1. \( \frac{1}{k_{eq}} = \frac{1}{k} + \frac{L}{YA} \)

2. Given process equation is, \( pT^2 = \text{constant} \)
   
   Using \( PV = nRT \)
   
   We can have, \( \frac{nRT}{V} \times T^2 = \text{constant} \)

   or \( \frac{T^3}{V} = \text{constant} \)

   By differentiating above equation on w.r. to \( V \)

   \[ \frac{3T^3dT}{V} - \frac{T^3dV}{V^2} = 0 \]

   or \( \gamma = \frac{dV}{V} \times \frac{1}{dT} \times \frac{3}{T} \)

   In above equation left side term is representing coefficient of volume expansion of gas, as from the definition. The coefficient of volume expansion is defined as fractional change in volume per unit rise in temperature.

3. Ideal gas equation is given by:
   
   \( PV = nRT \) .......(i)

   For oxygen : \( p = 1 \text{ atm}; V = 1 \text{L}; n = n_{O_2} \)

   Therefore, eqn. (i) becomes,

   \[ \therefore 1 \times 1 = n_{O_2} \frac{RT}{T} \text{ or } n_{O_2} = \frac{1}{RT} \]

   For nitrogen : \( p = 0.5 \text{ atm}; V = 2 \text{L}; n = 2n_{N_2} \)
\[ \therefore 0.5 \times 2 = n_{X_2}RT \quad \text{or} \quad n_{X_2} = \frac{1}{RT} \]

For mixture of gas:
\[ P_{mix} \cdot V_{mix} = n_{mix}RT \]

Here, \( n_{mix} = n_{X_2} + n_{N_2} \)
\[ \therefore \frac{P_{mix} \cdot V_{mix}}{RT} = \frac{1}{RT} + \frac{1}{RT} \]
\[ \therefore V_{mix} = 1L; P_{mix} = 2atm \]

4. Since \( A_t = A_0e^{-\frac{bt}{2m}} \)

When \( t = 2 \text{sec} \), \[ A = \frac{A_0}{3} = Ae^{-\frac{2b}{2m}} \]
\[ \frac{1}{3} = e^{-\frac{b}{m}} \]

When \( t = 6 \text{sec} \)
\[ \frac{A_0}{n} = A_0e^{-\frac{6b}{2m}} \]
\[ \frac{1}{n} = \left( e^{-\frac{b}{m}} \right)^3 \]
\[ \frac{1}{n} = \left( \frac{1}{3} \right)^3 \]
\[ n = 3^3 \]

5. Effective value of velocity of source
\[ V_s = \frac{100}{3} \cos \theta \]
\[ V_s = \frac{100}{3} \times \frac{3}{5} \quad V_s = 20 \text{ m/sec} \]

Apparent frequency
\[ n' = \left( \frac{v}{v - V_s} \right) n = \frac{340}{340 - 20} \times 640 = 680 \text{Hz} \]

6. \( F = \frac{2T}{d} A = \frac{2T}{V} \quad A^2 = \frac{2(70)}{5 \times 10^{-3}}(40)^2 \)

7. Moment of inertia of a rod.
\[ I = \frac{1}{12}ML^2 \]

where \( M \) is the mass of the rod and \( L \) is the length of the rod differentiate w.r. to \( L \)
\[ \therefore \Delta I = \frac{1}{12}2ML\Delta L \quad (\because M \text{ is a constant}) \] ....(ii)

Divide eqn. (ii) by (i), we get
\[ \frac{\Delta I}{I} = 2\frac{\Delta L}{L} \]

......(iii)

As \( \frac{\Delta L}{L} = \alpha \Delta T \)

or \[ \frac{\Delta L}{L} = \alpha \Delta T \]

Substituting the value \[ \frac{\Delta L}{L} \]

is eqn. (iii), we get,
\[ \Delta I = 2\alpha \Delta t \]

8. As here volume of the gas remains constant, therefore, the amount of heat energy to raise the temperature of the gas is:
\[ \Delta Q = nC_v \Delta T \]

Here, number of moles, \( n = \frac{1}{4} \)
\[ C_v = \frac{3}{2}R \quad (\because \text{He is a monoatomic gas}) \]
\[ \Delta T = T_2 - T_1 \]
\[ \therefore \Delta Q = \frac{1}{4} \left( \frac{3}{2}R \right)(T_2 - T_1) \]
\[ = \frac{3}{8}N_a K_b (T_2 - T_1) \quad \left[ k_b = \frac{R}{N_a} \right] \]

Hence, correct answer is (4).

9. \( x = a \sin \left( \omega t + \frac{\pi}{6} \right) \)
\[ \frac{dx}{dt} = a\omega \cos(\omega t + \pi / 6) \]

Max. velocity = \( a\omega \)
\[ \therefore \frac{a_0}{2} = a_0 \cos(\omega t + \pi / 6); \]
\[ \therefore \cos(\omega t + \pi / 6) = \frac{1}{2}; \]
\[ 60^\circ \text{ or } \frac{2\pi}{6} \text{ radian} = \frac{2\pi}{6}\cdot t + \pi / 6 = \frac{1}{2} = \pi; \]
\[ \frac{2\pi}{T} \cdot t = \frac{2\pi}{6} - \frac{\pi}{6} = + \frac{\pi}{6}; \]
\[ \therefore t = + \frac{\pi}{6} \times \frac{T}{2\pi} = + \frac{T}{12}; \]

10. Equation of the harmonic progressive wave given by:
\[ y = a \sin 2\pi (bt - cx) . \]

Here, \( 2\pi v = \omega = 2\pi b \)
or \( v = b \)
\[ k = \frac{2\pi}{\lambda} = \frac{2\pi c}{\lambda} \quad \left( \frac{1}{\lambda} = c \right) \]

(Here \( c \) is the symbol given for \( \frac{1}{\lambda} \) and not the velocity)
\[ \therefore \text{Velocity of the wave} = \lambda = b \frac{1}{c} = \frac{b}{c} \]
\[ \frac{dy}{dt} = a 2\pi b \cos 2\pi (bt - cx) = a \omega \cos(\omega t - k x) \]
Maximum particle velocity \( = a\omega = a 2\pi b = 2\pi ab \cdot \)
Given this equal to \( 2\times \frac{b}{c} \)
i.e., \( 2\pi a = \frac{2}{c} \) or \( c = \frac{1}{\pi a} \)

11. \[ \rho \left( \frac{V}{2} \right) g = \sigma \frac{4}{5} (V) g \]
\[ \rho = \sigma \left( \frac{8}{5} \right) \]

12. For mixture of gases:
\[ C_v = \frac{n_1 C_{v_1} + n_2 C_{v_2}}{n_1 + n_2} \]
where, \( C_v = \frac{f}{2} R \), \( f \) is degree of freedom
and \( C_p = \frac{n_1 C_{p_1} + n_2 C_{p_2}}{n_1 + n_2} \)

where, \( C_p = \left( 1 + \frac{f}{2} \right) R \)

For helium : \( n_1 = 4 \), \( f = 3 \)
For oxygen : \( n_2 = \frac{1}{2} \), \( f = 5 \)
\[ \therefore \frac{C_p}{C_v} = \frac{4 \times 5R}{2} + \frac{1}{2} \times \frac{7R}{2} \]
\[ = \frac{47}{29} = 1.62 \]

13. Specific heat of a gas is the amount of heat required to increase the temperature of one mole of the gas through unit degree. During different processes, the work done by a gas may be different. Hence, specific heat of a gas depends on the process followed. Since, number of processes which are possible is infinite, therefore, a gas has an infinite number of specific heats. Therefore, option (2) is correct.

14. The given equation of SHM is,
\[ 2 \frac{d^2 x}{dt^2} + 32 x = 0 \quad \text{OR} \]
\[ \frac{d^2 x}{dt^2} + \frac{32}{2} x = 0 \]
\[ \frac{d^2 x}{dt^2} = -16x \quad \text{...(i)} \]
The standard equation of SHM is,
\[ \frac{d^2 x}{dt^2} = -\omega^2 x \quad \text{...(ii)} \]
Comparing equation, (i) and (ii), we get
\[ \omega^2 = 16 \quad \text{OR} \quad \omega = 4 \]
The period, \( T = \frac{2\pi}{\omega} = \frac{2\pi}{4} = \frac{\pi}{2} \)

16. \( A_1 V_1 = A_2 V_2 \)
17. Let the temperature of the surrounding be \( \theta_0 \). According to Newton's law of cooling.

\[
\frac{62-50}{10} = K \left( \frac{62+50}{2} - \theta_0 \right)
\]

or

\[
\frac{12}{10} = K \left[ \frac{112}{2} - \theta_0 \right]
\]

......(i)

and

\[
\frac{50-42}{10} = K \left[ \frac{50+42}{2} - \theta_0 \right]
\]

or

\[
\frac{8}{10} = K \left[ \frac{92}{2} - \theta_0 \right]
\]

......(ii)

Divide eqn. (i) by (ii), we get;

\[
12 \times \frac{10}{8} = 112 - 2\theta_0 \quad \text{or} \quad \frac{3}{2} = \frac{112 - 2\theta_0}{92 - 2\theta_0}
\]

or

\[276 - 6\theta_0 = 224 - 4\theta_0\]

or

\[276 - 224 = 2\theta_0 \quad \text{or} \quad \theta_0 = \frac{52}{2} = 26^\circ C\]

20. Ideal equation

\[y = \sqrt{\left(\frac{1}{\sqrt{a}}\right)^2 + \left(\frac{1}{\sqrt{b}}\right)^2} \sin (\omega t + \phi)\]

\[y = \left(\frac{1}{a} + \frac{1}{b}\right) \sin (\omega t + \phi)\]

amplitude \( A = \sqrt{\frac{1}{a} + \frac{1}{b}} = \sqrt{\frac{a+b}{ab}}\)

21. \( \Delta L = \frac{FL}{YA} \)

\[\Delta L = \frac{(100)(6)}{10^4(10^{-5})} = 0.6 \times 10^{-3} \text{m}\]

22. Here; \( K_1 = K_2, l_1 = l_2 = 1 \text{m}, \)

\[A_1 = 2A, A_2 = A\]

\( T_1 = 100^\circ C \) and \( T_2 = 70^\circ C \)

\[\therefore \text{Temperature at C be } T, \text{ then}\]

\[
\frac{\Delta Q}{\Delta t} = \frac{K2A(100 - T)}{1} = \frac{KA(T - 70)}{1}
\]

or \( T = 90^\circ C \)

23. By Wien's displacement law, \( \lambda_m T = \text{constant} \)

\[\therefore \lambda_m T = \lambda_m T' \quad \text{or} \quad 500 \times 6000 = 400 \times T' \]

or \( T' = \frac{500 \times 6000}{400} = 7500 \text{ K} \)

25. Distance travelled by sound

\[= 32\lambda = 32 \left[ \frac{V}{n} \right] = 32 \left[ \frac{344}{256} \right] = 43 \text{m}.\]

26. From Stoke’s law the terminal velocity of water drop assuming buoyancy force negligible, is

\[v = \frac{2r^2\rho g}{9}\]

\[= \frac{2}{9} \times \frac{(1.5 \times 10^{-6})^2(1.0 \times 10^3) \times 9.8}{1.8 \times 10^{-5}}\]

\[= 2.72 \times 10^{-4} \text{ m/s}\]

27. According to Ideal gas equation

\[PV = nRT \quad \text{or} \quad V = \frac{nRT}{P}\]

For an isobaric process, \( P = \text{constant} \) and \( V \propto T \)

Therefore, \( V - T \) graph is a straight line passing through origin. Slope of this line is inversely proportional to \( P \).

(slope) \(_2 > \) (slope) \(_1\)

\[\therefore P_2 < P_1\]

28. Here, \( A = 1 \text{ cm}^2 = 10^{-4} \text{ m}^2 \)

\( T = 1000 \text{ K} \)

\( t = 1 \text{ s} \)

\( \sigma = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}\)

According to Stefan-Boltzman law, energy radiated by a body is,

\[E = \sigma AT^4t\]

\[= 5.67 \times 10^{-8} \times 10^{-4} \times (1000)^4 \times 1\]

\[= 5.67 \text{ J}\]
29. The reflected sound appears to propagate in a direction opposite to that of direct sound of engine. Thus, the source and the observer can be presumed to approach, each other, with same velocity.

\[ v' = \frac{v(u + u_0)}{(u - u_s)} = \frac{v(u + u_0)}{(u - u_s)} \quad \text{[} v_0 = u_s \text{]} \]

or \[ v' = 1.2 \left( \frac{350 + 50}{350 - 50} \right) = \frac{1.2 \times 400}{300} = 1.6 \text{kHz} . \]

30. \[ V_1 = 10\pi \cos \left( 100\pi t + \frac{\pi}{3} \right) \]

\[ V_2 = -10 \pi \sin (100 \pi t) = 10 \pi \cos (100 \pi t + \frac{\pi}{2}) \]

\[ \Delta \phi = 100\pi t + \frac{\pi}{2} - 100\pi t + \frac{\pi}{2} \]

\[ = -\frac{\pi}{6} \]

31. \[ \ell_1 \cos 45^\circ = \ell_2 \cos 60^\circ \]

32. \[ W = \text{Area of rectangle} \]

\[ = -100 \times 10^3 \times 200 \times 10^6 \]

\[ = -20 \text{ J} \]

34. \[ L_1 = 10 \log \left( \frac{I_1}{I_0} \right) ; \quad L_2 = 10 \log \left( \frac{I_2}{I_0} \right) \]

\[ \therefore L_1 - L_2 = 10 \log \left( \frac{I_1}{I_0} \right) - 10 \log \left( \frac{I_2}{I_0} \right) \]

or \[ \Delta L = 10 \log \left( \frac{I_1}{I_2} \right) \quad \text{or} \quad 20 \text{dB} = 10 \log \left( \frac{I_1}{I_2} \right) \]

or \[ 10^2 = \frac{I_1}{I_2} \quad \text{or} \quad I_2 = \frac{I_1}{100} \]

35. \[ \ell_2 = \ell_1 + \frac{21}{100} \ell_1 = \frac{121}{100} \ell_1 \]

\[ T \propto \sqrt{\ell} \]

\[ \frac{T}{T'} = \sqrt{\frac{\ell_1}{\ell_2}} \quad \Rightarrow \quad \frac{T'}{T} = \sqrt{\frac{121}{100}} \]

\[ \Rightarrow \quad T' = 1.1 \ T \]

\[ \frac{T' - T}{T} \times 100 = 10\% \]

36. \[ W = 2T \left[ 4\pi \left( R_2^2 - R_1^2 \right) \right] \]

38. Form first law of the thermodynamics

\[ dQ = dU + dW \]

In our case, \( Q = U + W \)

Here, \( U (Q - W) \) depends only on initial and final states, so \( U \) will be same for all curves. \( W \) represents the area surrounded by the curve by work done.

so, \( W_A > W_B > W_C \)

or \( Q_A > Q_B > Q_C \)

Here, choice (2) is correct.

39. Let \( \lambda = \) wavelength of light from a star

\( \lambda' = \) wavelength of light on the earth

Given:

\[ \frac{\lambda - \lambda'}{\lambda} = 0.4\% \]

i.e., \( \frac{\Delta \lambda}{\lambda} = \frac{v}{c} \quad \text{or} \quad v = \frac{\Delta \lambda}{\lambda} \times c \)

or \( v = \frac{4}{1000} \times 3 \times 10^8 \)

\[ = 1.2 \times 10^5 \text{ m/s} = 1.2 \times 10^8 \text{ m/s} \]

\[ = 1.2 \times 10^3 \text{ km/s} . \]

40. \[ t_1 = 2\pi \frac{m}{k_1} \quad t_2 = 2\pi \frac{m}{k_2} \]

\[ T = 2\pi \frac{m}{k_{eq}} \]

\[ \Rightarrow T = 2\pi \sqrt{\frac{m}{k_1 + k_2}} \]

\[ \Rightarrow T^2 = \left( 2\pi \frac{m}{k_1} \right)^2 + \left( 2\pi \frac{m}{k_2} \right)^2 \]

\[ \Rightarrow T^2 = t_1^2 + t_2^2 \]

41. Range of a liquid \( x = 2\sqrt{h(H-h)} \)

but \( h = \frac{3H}{4} \)

\[ \therefore x = 2 \sqrt{\frac{3H}{4} \left( H - \frac{3H}{4} \right)} = 2 \sqrt{\frac{3H}{4} \times \frac{H}{4}} = \frac{\sqrt{3H}}{2} \]
42. From Boyle’s law, \( PV = \text{constant} \)
\[
\therefore P_1 V_1 = P_2 V_2
\]
Here, \( P_1 = \rho g(h + \ell) \), \( V_1 = \frac{4}{3} \pi r^3 \)
\[
P_2 = \rho g\ell V_2 = \frac{4}{3} \pi (3r)^3
\]
\[
\therefore \rho g(h + \ell)\frac{4}{3} \pi r^3 = \rho g\ell \times \frac{4}{3} \pi (3r)^3
\]
or \( h + \ell = 27 \ell \) \( \therefore h = 26 \ell \)

44. Speed of sound is given by : \( v = \sqrt{\frac{\gamma RT}{M}} \)

\[ v_{O_2} = \sqrt{\frac{7 \times 5 \times RT}{32}} \quad \text{and} \quad v_{He} = \sqrt{\frac{5 \times 3 \times RT}{4}} \]

or \( v_{He} = 460 \times 10^2 \times \frac{2}{21} = 1420 \text{ m/s} \).

46. The speed of decomposition of \( H_2O_2 \) can be restarted by using \( H_3PO_4 \).

48. Solubility \( \propto \) Ionic Nature

49. According to Born Habor equation

\[ \text{S.E.} + E + \frac{1}{2} (\text{BDE}) + (-\Delta H_{\text{qy}}) + (-\text{L.E.}) = -\Delta H \]

51. Only temporary hardness can be removed by boiling water.

52. \( P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3NaH_2PO_2 \)

53. ICN is a pseudohalogen analogues of interhalogen.

54. Lattice energy \( \propto \) Charge

55. Earlier angles were 120\(^{\circ} \) and 90\(^{\circ} \).

Now 109.28\(^{\circ} \).

56. \( \text{CaC}_2 + D_2O \rightarrow \text{C}_2D_2 + \text{Ca(OD)}_2 \)

57. \( 2\text{HNO}_3 \rightarrow N_2O_5 + H_2O \)

Acidic anhydride

58. Acidic nature of hydride (non metal \( \propto \) atomic size)

59. Metallic character \( \propto \) Ionic nature

60. Lone pair on equitorial position.

61. Curium (at. no. 96) \([\text{Rn}]5f^{7}6d^{1} + 7s^{2}\)

62. Acidic nature \( \propto (+)ve \) oxidation state

So \( N_2O_5 > SO_2 > CO_2 > CO \)

63. \( \text{Na}_2\text{B}_4\text{O}_7 + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{H}_2\text{BO}_3 \)

Alkaline nature

64. Due to inter–H–bonding

65. (i) Electronic configuration of boron in ground state is \( 1s^22s^22p^1 \).

66. Electron gain enthalpy \( O < \text{Te} < \text{Se} < S \)

67. Zn has 3d\(^{10} \) configuration so 3d electron do not take part in metallic bond.

68. Due to itching of glass HF stored in copper container.

69. More directional characters, in p-orbital.

70. \( \text{BCl}_3 \)

\[
\begin{array}{c}
\text{sp}^3 \text{ hybridisation} \\
\text{2s} & \text{2p} \\
\hline
\end{array}
\]

(ii) Electronic configuration of nitrogen in ground state is \( 1s^22s^22p^3 \).

\[
\begin{array}{c}
\text{NH}_3 : \\
\text{sp}^3 \text{ hybridisation} \\
\text{2s} & \text{2p} \\
\hline
\end{array}
\]

(iii) Electronic configuration of phosphorus in ground state is \( 1s^22s^22p^63s^23p^3 \).

\[
\begin{array}{c}
\text{PCl}_3 : \\
\text{sp}^3 \text{ hybridisation} \\
\text{3s} & \text{3p} \\
\hline
\end{array}
\]

(iv) Electronic configuration of boron in ground state is \( 1s^22s^2 \).

\[
\begin{array}{c}
\text{BeF}_2 : \\
\text{sp} \text{ hybridisation} \\
\text{2s} & \text{2p} \\
\hline
\end{array}
\]

71. By addition of cis 1, 2 – dial the acidic nature of \( \text{B(OH)}_3 \) increases and reaction is more fearable.

72. Fact.

73. \( -1 +1 -1 \)

\( \text{N=N=N} \)

74. Crown structure.

75. \[
\begin{array}{cccc}
\text{C} & \text{N} & \text{F} & \text{O} \\
\text{C}^+ & \text{N}^+ & \text{F}^+ & \text{O}^+ \\
\text{Configuration} & 2p^1 & 2p^2 & 2p^4 & 2p^3 \\
\text{(Half filled)} & & & & \\
\end{array}
\]
77. \( \text{CrO}_4^{2-} \xrightarrow{H^+} \text{Cr}_2\text{O}_7^{2-} \)

78. Ac to M.O.T in \( \text{O}_2, \text{O}_2, \text{O}_2^2 \), the total no. of antibonding electron respectively are 7, 6, 8.

79. Due to hydrogen bonding.

80. Due to lanthanoid contraction, atomic size of Zr and Hf are almost same.

81. \( \text{H}_2\text{SO}_4 + 2\text{PCl}_5 \rightarrow \text{SO}_3\text{Cl}_2 + 2\text{POCl}_3 + 2\text{HCl} \)

82. Stability of +3 oxidation state decreases from Al to Tl. B always shows +3 oxidation state in all of its compounds.

83. \( \text{H}_2\text{SO}_4 \xrightarrow{\Delta} \text{SO}_3 + \text{H}_2\text{O} \)

84. \( \text{CH} = \text{C} - \text{CH} = \text{CH}_2 \)
\( \text{sp} - \text{sp}^2 \)

85. Acidic nature \( \propto \) Ionisation energy \( \propto \frac{1}{\text{basic nature}} \)

86. Thermal stability \( \propto \frac{1}{\text{Ionic potential} (\phi)} \)

IA carbonates are stable towards heat. So these are not decomposes.

87. \( \text{Cl} - \text{Al} - \text{Cl} \)
\( \text{Cl} - \text{Al} - \text{Cl} \)
\( \text{Cl} - \text{Al} - \text{Cl} \)
\( \text{Cl} - \text{Al} - \text{Cl} \)
\( \text{AlCl}_3 \) (dimer)

88. In \( \text{SF}_6 \) hybridisation is \( \text{sp}^3\text{d}^2 \), bond angle = \( 90^\circ \) (all)

\% d-character = \( \frac{2}{6} \times 100 \approx 33\% \)

89. \( \text{O}_2^+ \rightarrow 2.5 \)
\( \text{O}_2^- \rightarrow 2 \)
\( \text{O}_2^2^- \rightarrow 1.5 \)

90. \( \text{N} \xrightarrow{\text{sp}^3} \text{N}^- \)
(2p\(^3\))
(Half filled)
(more stable)
(less stable)

91. NCERT XI Pg. # 319

92. NCERT XI Pg. # 321

93. NCERT XI Pg. # 331

94. NCERT XI Pg. # 324

95. NCERT XI Pg. # 337

96. NCERT XI Pg. # 307

97. NCERT XI Pg. # 273

98. NCERT XI Pg. # 323

99. NCERT XI Pg. # 311

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101. NCERT XI Pg. # 259 para II

102. NCERT XI Pg. # 312

103. NCERT XI Pg. # 309

104. NCERT XI Pg. # 286

105. NCERT XI Pg. # 324

106. NCERT XI Pg. # 259 para I fig. 163

107. NCERT XI Pg. # 302

108. NCERT XI Pg. # 264 para V, 265 Table 16.1

109. NCERT XI Pg. # 308

110. NCERT XI Pg. # 263, 264 para I

111. NCERT Pg. # 177

112. NCERT XI Pg. # 335

113. NCERT Pg. # 243

114. NCERT Pg. # 228