**Test Type : MAJOR**

**Test Pattern : AIPMT**

**TEST DATE : 29 - 03 - 2016**

**TEST SYLLABUS : SYLLABUS - 02**

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**HINT – SHEET**

1. \( W = \frac{1}{2} F \Delta \ell \)

   \( \frac{1}{2} \times 200 \times (10^{-3}) = 0.1 \text{ J} \)

2. \( \gamma_{\text{real}} = \gamma_{\text{app}} + \gamma_{\text{vessel}} \)

   \( \gamma_{\text{vessel}} = 3 \alpha \)

   For vessel 'A' : \( \gamma_{\text{real}} = \gamma_1 + 3 \alpha \)

   For vessel 'B' : \( \gamma_{\text{real}} = \gamma_2 + 3 \alpha_B \)

   Hence, \( \gamma_1 + 3 \alpha = \gamma_2 + 3 \alpha_B \)

   or \( \alpha_B = \frac{\gamma_1 - \gamma_2}{3} + \alpha \)

3. First law of thermodynamics is in fact, the law of conservation of energy. According to the law of conservation of energy, the energy can neither be created nor it can be destroyed but can change itself from one form to another.

4. \( \frac{t_o}{9} = 2\pi \sqrt{\frac{h}{g}} \) and \( \frac{t_B}{7} = 2\pi \sqrt{\frac{t_2}{g}} \)

   \( \therefore \) \( \frac{t_1}{t_2} = \left( \frac{7}{9} \right)^2 = \frac{49}{81} \)
5. \[ v = \frac{dy}{dt} = y_0 \cos \left[ 2\pi \left( \frac{ft - \frac{x}{\lambda}}{\lambda} \right) \right] \times 2\pi \]

\[ = 2\pi y_0 \cos \left[ 2\pi \left( \frac{ft - \frac{x}{\lambda}}{\lambda} \right) \right] \]

The particle velocity is maximum, when

\[ \cos \left[ 2\pi \left( \frac{ft - \frac{x}{\lambda}}{\lambda} \right) \right] = 1 \]

\[ \therefore \quad v_{\text{max}} = 2\pi y_0 \quad \text{......(i)} \]

We know that \( y = a \sin (\omega t - kx) \). The wave velocity \( V \) is given by:

\[ V = \frac{\omega}{K} = \frac{2\pi f}{2\pi/\lambda} = f\lambda \quad \text{......(ii)} \]

Given that, \( v_{\text{max}} = 4V \)

\[ \therefore \quad 2\pi y_0 = 4 f \lambda \quad \text{or} \quad \lambda = \frac{\pi y_0}{2} \]

6. Given : \[ \frac{\Delta V}{V} = 1\% = \frac{1}{100} \]

Bulk modulus,

\[ B = \frac{P}{\Delta V / V} = \frac{PV}{\Delta V} \]

or \[ P = B\Delta V / V \]

\[ = 7.5 \times 10^3 \times \frac{1}{100} = 7.5 \times 10^2 \text{Nm}^{-2} \]

7. Since, the block of ice at 0°C is large, the whole of ice will not melt, hence final temperature is 0°C.

\[ \therefore \quad Q_1 = \text{heat given by water in cooling upto 0°C} = m\Delta\theta = 80 \times 1 \times (30 - 0) = 2400 \text{cal} \]

If \( m \text{ gm} \) be the mass of ice melted, then

\[ Q_2 = mL_f = m \times 80 \]

Now, \[ Q_2 = Q_1 \]

\[ m \times 80 = 2400 \quad \text{or} \quad m = 30 \text{ gm.} \]

8. For an adiabatic process, \( PV^{\gamma} = K \)

Here, \( \gamma = \frac{3}{2} \) and \( K = \text{constant} \)

\[ \therefore \quad PV^{\frac{3}{2}} = K \]

\[ \log P + \frac{3}{2} \log V = \log K \]

\[ \frac{\Delta P}{P} + \frac{3}{2} \frac{\Delta V}{V} = 0 \]

\[ \therefore \quad \frac{\Delta V}{V} = -\frac{2}{3} \frac{\Delta P}{P} \]

\[ \Delta V \times 100 = -\left( \frac{2}{3} \right) \left( \frac{\Delta P}{P} \times 100 \right) = -\frac{2}{3} \times \frac{2}{3} = -\frac{4}{9} \]

\[ \therefore \quad \text{Volume decreases by about} \quad \frac{4}{9} \% . \]

9. With mass \( m_2 \) alone, the extension of the spring \( l \) is given as:

\[ m_2g = kl \quad \text{......(i)} \]

With mass \((m_1 + m_2)\), the extension \( l' \) is given by:

\[ (m_1 + m_2)g = k(l + \Delta l) \quad \text{......(ii)} \]

The increase in extension \( \Delta l \) which is the amplitude of vibration.

Subtracting eqn. (i) from eqn. (ii), we get;

\[ m_1g = k \Delta l \quad \text{or} \quad \Delta l = \frac{m_1g}{k} \]

12. Moment of inertia of a sphere,

\[ l = \frac{2}{5} mr^2 \]

Given:

\[ \omega = 2\pi n \text{ rad/sec} \]

\[ \therefore \quad KE = \frac{1}{2} l\omega^2 = \frac{1}{2} \times \frac{2}{5} \times m \pi^2 r^2 \times (2\pi n)^2 \]

\[ = \frac{4}{5} m\pi^2 r^2 n^2 \]

Half of this energy is converted into heat.

i.e.,

\[ \frac{4}{5} m\pi^2 r^2 n^2 \times \frac{1}{2} = J(\text{ms}\Delta\theta) \]

or \[ \Delta\theta = \frac{2\pi^2 r^2 n^2}{5} \text{ sJ} \]

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

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

\[ \text{or} \quad T' = \frac{500 \times 600}{400} = 7500 \text{K} . \]
14. \( a_{\text{max}} = \frac{g}{2} = \omega^2 A \)

\[
\Rightarrow \omega^2 = \frac{g}{d}
\]

\[
\Rightarrow \omega = \sqrt{\frac{g}{d}}
\]

or \( f = \frac{1}{2\pi} \sqrt{\frac{g}{d}} \)

15. \( A = \sqrt{a_1^2 + a_2^2 + 2a_1a_2 \cos \phi} \)

\[
A = \sqrt{a^2 + a^2 + 2aa \cos 90^\circ}
\]

\[ A = \sqrt{2}a \]

17. According to Newton's law of cooling, the rate of cooling is directly proportional to the temperature difference. When the temperature difference is halved, the rate of cooling is also halved. So, time taken is 10 sec.

19. \( \ell = \ell_1 + \ell_2 \)

\[ k\ell_1 = k_2\ell_2 = k\ell = \text{const.} \]

\[ k_1\ell_1 = k(\ell_1 + \ell_2) \]

\[ k_1n\ell_2 = n_k \ell_2(n + 1) \]

\[ k_1 = \frac{(n-1)}{n}k \]

and \( k_2\ell_2 = k\ell_2(n + 1) \)

\[ k_2 = k(n + 1) \]

20. When a stationary wave is established in a medium, then maximum deformation of the medium is produced at nodes. Hence, maximum pressure change takes place at nodes and at antinodes no pressure changes take place. Hence, option (b) alone is correct.

21. \( T + F_b = mg \)

\[ T = mg - F_b \]

\[ T = (\rho_S - \rho_i)Vg \]

\[ T = (10.4 - 0.8) \times \frac{2.6}{10.4} \text{g} \]

\[ \therefore V = \frac{m}{\rho_S} \]

\[ T = 2.4 \text{ (Kg-wt)} \]

22. \[ \frac{dH}{dt} = \frac{dH}{dt} \]

\[ K_1A(100 - T) = K_2A(T - 0) \]

\[ 2(100 - T) = 3(T) \]

\[ 5T = 200 \]

\[ T = 40^\circ C \]

23. \[ \Delta L_1 = \Delta L_2 \]

\[ L_1\alpha_1\Delta \theta = L_2\alpha_2\Delta \theta \] or \( \frac{L_1}{L_2} = \frac{\alpha_1}{\alpha_2} \)

24. \( Mg = Kx_1 \) 

\( (M + m)g = Kx_2 \) 

subtract eqn. (1) from eqn. (2)

\[ Mg = K(x_2 - x_1) = Kx \]

\[ K = \frac{Mg}{x} \]

Time period \( T = 2\pi \sqrt{\frac{(M+m)}{K}} \)

\[ T = 2\pi \sqrt{\frac{(M+m)x}{mg}} \]

25. \[ \frac{n}{2l}v = 315 \] and \( \frac{(n+1)v}{2l} = 420 \)

Solving, \( \frac{v}{2l} = 105 \)

\[ n = \frac{1}{2l} = \sqrt{\frac{T}{m}} \]

26. \begin{align*}
8 \text{ cm} & \quad Y \\
A & \quad P \\
B & \quad 10 \text{ cm} \\
X & \end{align*}

\[ P_A = P_B \]

\[ P_0 + \rho_y g \times 8 \times 13.6 \times g \times 2 \]

\[ = P_0 + 3.36 \times 10 \times g \]

\[ \rho_y \times 8 = 33.6 - 27.2 = 6.4 \]

\[ \rho_y = 0.8 \text{ g/cc} \]
27. Internal energy of a gas is,

\[ U = \frac{3}{2} nRT \]

For a given number of moles of the same gas, \( U \) depends only on \( T \). Therefore, \( U_B \) at \( 2T < U_A \) at temperature \( T \) is a wrong statement.

28. As \( \frac{\Delta L}{L} = 0.10\% = 0.001 \) and \( \Delta T = 100^\circ \text{C} \), hence

using \( \frac{\Delta L}{L} = \alpha \Delta T \),

we get; \( \alpha = \frac{0.001}{100} = 10^{-3} / \text{C} \)

\( \therefore \gamma = 3\alpha = 3 \times 10^{-3}/\text{C} \)

and \( \frac{\Delta V}{V} = \gamma \Delta T = 3 \times 10^{-5} \times 100 = 3 \times 10^{-3} = 0.30\% \).

29. \( T = 2\pi \sqrt{\frac{m}{K}} \)

after cut into \( n \) equal part then

\( K' = nK \)

so new time period

\( T' = 2\pi \sqrt{\frac{m}{nK}} \)

30. At resonance, first overtone of closed pipe

= second overtone of open pipe

\[ 3 \times \frac{v}{4L_1} = \frac{3}{2L_2} \]

\[ \frac{4}{4L_1} = \frac{1}{2L_2} \]

\[ L_1 = 2L_2 \]

\( L_1 : L_2 = 2 : 4 = 1:2 \)

31. Volume flowing per sec in left tube

= volume flowing per sec in 1st branch tube

+ volume flowing per sec in 2nd branch tube

\( Av_1 = Av_2 + 1.5 Av \)

\( A \times 3 = A \times 1.5 + 1.5Av \)

\( \therefore v = 1 \text{ m/s.} \)

32. The efficiency of Carnot enegine,

\[ \eta = \left( 1 - \frac{T_2}{T_1} \right) \]

\( \therefore \frac{1}{6} = \left( 1 - \frac{T_2}{T_1} \right) \) \[ \text{(Given, } \eta = \frac{1}{6} \text{) } \]

\[ \frac{T_2}{T_1} = \frac{5}{6} \text{ or } T_1 = 6T_2 \]

\[ T_2 \]

\[ \text{As per question, when } T_2 \text{ is lowered by 62 K, then its efficiency becomes } \frac{1}{3} \]

\[ \therefore \frac{1}{3} = \left( 1 - \frac{T_2 - 62}{T_1} \right) \]

\[ \frac{T_2 - 62}{T_1} = \frac{2}{3} \]

\[ \frac{T_2}{T_1} = \frac{5}{6} - \frac{2}{3} \] \[ \text{[Using eqn. (i)]} \]

\[ \frac{5(T_2 - 62)}{6T_2} = \frac{2}{3} \]

\[ 5T_2 - 310 = 4T_2 \Rightarrow T_2 = 310 \text{ K} \]

Form equation (i),

\[ T_1 = \frac{6 \times 310}{5} = 372 \text{ K} \]

33. \[ \frac{C - 0}{100} = \frac{F - 32}{180} \]

\[ \frac{25}{100} = \frac{F - 32}{180} \]

\[ F - 32 = 45 \]

\[ F = 77^\circ \text{F} \]

34. Since, energy \( \propto \) (Amplitude)\(^2\), the maximum for both of them occur at the same frequency. Hence, option (a) is correct.
35. \[ n_1 = n \frac{V}{V - 34} = v_1 \]
\[ n_2 = n \frac{V}{V - 17} = v_2 \]
\[ \frac{v_1}{v_2} = \frac{V - 17}{V - 34} = \frac{19}{18} \quad \therefore \quad V = 340 \text{ m/s} \]

36. When the sphere falls in a gravity-free region, no force acts on it in any direction initially. Hence, its terminal velocity will be zero, i.e., it will remain at rest.

37. This is a case of free expansion. There will be no change of temperature.

39. \[ a = -\omega^2 x \]
\[ a = -\omega^2 x_0 \cos \left( \omega t - \frac{\pi}{4} \right) \]
\[ a = \omega^2 x_0 \cos \left( \pi + \omega t - \frac{\pi}{4} \right) \]
\[ a = \omega^2 x_0 \cos \left( \omega t + 3\pi \frac{3}{4} \right) \]
so \[ A = x_0 \omega^2 \]
\[ \delta = \frac{3\pi}{4} \]

41. \[ \Delta L_{\text{total}} = \Delta L_{\text{brass}} + \Delta L_{\text{steel}} \]
\[ = L \left[ \alpha_{\text{brass}} + \alpha_{\text{steel}} \right] \Delta t \]
\[ = 500 \times 3.75 \times 10^{-5} \]
\[ = 2.8 \text{ mm} \]

42. \[ \frac{dU}{dQ} = \frac{nC_v dT}{nC_p dT} = \frac{C_v}{C_p} = \frac{1}{\gamma} \]
for diatomic gas \[ \gamma = \frac{7}{5} \]
so \[ \frac{dU}{dQ} = \frac{5}{7} \]

43. \[ V_0 = A \omega \]
\[ V = \omega \sqrt{A^2 - \left( \frac{A}{2} \right)^2} \]
\[ V = \frac{\sqrt{3}}{2} A \omega = \frac{\sqrt{3}}{2} V_0 \]

44. Particle velocity, \[ \frac{dy}{dt} = -\frac{dy}{dx} \]
or \[ \frac{dy}{dt} = -\text{wave velocity} \times \text{slope of the wave} \]

(a) For upward velocity, \( \text{v}_p = + \text{ve} \), so slope must be negative which is at the points D, E and F.

(b) For downward velocity, \( \text{v}_p = -\text{ve} \), so slope must be positive which is at the points A, B and H.

(c) For zero velocity, slope must be zero which is at C and G.

(d) For maximum magnitude of velocity, |slope| = maximum, which is at A and E. Hence, alternative is wrong.

45. \[ P^2 V = \text{constant} \ldots \ldots (1) \]
for an ideal gas:
\[ PV = nRT \ldots \ldots (2) \]
from eqn. (1) & (2)
\[ \frac{T^2}{V} = \text{const.} \]
\[ T_2 = \sqrt{\frac{V_2}{V_1}} T_1 = \sqrt[2]{T_0} \]

46. Inert gases have highest 'IE' in respective period due to full filled configuration.

47. \[ \text{Fe(CO)}_5 \Rightarrow \text{Fe(O)} \]
\[ K_3[\text{Fe(CN)}_6] \Rightarrow \text{Fe}^{(2+)} \]
\[ \text{FeSO}_4 . (\text{NH}_4)_2 \text{SO}_4 . 6\text{H}_2 \text{O} \Rightarrow \text{Fe}^{(2+)} \]
\[ K_3[\text{Fe(CN)}_6] \Rightarrow \text{Fe}^{(3+)} \]
58. $\text{H}_2\text{SO}_4$ has high boiling point.

59. $\text{Al}_2\text{Cl}_6 + 12\text{H}_2\text{O} \rightarrow 2[\text{Al}(\text{H}_2\text{O})_6]^3^+ + 6\text{Cl}^- (\text{aq.})$

60. fact

61. Valency remains constant in a group.

62. $\text{OF}_2 < \text{H}_2\text{O} < \text{NH}_3 < \text{Cl}_2\text{O}$

63. fact

64. $\text{CaP}_3 \xrightarrow{\text{H}_2\text{O}} \text{Ca(OH)}_2 + \text{PH}_3$

65. Left of right in the period $\Rightarrow$ basic character decreases.

66. CuI does not exist

67. $\text{C}_2 \rightarrow \text{C}_3 = \text{sp}^2 - \text{sp}^3$

68. $\text{Me}_2\text{SiCl}_2$ forms dimer only

69. fact

70. fact

71. $\text{MnO}_2 + \text{KOH} \rightarrow \text{K}_2\text{MnO}_4$ green.

72. fact

73. $\text{Al}_4\text{C}_3 + \text{H}_2\text{O} \rightarrow \text{CH}_4$

$\text{Mg}_2\text{C}_3 + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{C} = \text{CH}, \text{CaC}_2 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_2.$

74. $\pi * 2p^1 = \pi * 2p^1$

75. fact

76. Ni(CO)$_4$ $\rightarrow$ Number of unpaired e $\rightarrow 0$

$\left[\text{Mn(CN)}_6\right]^{4-} \rightarrow$ Number of unpaired e $\rightarrow 1$

$[\text{Cr(NH}_3)_6]^3$ $\rightarrow$ Number of unpaired e $\rightarrow 3$

$[\text{CoF}_4]^{-3} \rightarrow$ Number of unpaired e $\rightarrow 4$

On increasing number of unpaired electron magnetic moment increases.

77. fact

78. fact

79. The conditions required for the formation of an ionic bond.

(i) Ionization enthalpy $[\text{M}(g) \rightarrow \text{M}^+(g) + e^-]$ of electropositive element must be low.

(ii) Negative value of electron gain enthalpy $[X^-(g) + e^- \rightarrow X^-(g)]$ of electronegative element should be high.

80. fact

81. $\text{AgNO}_3 \xrightarrow{\Delta} \text{Ag} + \text{NO}_2^+ + \frac{1}{2}\text{O}_2$

82. fact

83. fact

84. $\text{N}_2^*$ (Number of unpaired e $\Rightarrow \sigma 2p^1$)

$= 1 = \text{Paramegnetic}$

85. fact

86. IP order $\text{F}^- < \text{Cl}^-$

87. $\text{O} = \text{S} = \text{sp}^3$ hybride

88. Rx. with dil HNO$_3$, of $-ve$ SRP metal gives H$_2$ gas.

89. Due to unavailability of vacant orbitals.

90. Bond angle $\propto \frac{1}{\text{Number of lp}}$

91. NCERT - XI, Page No. # 262, 263

96. NCERT - XI, Page No. # 326

97. NCERT - XI, Page No. # 321

98. NCERT (E), Page No. # 217 [Figure 13.8]

NCERT (H), Page No. # 217 [Figure 13.8]

100. NCERT - XII Page No. 158

101. NCERT - XI, Page No. # 265, 266
102. NCERT - XI, Page No. # 331,332
103. NCERT - Page no. 269
105. NCERT - XI, Page No. # 291,292
106. NCERT - XI, Page No. # 323
107. NCERT - XI, Page No. # 317,318
111. NCERT - XI, Page No. # 263
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115. NCERT - XI, Page No. # 298,294
117. NCERT - XI, Page No. # 321
121. NCERT - XI, Page No. # 262, 263, 264
123. NCERT - XI, Page No. # 294
124. NCERT - XI, Page No. # 311
125. NCERT - XI, Page No. # 282
126. NCERT(XI), Page no. 326 1st para
131. NCERT - XI, Page No. # 260
132. NCERT - XI, Page No. # 338,339
134. NCERT - Pg # 294
135. NCERT - XI, Page No. # 283
140. NCERT - Pg # 154
141. NCERT - XI, Page No. # 263, 264
144. NCERT - Pg # 297
145. NCERT - XI, Page No. # 282
151. NCERT - XI, Page No. # 264
152. NCERT - XI, Page No. # 332
154. NCERT - XI, Page No. # 292,294,295
156. NCERT - XI, Page No. # 320,321
157. NCERT - Page # 252
161. NCERT - XI, Page No. # 338
162. NCERT- Page no. 272
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164. NCERT - XI, Page No. # 297
166. NCERT - XI, Page No. # 321
167. NCERT - XIth, Page No. # 26 (old)
172. NCERT - Pg # 273
173. NCERT - Page No. 312
174. NCERT - XI, Page No. # 295
175. NCERT - XI, Page No. # 288
176. NCERT - XI, Page No. # 322