic resistance, in the year 1972.

83. Restriction enzyme *Eco* RI cuts the DNA between bases G and A (producing sticky ends) only when the sequence in DNA is GAATTC.



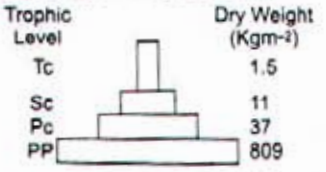
84. If the process of replication of DNA is repeated many times, the segment of DNA can be amplified to approximately a billion times, *i. e.*, 1 billion copies are made. Such repeated amplification is achieved by the use of a thermostable DNA polymerase.

85. A number of processes are involved in decomposition. They are grouped into three catagories, *i. e.*, fragmentation of detritus, catabolism and leaching. Decomposition leads

to the formation of two products humus and inorganic nutrients (minerals). Processes involved in their formation are called humification and mineralisation respectively.

86. Each trophic level in an ecosystem has a certain mass of living material (living biomass) at a particular time, called as the standing crop.

87. Pyramid of biomass shows a sharp decrease in biomass at higher trophic levels.



88. In order to control environmental pollution the Government of India has passed the **Environment** (Protection) **Act, 1986** to protect and improve the quality of our environment (air, water and soil).

89. A mere 0.1% impurities make domestic sewage unfit for human use. These impurities include suspended solids (*e.g.*, sand, silt and clay), colloidal material (*e.g.*, Faecal matter, bacteria, cloth and paper fibres) and dissolved materials *e.g.*, nutrients (nitrate, ammonia, phosphate, sodium, calcium, etc.).

90. Through biomagnification the concentration of DDT is increased at successive trophic levels; say if it starts at 0.003 parts per million (ppm) in water, it can ultimately reach 25 parts per million (ppm) in fish eating birds.

Water (DDT 0.003 ppm) ⟶ Zooplankton (DDT 0.04 ppm) ⟶
Small Fish (DDT 0.05 ppm) ⟶ Large fish (DDT 2 ppm) ⟶
Fish-eating birds (DDT 25 ppm)

91. Some organisms are tolerant of a wide range of salinities, these are called **euryhaline**. On the other hand, organisms which are restricted to a narrow range of salinity are called **stenohaline**.

92. Ernst Mayr, the Harward University evolutionary biologist, who has been called **The Darwin of the 20th century**, was one of the 100 greatest scientists of all time. He joined Harward's Faculty of Arts and Sciences in 1953 and retired in 1975, assuming the title *Alexander Agassiz Professor of Zoology Emeritus.*

93. The hierarchial arrangement of taxonomic categories in descending order is as follows

Kingdom ⟶ Phylum/Division ⟶ Class ⟶ Order ⟶ Family ⟶ Genus ⟶ Species.

94. Cocci (sing. coccus; Gr. *Kokkos* = berry) are the bacteria spherical or nearly spherical in shape.

95. The group **Chrysophytes** includes diatoms and golden **algae** (desmids). Diatoms are the chief producers in the oceans.

96. In Rhodophyceae (red algae), the photosynthetic pigments include chlorophyll-*a*, chlorophyll *d*, carotenoids and phycobilins (phycoerythrin, phycocyanin, allophycocyanin). Red colour is due to *r*-phycoerythrin.

97. When the margin of thalamus grows upward enclosing the ovary completely and getting fused with it and the other parts of the flower arise above the ovary, such flowers are called **epigynous flowers** and this type of ovary is said to be inferior, *e.g.*, flowers of guava and cucumber and the ray florets of sunflower.

98. In **marginal placentation**, the placenta forms a ridge along the ventral suture of the ovary and the ovules are borne on this ridge forming two rows, as in pea.

99. In *Cocos nucifera* (coconut), the epicarp is membranous, mesocarp is fibrous (hence, called fibrous drupe and yields coir) and the endocarp is stony.

100. Katherine Esau (1898-1997) dominated the field of plant biology upto the age of 99 years. She contributed mainly in the field of Anatomy of seed plants. The Anatomy of seed plants by K Esau was published in 1960.