# ANSWER KEY

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<th>CHEMISTRY</th>
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1. (b) 
\[ a_{\text{avg}} = \frac{\Delta v}{\Delta t} = 2v \frac{v}{\pi R} = \frac{2v^2}{\pi R} \]

2. (a) 
Taking moment about A,
\[ mg \times \frac{l}{2} + mgl = I_A \alpha \]
\[ \alpha = \frac{3}{2} \frac{mgl}{m^2} + \frac{m}{3} \]
\[ \alpha = \frac{9g}{8l} \]

3. (d) 
\[ \vec{r} = \vec{r} \times \vec{F} = (-\hat{i} + \hat{j}) \times (-10\hat{k}) = -10\hat{i} - 10\hat{j} \]

4. (a) 
\[ v = \frac{ds}{dt} = 6t + 6 \]
\[ a_t = \frac{dv}{dt} = 6 \]
\[ a_c = \frac{v^2}{r} = \frac{12^2}{12} = 12 \]
\[ \Rightarrow a = \sqrt{a_c^2 + a_t^2} = 6\sqrt{5} \text{ m/s}^2 \]

5. (b) 
\[ I = m(0) + m\left(\frac{a}{2}\right)^2 + m\left(\frac{a}{2}\right)^2 \]
\[ I = \frac{ma^2}{2} \]

6. (c) 
Heat given = heat taken
\[ n_1 C_1 \Delta T = n_2 C_2 \Delta T \]
\[ \frac{1}{2}(3R)(T - 300) = \frac{5}{2}(5R)(300 - T) \]
\[ 6T - 1800 = 1550 - 5T \]
\[ \Rightarrow T = 304.54 \text{ K} = 31.5^\circ \text{C} \]

7. (c) 
\[ a = \frac{4g - 0.2(4g)}{8} = 4 \text{ m/s}^2 \]
\[ 4g - T = 4a \Rightarrow T = 24 \text{ N} \]

8. (b)

9. (c)

10. (c) 
Force constant of spring is inversely proportional to length of spring.

Time period of mass suspended from spring,
\[ T = 2\pi \sqrt{\frac{m}{k}} \] ... (i)
Now we know that,

spring constant $\propto \frac{1}{\text{length}}$

or $k \propto \frac{1}{x}$ ...(ii)

Since, spring is cut into four equal parts, hence force constant of each part becomes four times the previous, So $k' = 4k$

So, new time period of same mass suspended from one of the parts,

$$T' = 2\pi \sqrt{\frac{m}{4k}} = \frac{1}{2} \cdot 2\pi \sqrt{\frac{m}{k}} = \frac{T}{2}$$

11. (a)
   $$a = \omega^2 x$$
   $$\omega = \sqrt{2} \text{ rad/sec}$$

12. (d)

13. (c)
   $$K = F^2 v^2 T^2$$
   $\therefore x = y = z = 1$

14. (b)

15. (d)

   In series $R = R_1 + R_2 \Rightarrow \frac{2\ell}{\sigma A} = \frac{\ell}{\sigma_1 A} + \frac{\ell}{\sigma_2 A} \Rightarrow \frac{2}{\sigma} = \frac{1}{\sigma_1} + \frac{1}{\sigma_2}$

   so $\frac{2}{\sigma} = \frac{\sigma_1 + \sigma_2}{\sigma_1 \sigma_2}$

   so $\sigma = \frac{2\sigma_1 \sigma_2}{\sigma_1 + \sigma_2}$

16. (a)

   By KCL $\Rightarrow \frac{5-x}{1} + \frac{2-x}{1} + \frac{2-x}{1} = 0$

   $$3x = 9$$
   $$x = 3 \text{ Volt}$$

17. (c)

   $$V = i(G+R)$$
   or $24 = 3(G+7)$ or $G = 1\Omega$

18. (c)

   $$C_1 = \frac{(2K)\varepsilon_0 A}{2d}, \quad C_2 = \frac{(3K)\varepsilon_0 A}{d}, \quad C_3 = \frac{(6K)\varepsilon_0 A}{d}$$

   $$C_{eq} = \frac{3K\varepsilon_0 A}{d}$$

19. (a)

   because particle is at rest so force due to $B$ is zero

20. (c)

   because flux changes

21. (b)
B (at centre of solenoid) = \mu_0 n I
B \propto I, Current in C is half of current in A.

22. (d)
23. (b)
Resistance decreases
⇒ I ⇒ x

24. (c)
Enclosed area in P-V curve & it is clockwise i.e positive

25. (a)
On increasing temperature volume of iron block increases as well as density of water increases (2°C < 4°C)

26. (b)
P_A - P_B = \frac{3\rho\ell a}{2}
⇒ h = \frac{3\alpha\ell}{2g}

27. (a)
28. (b)
Convex lens show diverging nature in figure so that \mu < \mu_2

29. (a)
30. (a)
Focal length of plano-cancave lens comes to -1 m. hence power is -1 D

31. (c)
32. (c)
33. (c)
34. (b)
Potential drop across resistance X must be equal to emf of E_2.

35. (d)
Fringe width depends on wavelength of light only.

36. (a)
Radius is proportional to mass of the particle.

37. (d)
No change in flux due to motion of square loop.

38. (c)
Carbon rating

39. (a)
Momentum is inversely proportional to wavelength.

40. (a)
41. (a)
If the rate at which molecules of same mass having same rms velocity striking a wall decreases, then the rate at which momentum is imparted to the wall decreases. This results in lowering of pressure. Hence statement-2 is correct.

In statement-1 the rms velocity of gas remains same on increasing the volume of container by piston, since the given process is isothermal. Now the piston is at a greater distance from opposite wall and hence time taken by gas molecules from near the opposite wall to reach the piston will be more. Thus rate of molecules striking
the piston decreases. Hence statement-1 is correct and statement-2 is correct explanation.

42.  (d)

\[ V_{\text{rms}} = \sqrt[3]{\frac{3RT}{M}} \]

For different gases at same temp. have different molar mass so different \( V_{\text{rms}} \) and KE\(_{\text{avg}} = \frac{1}{2}mv^2 \).

So reason is false.

43.  (a)

44.  (d)

45.  (a)

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**CHEMISTRY**

46.  (b)

From the given relative abundance, the average weight of Fe can be calculated as –

\[ A = \frac{54 \times 5 + 56 \times 90 + 57 \times 5}{100} = 55.95 \]

47.  (b)

The balanced redox reaction is :

\[
3\text{MnO}_4^- + 5\text{FeC}_2\text{O}_4 + 24\text{H}^+ \rightarrow 3\text{Mn}^{2+} + 5\text{Fe}^{3+} + 10\text{CO}_2 + 12\text{H}_2\text{O}
\]

5 moles of FeC\(_2\)O\(_4\) require 3 moles of KMnO\(_4\)
1 moles of FeC\(_2\)O\(_4\) require \( \frac{3}{5} \) moles of KMnO\(_4\)

48.  (b)

Compressibility factor (Z) = \( \frac{V}{V_{\text{id}}} < 1 \) (given)

\[ = V < 22.4 \text{ L} \]

\[ = V_{\text{id}} (1 \text{ mol}) = 22.4 \text{ L at STP} \]

49.  (c)

Using the de-Broglie’s relationship :

\[ \lambda = \frac{\hbar}{mv} = \frac{6.625 \times 10^{-34}}{0.2 \times \frac{5}{60 \times 60}} = 2.3 \times 10^{-30} \text{ m} \]

50.  (a)

The number of radial nodes is given by expression \( (n - l - 1) \).

For 3s, number of nodes = \( 3 - 0 - 1 = 2 \)

For 2p, number of nodes = \( 2 - 1 - 1 = 0 \)

51.  (d)

First ionization energy of oxygen is less than that of nitrogen on the ground of stability of valence shell configuration, hence, (a) is the correct answer.

52.  (d)

53.  (a)

The bond order of CO = 3. NO\(^+\), CN\(^-\) and N\(_2\) are isoelectronic with CO, have the same bond order as CO.

NO\(^-(16e^-)\) has bond order of 2.

54.  (d)
55. (b) NaCN is basic salt, has highest pH while HCl has lowest pH. NaCl is neutral salt has pH = 7 while NH₄Cl is acidic salt, has pH less than 7

56. (d)

57. (a) According to Arrhenius equation, rate constant increases exponentially with temperature: \( k = Ae^{Ea/RT} \)

58. (a)

59. (c) One of the requirement for electrolyte used in salt bridge is, both cation and anion must have comparable size so that they migrate towards electrodes of opposite polarity at comparable speeds.

60. (c) Sb₂S₃ is a negative sol. According to Hardy Schulze rule, greater the valency of cationic coagulating agent, higher its coagulating power. Therefore, Al₂(SO₄)₃ will be the most effective coagulation agent in the present case.

61. (b)

62. (b)

63. (d) \( S_2O_7^{2–} \) has no S–S linkage

64. (d)

65. (d)

66. (b)

67. (d)

68. In Ni(CO)₄ Ni is sp³ hydridised while in [Ni(CN)₄]²–, Ni²⁺ is dsp² hybridised.

69. (d) Haematite is Fe₂O₃, in which oxidation number of iron is III. Magnetite is Fe₃O₄ which is in fact a mixed oxide {FeO. Fe₂O₃}, hence, iron is present in both II and III oxidation state.

70. (c)

71. (a)

72. (d)

73. (a)

74. (a) NOCl → + N → O + Cl⁻

CH₃–CH = CH₂ + NO → CH₃–CH = CH₂ + Cl⁻ → CH₃–CH = CH₂

75. (b)

76. (c) CH⁻₃, being the strongest base, has highest nucleophilicity.

77. (d) If alkyl groups are same, the order of leaving ability of halides in SN₂ reaction is F⁻ < Cl⁻ < Br⁻ < I⁻
78. (a)
79. (b)
\[ C_6H_5MgBr + (CH_3)_3COH \rightarrow C_6H_6 + Mg[(CH_3)_3CO]Br \]
80. (b)
81. (c)
82. (d)
83. (b)
84. (d)

85. (b)
Both glucose and fructose are reducing sugars, reduces Tollen’s reagent to metallic silver.
86. (a)
87. (c)
88. (a)
89. (a)
90. (d)