शिव सेना
उद्धव बाळासाहेब ठाकरे

ANSWER KEY & SOLUTIONS
TO
NEET (UG) MOCK TEST
(Physics, Chemistry & Biology)

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Subjects : Physics, Chemistry & Biology

1. Answer key is provided to all the questions.
2. Solutions are provided for the questions, wherever required.

1. (D)

$I \propto A^2 n^2$

$\therefore \quad \frac{I_1}{I_2} = \left(\frac{A_1}{A_2}\right)^2 \left(\frac{n_1}{n_2}\right)^2$

$= \left(\frac{A}{2A}\right)^2 \left(\frac{4n}{n}\right)^2$

$= \frac{16}{4} = 4$

$\therefore \quad I_2 = \frac{I_1}{4}$

2. (D)

Nickel is a ferromagnetic material which means it exhibits spontaneous magnetization below Curie temperature. Above the Curie temperature, Nickel becomes paramagnetic because the thermal energy overcomes the magnetic interactions between the atoms in Nickel, thus, causing the magnetic domains to align randomly.

3. (B)

Condition of photoemission: $\lambda < \lambda_0$ and $\lambda_{UV} < 5000\ \text{Å} < \lambda_{IR}$

Hence, the radiation should be ultraviolet.

Also, given $\frac{n}{t} = 1.25 \times 10^{20}$

Power (P) = $\frac{nhc}{\lambda t}$

$\therefore \quad P = \frac{nhc}{\lambda t}$

$= \frac{1.25\times10^{20}\times20\times10^{-26}}{5000\times10^{-10}}$

$= 50\ \text{W}$

4. (A)

$\lambda = \frac{hc}{E} = \frac{hc}{40\times10^3 e} = \frac{1240\times10^{-9}}{35\times10^3}\ \text{m}$

$= 3.54 \times 10^{-11}\ \text{m}$

5. (C)

As $\mu_3 > \mu_1$, the part of lens in μ_3 behaves as a divergent lens. While the upper part (placed in μ_2) behaves as convergent lens.

6. (B)

$\Delta v / v = \Delta d / d + \Delta t / t$

Where:

v is the speed,

d = 28.0 m, Δd = 0.4 m (error in distance),

t = 3.5 s, Δt = 0.2 s (error in time).

$\Delta d / d = 0.4 / 28.0 = 0.01429$

$\Delta t / t = 0.2 / 3.5 = 0.05714$

$\Delta v / v = 0.01429 + 0.05714 = 0.07143$

$\Delta v = v\ (\Delta v / v) = (8.0)\ (0.07143) = 0.5714\ \text{m/s} \approx 0.6\ \text{m/s}$

$\therefore$ Speed = 8.0 ± 0.6 m/s

7. (A)
When white light is used, central fringe will be white with red edges and on either side of it, we shall get few coloured bands and then uniform illumination.

8. (B)
The given nuclear reaction is given by the equation
$^{22}_{10}Ne \rightarrow {}^{4}_{2}He + {}^{4}_{2}He + {}^{A}_{Z}X$
Since the atomic number is conserved, we have,
$10 = 2 + 2 + Z$ or $Z = 6$
The carbon nucleus has atomic number 6.

9. (A)
If n capacitors each of same capacitance C are connected in parallel, then equivalent capacitance is $C_P = nC$.
$C_{max} = 3 \times 4\mu F = 12\ \mu F$,
If n capacitors each of same capacitance C are connected in series, then equivalent capacitance of combination is $C_S = (C/n)$

$$C_{min} = \frac{4\mu F}{3} = 1.33\ \mu f$$

10. (C)
$B_y = 2 \times 10^{-7} \sin(\pi \times 10^3 x + 3\pi \times 10^{11} t)\ T$
General equation of magnetic field in a plane electromagnetic wave,
$B = B_0 \sin(kx + \omega t)$
$\therefore \quad k = \pi \times 10^3$
$\therefore \quad \frac{2\pi}{\lambda} = \pi \times 10^3 \ldots.(\because k = \frac{2\pi}{\lambda})$
$\therefore \quad \lambda = 2 \times 10^{-3}\ m$

11. (D)
If a.c. is produced by a generator having a large number of poles then its frequency

$$\nu = \frac{\text{Number of poles} \times \text{rotation per second}}{2}$$

$$= \frac{P \times n}{2}$$

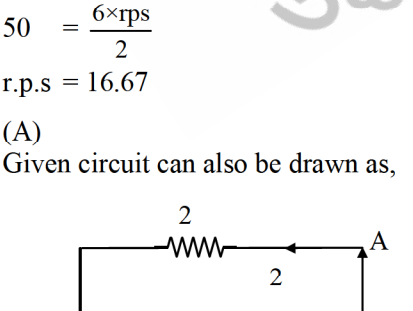
Where P is the number of poles; n is the rotational frequency of the coil.

$$\nu = \frac{\text{Number of poles} \times \text{rotation per second}}{2}$$

$$50 = \frac{6 \times rps}{2}$$

r.p.s = 16.67

12. (A)
Given circuit can also be drawn as,



By Kirchhoff's voltage law,

$V_A - (2 \times 2) - (3) - (2 \times 1) - V_B = 0$

$\therefore \quad V_A - 4 - 3 - 2 - V_B = 0$

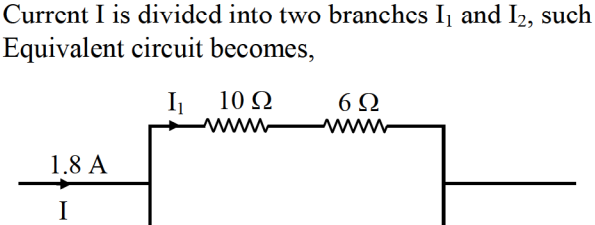
$\therefore \quad V_A - V_B = +9V$

13. (D)

There is no current through galvanometer.

$\therefore$ Current I is divided into two branches I_1 and I_2, such that $I = I_1 + I_2$ ....(i)

Equivalent circuit becomes,



Current I_1 flows through series resistor 16 Ω and current I_2 flows through series resistor 8 Ω. As resistors 16 Ω and 8 Ω are parallel to each other, voltage drop across them is same.

$\therefore \quad I_1 = \frac{V}{R_1} = \frac{V}{16}$ and $I_2 = \frac{V}{R_2} = \frac{V}{8}$

$\frac{I_1}{I_2} = \frac{V}{16}\frac{8}{V} = 0.5 \Rightarrow I_1 = 0.5\ I_2$

Substituting this value in equation (i),

$1.8 = 0.5\ I_2 + I_2$

$\therefore \quad 1.8 = 1.5\ I_2$

$\therefore \quad I_2 = \frac{1.8}{1.5} = \frac{6}{5} = 1.2$ A.

14. (D)

Using, $W = \frac{nR(T_i - T_f)}{\gamma - 1}$

$\therefore \quad 6R = \frac{R(T - T_f)}{\left(\frac{5}{3} - 1\right)}$ .... (Given: n = 1)

$\therefore \quad T_f = (T - 4)$ K

15. (C)

16. (D)

$\Delta Q = \Delta U + \Delta W = (U_f - U_i) + \Delta W$

$\therefore \quad -10 = (U_f - 25) - 15$

$\therefore \quad U_f = 30$ J

17. (C)

Equation of trajectory:

For oblique projectile motion,

$y = x \tan\theta - \frac{1}{2}\frac{gx^2}{u^2\cos^2\theta}$ for horizontal projectile motion, $y = \frac{1}{2}\frac{gx^2}{u^2}$

Both equations give parabolic path, but equation of trajectory for horizontal projectile motion is independent of angle of projection.

18. (D)

I. $U = -pE\cos\theta = -(3.84 \times 10^{-28})(6 \times 10^{5})\cos 0°$

$U = -3.84 \times 10^{-28} \times 6 \times 10^{5}$

$U \approx -2.3 \times 10^{-22}$ J

II. $U = -pE\cos\theta = -(3.84 \times 10^{-28})(6 \times 10^{5})\cos 60°$

$U = -3.84 \times 10^{-28} \times 6 \times 10^{5} \times 0.5$

$U = -1.15 \times 10^{-22}$ J

III. $U = -pE\cos\theta = -(3.84 \times 10^{-28})(6 \times 10^{5})\cos 180°$

$U = 2.3 \times 10^{-22}$ J

19. (B)

Zener diode regulates above zener breakdown voltage.

20. (D)

[Work] = [Kinetic energy]

= [Potential energy]

$= [ML^2T^{-2}]$

21. (A)

Angular velocity $\omega = \frac{d\theta}{dt} = \frac{d}{dt}\left(\frac{t^2}{8}+\frac{t}{4}\right)$

$= \frac{2t}{8}+\frac{1}{4}$

When t = 3 seconds then

$\omega = \frac{2\times3}{8}+\frac{1}{4} = 1$ rad/s

22. (B)

Maxwell's addition of the displacement current $\varepsilon_0\frac{\partial\vec{E}}{\partial t}$ completes Ampere's law, enabling it to describe situations with changing electric fields, such as in capacitors or EM wave propagation.

23. (D)

Gravitational potential is given as,

$V = \frac{-GM}{R}$

$\therefore \quad V = -GM\left[\frac{1}{1}+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+....+\infty\right]$

For M = 2 kg,

$V = -G \times 2\left[1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+....+\infty\right]$

$= -2G\frac{1}{\left(1-\frac{1}{2}\right)}$ .... $\left(\because \text{For an infinite GP } \text{Sum}=\frac{1^{st}\text{ term}}{1-\text{Common Ratio}}\right)$

$\therefore \quad V = -4G$

24. (C)

Given $i = e = \frac{4}{3}A = \frac{4}{3}\times 60 = 80°$

In the position of minimum deviation

$2i = A + \delta_m$ or $\delta_m = 2i - A = 160° - 60° = 100°$

25. (A)

$F - Mg = Ma$

$\therefore$ $28000 - 20000 = 2000\ a$

$\therefore$ $8000 = 2000a$

$\therefore$ $a = 4\ m/s^2$

$\therefore$ Apparent weight > actual weight

$\therefore$ Acceleration is $4\ m\ s^{-2}$ upwards

26. (D)

$$F = -\frac{mv^2}{r} = \frac{-\alpha e^{-b}}{r^2}$$

$\therefore$ $-mv^2 = \frac{-\alpha e^{-b}}{r}$ (–ve sign indicates attractive force)

$\therefore$ $\frac{1}{2}mv^2 = \frac{+\alpha e^{-b}}{2r} = K.E.$

$\therefore$ $T.E. = -K.E.$

$\therefore$ $T.E. = \frac{-\alpha e^{-b}}{2r}$

27. (C)

Given;

$m = 2kg$ (mass attached to the spring),

$k = 300\ N/m$ (spring constant).

$$T = 2\pi\sqrt{\frac{m}{k}}$$

$$T = 2\pi\sqrt{\frac{2}{300}} = 2\pi\sqrt{\frac{1}{150}}$$

$T = 2\pi\ (1/12.247) \approx 2 \times 3.1416 \times 0.0817$

$T = 0.513\ s \approx 0.5\ s$

28. (B)

The Assertion is True because an AND gate can be built using a CE transistor configuration.

The reason is true.

The Reason is not a correct explanation for the Assertion because the phase difference is not essential or typically considered for the function of a logic gate like AND, which operates on binary signals rather than AC signals requiring phase analysis.

29. (C)

The slope of a displacement-time graph gives the velocity of the particle.

In the given graph the slope of the displacement-time graph of particle (i) is increasing with time, therefore its velocity is increasing with time. This implies a uniform acceleration. In the case of particle (ii), the slope is decreasing with time. This implies that the velocity is decreasing with time, which means uniform retardations.

So, the correct option is (3) particle (i) is having a uniformly accelerated motion while particle (ii) is having a uniformly retarded motion.

30. (C)

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

$\therefore$ $\frac{1}{20} = (1.5 - 1)\left(\frac{2}{R}\right)$

$\therefore$ $R = 20$ cm

The rays refracted at the unsilvered face will be incident on silvered face. So virtual image formed by the lens is at the centre of curvature of the silvered face. As $R = 20$ cm

$\therefore$ $v = -20$ cm

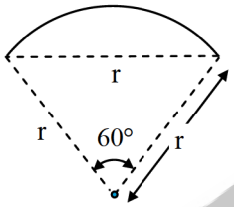
$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow -\frac{1}{20} - \frac{1}{u} = \frac{1}{20}$$

$u = -10$ cm (Negative is for sign convention)

31. (B)

$$L = \frac{\pi}{3} \times r$$

$\therefore$ $r = \frac{3L}{\pi}$



$$M' = m \times r = m\left(\frac{3L}{\pi}\right)$$

$$= \frac{3M}{\pi} \quad [\because M = mL]$$

32. (A)

The Assertion is True because an object can have acceleration (due to direction change) even with constant speed, as in circular motion.

The Reason is True because centripetal acceleration occurs in circular motion, even with constant speed, and it directly explains why the object has acceleration despite constant speed. Therefore, the Reason is a correct explanation for the Assertion, as it provides the specific mechanism (centripetal acceleration in circular motion) that supports the Assertion.

33. (C)

Vaporization occurs at a constant temperature (the boiling point) and constant pressure (e.g., standard atmospheric pressure or another fixed pressure), where the energy supplied is used to change the phase without changing the temperature.

34. (B)

If two drops of same radii r coalesce then radius of new drop is given by R

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

$\Rightarrow R^3 = 2r^3$

$\Rightarrow R = 2^{1/3}r$

If drop of radius r is falling in viscous medium then it acquires a critical velocity v and $v \alpha r^2$

$$\frac{v_2}{v_1} = \left(\frac{R}{r}\right)^2 = \left(\frac{2^{1/3}r}{r}\right)^2$$

$\Rightarrow v_2 = 2^{2/3} \times v_1 = 2^{2/3} \times (9) = 14.28$ cm/s

35. (C)

Transition A ($n = \infty$ to 1) : Series limit of Lyman series,

Transition B ($n = 5$ to $n = 2$) : Third spectral line of Balmer series,

Transition C ($n = 5$ to $n = 3$) : Second spectral line of Paschen series.

36. (D)

Consider two bodies A and B having head on elastic collision:

Condition	Result	Inference
$m_1 = m_2$	$v_1 = u_2$ $v_2 = u_1$	A and B will exchange their velocities

37. (B)

$E = E_0 \sin\omega t$

$E = 110 \sin\frac{\pi}{6}$

$I = I_0 \sin\omega t$

$I = 90 \sin\frac{\pi}{6}$

$E_0 = 110$ V, $I_0 = 90$ A

$P_{inst} = E_0 I_0 \sin^2\omega t$

$P_{inst} = 110 \times 90 \times \sin^2\frac{\pi}{6}$

$P_{inst} = 110 \times 90 \times \left(\frac{1}{2}\right)^2 = \frac{110 \times 90}{4}$

$P = 2475$ W

$P \approx 2.5$ kW

38. (A)

$q = (\phi_2 - \phi_1)\varepsilon_0 = (12 - 15) \times 10^5 \times 8.85 \times 10^{-12}$

$= -2.65 \times 10^{-7}$ C

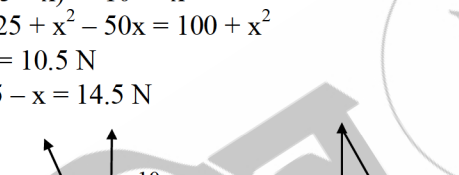
39. (A)

$(25 - x)^2 = 10^2 + x^2$

$625 + x^2 - 50x = 100 + x^2$

$\therefore$ $x = 10.5$ N

$\therefore$ $25 - x = 14.5$ N



40. (A)

Strain = $\alpha\Delta T$

Stress = $Y\alpha\Delta T$

$\therefore$ Stress is independent of L.

41. (B)

For a resonance tube experiment, difference between lengths of column for two successive resonances is given by,

$L_{n+1} - L_n = \frac{\lambda}{2} = \frac{v}{2n}$

$\therefore$ $v = 2n(L_{n+1} - L_n)$

$= 2 \times 320 \times (0.73 - 0.20) = 339.2$ m/s

42. (D)

As, the loop is pulled out uniformly,

$\therefore$ speed of the loop, $v = \frac{l}{t} = \frac{2}{4} = 0.5$ m/s

Induced e.m.f, $e = Blv = 0.3 \times 2 \times 0.5 = 0.3$ v

$\therefore$ current in the loop, $i = \frac{e}{R} = \frac{0.3}{10} = 3 \times 10^{-2}$ A

Due to the induced current, the left arm experiences a magnetic force towards left.

$F_{mag} = Bil = 0.3 \times 3 \times 10^{-2} \times 2 = 1.8 \times 10^{-2}$ N

Hence, to pull the loop uniformly an external force of 1.8×10^{-2} N must be applied towards right.

$\therefore$ Work done, $W = F_m l = (1.8 \times 10^{-2})\ (2) = 3.6 \times 10^{-2}$ J

43. (D)

$V = V_1 + V_2$

$= \frac{1}{4\pi\varepsilon_0}\left(\frac{q_1}{6\times10^{-2}} + \frac{q_2}{4\times10^{-2}}\right)$

$= 9 \times 10^9\left(\frac{12\times10^{-9}}{6\times10^{-2}} + \frac{-12\times10^{-9}}{4\times10^{-2}}\right)$

$= 9 \times 10^9 \times 10^{-7}\ (2 - 3)$

$= -900$ V.

44. (B)

For metals, resistance increases linearly with temperature and for intrinsic semiconductors, resistance decreases exponentially with rise in temperature.

45. (C)

No force acts in cases except (C).

46. (D)

Since $\Delta n = 0$, the state of equilibrium is not effected by the change in pressure.

47. (D)

48. (D)

Complex ion	Hybridization of central metal ion
$[Fe(CN)_6]^{4-}$	d^2sp^3 (inner)
$[Mn(CN)_6]^{4-}$	d^2sp^3 (inner)
$[Co(NH_3)_6]^{3+}$	d^2sp^3 (inner)
$[Ni(NH_3)_6]^{2+}$	sp^3d^2 (outer)

49. (A)

50. (A)

51. (D)

52. (B)

Enthalpy change can be calculated as follows:

$CH_3COOH + OH^- \rightarrow CH_3COO^- + H_2O + q_1/2$

$-\quad H^+ + OH^- \rightarrow H_2O + q_2/2$

$CH_3COOH \longrightarrow CH_3COO^- + H^+ + \frac{q_1}{2} - \frac{q_2}{2}$

$\Delta H = \left(\frac{q_2}{2} - \frac{q_1}{2}\right) = -\left(\frac{q_1 - q_2}{2}\right)$

53. (C)

Approximate % of phosphorus $= \frac{m}{w} \times 28$

$= \frac{3.465}{2.5} \times 28 = 38.808 \approx 38.81\ \%$

54. (C)

Reaction A has lower energy of activation and greater difference in enthalpy of reactants and products as compared to reaction B.

55. (A)

$$\underset{\text{Bromopropane}}{C_3H_7Br} + KCN \xrightarrow{\text{boil}} \underset{\text{Butanenitrile}}{C_3H_7CN} + KBr$$

56. (C)

ΔT_b = elevation of boiling point

= (385.0 – 383.8) K = 1.2 K

$\Delta T_b = K_b \frac{W_B}{M_B W_A}$; $1.2 = 3.4 \frac{2.5}{M_B \times 100 \times 10^{-3}}$

$\therefore \quad M_B = \frac{3.4 \times 2.5}{1.2 \times 100 \times 10^{-3}} = 70.83\ g\ mol^{-1} \approx 71\ g\ mol^{-1}$

Hence, molar mass of the solute = 71 g mol^{-1}

57. (A)

(I) n = 4, l = 1 4p-orbital
(II) n = 4, l = 0 4s-orbital
(III) n = 3, l = 2 3d-orbital
(IV) n = 3, l = 1 3p-orbital

Hence, the correct order of increasing energy is: 3p < 4s < 3d < 4p

58. (A)

59. (D)

The product 'X' obtained is known as methyl orange which is generally used in acid base titration as an indicator.

Dimethylaniline — Sodium salt of p-Azobenzenesulphonate — Methyl orange (X)

60. (D)

Compound	Formula	No. of ions in solution
Hexaamminecobalt (III) chloride	$[Co(NH_3)_6]Cl_3$	4
Pentaamminesulphatocobalt (III) chloride	$[Co(NH_3)_5(SO_4)]Cl$	2
Pentaamminechlorido cobalt(III) sulphate	$[Co(NH_3)_5Cl]SO_4$	2
Pentaamminechlorido cobalt(III) chloride	$[Co(NH_3)_5Cl]Cl_2$	3

61. (D)

62. (D)

63. (D)

$$\underset{\text{But-1-ene}}{2CH_3CH_2CH = CH_2} \xrightarrow[\text{peroxide}]{\text{HBr}} \underset{\text{1-Bromobutane}}{2CH_3CH_2CH_2CH_2Br} \xrightarrow[\text{dry ether}]{\text{Na}} \underset{\text{n-Octane}}{CH_3(CH_2)_6CH_3}$$

64. (A)

$\overset{0}{S_8}$, $\overset{+1\ -1}{S_2F_2}$, $\overset{+1\ -2}{H_2S}$

Here, Oxidation number of S in S_8, S_2F_2 and H_2S respectively are 0, +1 and –2.

65. (A)

$$Na_2SO_{3(s)} + H_2SO_{4(aq)} \longrightarrow SO_{2(g)} + Na_2SO_{4(aq)} + H_2O_{(l)}$$

$$\underset{[X]}{SO^{2-}_{3(aq)}} + 2H^+_{(aq)} \longrightarrow \underset{[Y]}{SO_{2(g)}} + H_2O_{(l)}$$

SO_2 is a colourless, suffocating gas.

$$3\underset{[Y]}{SO_{2(g)}} + K_2Cr_2O_7 + H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O$$

Green colour of solution is due to formation of $Cr_2(SO_4)_3$.

66. (B)

In the overall reaction, $\overset{+3}{C_2}O_4^{2-} \longrightarrow \overset{+4}{CO_2}$

67. (B)

$$E_{M^{2+}/M} = E^\circ_{M^{2+}/M} - \frac{0.059}{2} \log \frac{1}{[M^{2+}]}$$

$$E_{M^{2+}/M} = E^\circ_{M^{2+}/M} + \frac{0.059}{2} \log [M^{2+}]$$

This is same as straight line equation $y = mx + c$;

c intercept = $E^\circ_{M^{2+}/M}$, slope is positive,

$$m = \frac{0.059}{2}$$

68. (B)

69. (A)

Empirical formula = CH_2O

Empirical formula mass = $12 \times 1 + 2 \times 1 + 16 \times 1 = 30$ g

Molecular mass = 270 g

Molecular formula = n × empirical formula … (1)

$$n = \frac{\text{Molecular mass}}{\text{Empirical formula mass}}$$

$$n = \frac{270}{30} = 9$$

∴ Substituting the value of n in equation (1),

Molecular formula of CH_2O = 9 × empirical formula

= 9 × CH_2O

= $C_9H_{18}O_9$

70. (C)

Integrated rate law for zero order reaction is,

$$k = \frac{[A]_0 - [A]_t}{t}$$

t = 48 min = 0.8 hr

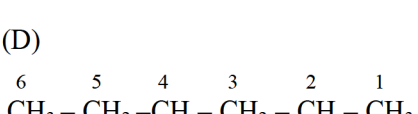
$$\therefore \quad 0.3 = \frac{[A]_0 - 0.05}{0.8}$$

$[A]_0 = 0.29$ mol dm^{-3}

71. (B)
The rate of reactivity of alcohols towards Lucas reagent is 3° > 2° > 1°.

72. (C)
For process A:
$\Delta U = q + w$
$= 54 - 238 = -184$ J
∴ Internal energy of the system decreases.

73. (D)



4-Ethyl-2-methylhexane

74. (A)
11.1 % (w/v) $CaCl_2$ solution means 100 mL of solution contains 11.1 g of $CaCl_2$.
10.6 % (w/v) Na_2CO_3 solution means 100 mL of solution contains 10.6 g of Na_2CO_3.

	$CaCl_2$	+ Na_2CO_3	⟶	$CaCO_3\downarrow$	+ 2NaCl
In 100 mL	11.1 g	10.6 g		-	-
In 1L	111 g	106 g		-	-
	≡ 1 mol	≡ 1 mol			
In 50 mL	0.05 mol	0.05 mol		0.05 mol	-

When 0.05 mol of $CaCl_2$ reacts with 0.05 mol of Na_2CO_3, 0.05 mol of $CaCO_3$ is formed.
∴ The mass of the precipitate formed $= 0.05 \text{ mol} \times 100 \text{ g mol}^{-1} = 5$ g

75. (D)

76. (D)

Complex	Oxidation state of metal	Number of unpaired electrons
$[MnCl_4]^{2-}$	+ 2	5
$[CoCl_4]^{2-}$	+ 2	3
$[NiCl_4]^{2-}$	+ 2	2
$[ZnCl_4]^{2-}$	+ 2	0

77. (C)
Halogens shows –I effect, –I effect of Br < F. As the distance from –COOH group increases, the effect gradually decreases. Strength of the acid decreases in the order CH_3CH FCOOH > FCH_2CH_2COOH > $CH_3CHBrCOOH$ > $BrCH_2CH_2COOH$. Thus, $BrCH_2CH_2COOH$ has smallest dissociation constant.

78. (B)
Lysine $NH_2 - (CH_2)_4 - \underset{\underset{COOH}{|}}{CH} - NH_2$ is a basic amino acid.

79. (C)
Purple colour of $KMnO_4$ results from the transfer of an electron from oxygen (ligand L) to Mn (metal M).

80. (A)

$\nu = 5\ \text{GHz} = 5 \times 10^9\ \text{s}^{-1}$

$c = \nu\lambda$

$\therefore \quad \lambda = \frac{3.0\times10^8\ \text{m s}^{-1}}{5\times10^9\ \text{s}^{-1}}$

$\lambda = 0.06\ \text{m} = 6\ \text{cm}$

81. (B)

i. Size of cation is always smaller while that of an anion is always bigger than the neutral atom i.e., $I^+ < I < I^-$.

ii. Atomic radii decrease from left to right in a period due to higher nuclear charge therefore, N has higher atomic radius than O. N and O belongs to 2nd period and P belongs to 3rd period so atomic radii of N and O is less than P. Hence, overall increasing atomic radii is N < O < P.

iii. Among isoelectronic species, the anion with higher negative charge is larger in size.

iv. Li, Be and B all belong to 2nd period. Atomic size decreases as nuclear charge increases. Therefore, order is Li < Be < B.

82. (D)

K_w increases with increase in temperature as it is an equilibrium constant.

83. (D)

$\wedge_m^\circ = \lambda^\circ_{\left(\left[COO^-\right]_2\right)} + \lambda^\circ_{(K^+)} + \lambda^\circ_{(Na^+)}$

$= 148.2 + 73.5 + 50.1$

$= 271.8\ \text{S cm}^2\ \text{mol}^{-1}$

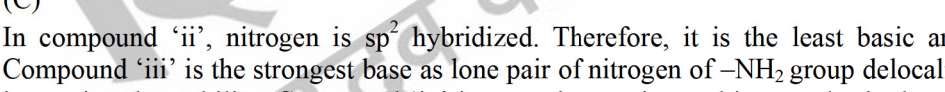
$\therefore$ Equivalent conductivity at infinite dilution,

$\wedge_e^\circ = \frac{\wedge_m^\circ}{\text{valency}} = \frac{271.8}{2}$

$= 135.9\ \text{S cm}^2\ \text{eq}^{-1}$

84. (C)

In compound 'ii', nitrogen is sp^2 hybridized. Therefore, it is the least basic among given compounds. Compound 'iii' is the strongest base as lone pair of nitrogen of $-NH_2$ group delocalizes in resonance thereby increasing the stability. Compound 'iv' is secondary amine and is more basic than compound 'i' which is a primary amine. Hence, the increasing order of basicity is,



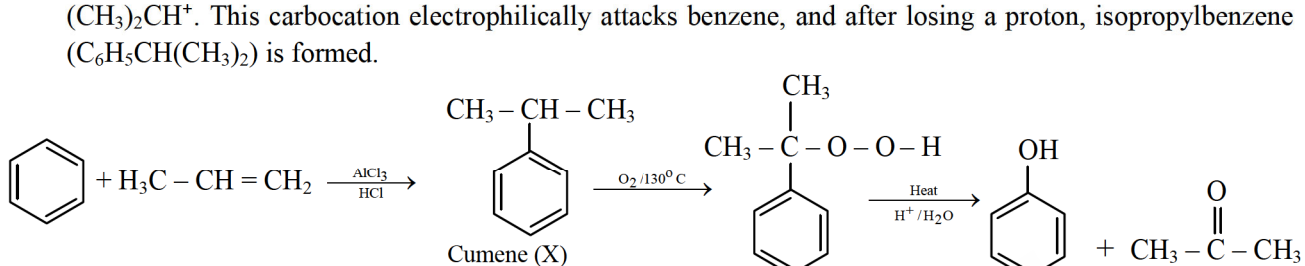
ii. i. iv. iii.

85. (B)

Molecule	Geometry	Bond angle
SF_6	octahedral	90°
CCl_4	tetrahedral	109.5°
BCl_3	trigonal planar	120°
$BeCl_2$	linear	180°

86. (A)

Propylene ($CH_3 - CH = CH_2$) is protonated by an acid catalyst HCl, forming a stable secondary carbocation, $(CH_3)_2CH^+$. This carbocation electrophilically attacks benzene, and after losing a proton, isopropylbenzene ($C_6H_5CH(CH_3)_2$) is formed.



Cumene (X) (or Isopropyl benzene) | Cumene hydroperoxide (Y) | Phenol | Acetone (Z)

87. (B)

$CaF_{2(s)} \rightleftharpoons \underset{S}{Ca^{2+}_{(aq)}} + \underset{2S}{2F^-_{(aq)}}$

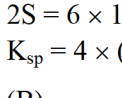
$K_{sp} = [Ca^{2+}][F^-]^2 = S \times (2S)^2 = 4S^3$

Now, $[F^-] = 6 \times 10^{-4}$ M

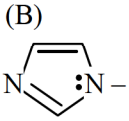
$\therefore$ $2S = 6 \times 10^{-4} \Rightarrow S = 3 \times 10^{-4}$ M

$\therefore$ $K_{sp} = 4 \times (3 \times 10^{-4})^3 = 4 \times 27 \times 10^{-12} = 1.08 \times 10^{-10}$

88. (B)



Imidazole contains 6π electrons and therefore, obeys the Huckel's rule, where n = 1. Thus, aromatic.



Cyclobutenyl dication contains 2π electrons (n = 0) and it is planar. 2π-electrons are in resonance or delocalisation with two positive charges. Thus, aromatic.

89. (C)

$\Delta H = -525$ kJ mol^{-1}

$\Delta S = -35$ kJ mol^{-1} K^{-1}

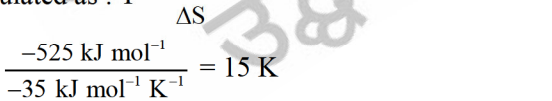
Since, both ΔH and ΔS are negative, the reaction will be spontaneous at lower temperatures.

The temperature at which change over between spontaneous and non-spontaneous behaviour occurs is calculated as : $T = \frac{\Delta H}{\Delta S}$

$\therefore$ $T = \frac{-525 \text{ kJ mol}^{-1}}{-35 \text{ kJ mol}^{-1} \text{ K}^{-1}} = 15$ K

Thus, the given reaction is spontaneous below 15 K.

90. (D)



3-Methylpent-2-ene | 2-Bromo-3-methylpentane (Anti-Markovnikov's product)

Four stereoisomers are possible due to the presence of 2 chiral centres in the addition product.

91. (A)

Dedifferentiation is the process in which differentiated cells regain division capacity under certain conditions.

92. (D)

93. (B)
Ovulation occurs around the 14th day of the menstrual cycle, which is counted from the first day of menstruation. If menses begin on April 5th in a normally menstruating person the next ovulation is expected around April 18th.

94. (B)

95. (B)

96. (B)

97. (C)
As amount of guanine is 19%, thus the amount of cytosine has to be 19% because in a DNA molecule, guanine always pairs with cytosine.

98. (B)

99. (A)

100. (D)
The cranial capacity steadily increased from early ancestors of human to modern man. *Homo habilis* had cranial capacity of about 650-800 cc.
Homo erectus had cranial capacity of around 900 cc. *Homo neanderthalensis* had cranial capacity of about 1400 cc and *Homo sapiens* has cranial capacity of about 1450 cc.

101. (D)

102. (B)

103. (B)

104. (D)

105. (B)

106. (A)
For multiplication of alien piece of DNA, it needs to be a part of chromosome which has specific sequence called – origin of replication.

107. (C)
Some of the organisms can fix atmospheric nitrogen in specialised cells called heterocysts e.g. *Nostoc* and *Anabaena.*
Karyogamy refers to fusion of two nuclei.
Organisms that depend on living plants are called primary consumers.

108. (D)
The given cross is dihybrid cross having ratio 9 : 3 : 3 : 1 in F2 generation. There are altogether 10 (i.e., 9+1) parental combinations and 6 (i.e., 3+3) non parental combinations. Since total individuals are 960, Number of offspring having parental combination = (10/16) × 960 = 600

109. (B)

110. (A)

111. (A)

112. (D)

113. (B)
Template: TAC GAC AAC CAC TTA ATT
mRNA: AUG CUG UUG GUG AAU UAA
t-RNA: UAC GAC AAC CAC UUA AUU

114. (A)

115. (C)

116. (B)

117. (A)

118. (B)
DCT is located in the cortex of kidney. In cortical nephrons, the loop of Henle is too short.

119. (C)

120. (B)
i. Higher the BOD higher is the pollution in water.
ii. Flocs are masses of bacteria associated with fungal filaments to form mesh like structures.

121. (B)

122. (A)
DNA-dependent RNA polymerase catalyses polymerization in the 5' → 3' direction.

123. (B)

124. (D)
Blood plasma contains red blood cells, white blood cells (lymphocytes) and platelets.
Serum = Blood plasma – Clotting factors Lymph does not normally contain any red blood cells.

125. (A)
i. DNA is negatively charged molecule and is loaded on the gel at the cathode (which is positive in electrolytic cell, that is used in gel electrophoresis), and forced to move towards the anode under an electric field through a matrix.
ii. DNA fragments travel along the surface of the gel whose concentration affects the movement of DNA.
iv. DNA can be visualized only after staining with ethidium bromide followed by exposure of UV radiation.

126. (C)

127. (C)
65 ovaries → 65 fruits
Total no. of seeds = Total no. of ovules
So, 65 ovaries, with 20 ovules per ovary
= (65 X 20) = 1300 ovules = 1300 seeds.

128. (A)

129. (B)

130. (A)

131. (A)

132. (C)
As new organisms are identified, they are classified according to binomial nomenclature.

133. (A)

134. (C)

135. (D)

136. (C)

137. (C)

138. (D)

139. (D)

140. (A)

141. (C)

142. (A)

143. (A)
ii. Annelids are coelomate organisms.
iii. Circulatory system in annelids is of closed type.

144. (B)
Phenotype of parents : Male × Female
Genotype : $I^A\ I^B \times I^A\ I^B$
Gametes : $(I^A)(I^B)\ (I^A)(I^B)$
Progeny :

	I^A	I^B
I^A	$I^A I^A$	$I^A I^B$
I^B	$I^A I^B$	$I^B I^B$

Therefore, the blood group of the children would be A, B and AB.

145. (A)
Oligodendrocytes form the myelin sheath around the axons in CNS, while the Schwann cells form the myelin sheath around the axons in PNS.

146. (B)

147. (D)
iii. Seedless fruits in grapes are formed due to parthenocarpy.
iv. The persistent nucellus is known as perisperm which is diploid.

148. (A)

149. (B)

150. (B)
Viruses that infect plants have single stranded RNA.

151. (B)

152. (D)

153. (C)

154. (D)

155. (B)

156. (A)

157. (C)
i – Kidney
ii – Fat bodies
iv – Cloaca

158. (B)
i. Adrenal medulla secretes the hormone adrenaline.
iv. Adrenaline increases the strength of heart contraction, heart beat and rate of respiration.

159. (D)

160. (B)

161. (B)

162. (B)

163. (A)
Founder effect: When section of population migrates to another place, the gene frequencies change in the original as well as in the new population. The change in allelic frequency is so different in the new sample of population that they become a different species. The original drifted population becomes founders and the effect is called founder effect.

164. (A)
The calyx whose sepals are fused is known as gamosepalous calyx.

165. (B)
ii. The differentiation of the ovum begins before meiosis is complete. As the primary oocyte enters meiosis I it gets arrested in prophase I. It resumes meiosis only at fertilization to complete meiosis II.
iv. Oogenesis is initiated during embryonic development.

166. (D)
ii. RNA can be removed by RNase enzyme.
iv. DNA can be precipitated by adding chilled ethanol.

167. (A)

168. (D)

169. (B)
Coralloid roots of *Cycas* shows blue green algae i.e. *Anabaena cycadae*.
Roots of *Pinus* show ectotrophic mycorrhiza i.e. symbiotic association of fungal hyphae with ultimate branches of *Pinus* roots.

170. (C)

171. (A)

172. (A)
Relaxation of diaphragm occurs during expiration, all others are seen during inspiration.

173. (A)

174. (D)

Grass	→	Lamb	→	Wolf	→	Tiger
(Producer)		(Primary consumer)		(Secondary consumer)		(Tertiary consumer)

175. (C)

176. (D)

177. (B)
Pelvic girdle consists of two coxal bones

178. (B)

179. (B)

180. (A)
Variation in terms of concentration and potency of the chemical reserpine in *Rauwolfia vomitoria* is an example of genetic diversity.