PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 86

Total Marks : 27

Max. Time : 30 min.

Topics : Simple Harmonic Motion, Sound Waves, Center of Mass, Circular motion, Kinetic Theory of Gases & Heat

Type of Questions			M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5		(3 marks, 3 min.)	[15,15]
Subjective Questions ('–1' negative marking) Q.6		(4 marks, 5 min.)	[4, 5]
Match the Following	(no negative marking) (2 × 4)	(8 marks, 10 min.)	[8, 10]

1. Two pendulums differ in lengths by 22 cm. They oscillate at the same place so that one of them makes 30 oscillations and the other makes 36 oscillations during the same time.The lengths (in cm) of the pendulum are :

(A) 72 and 50 (B) 60 and 38 (C) 50 and 28 (D) 80 and 58

2. Three waves of the same amplitude have frequencies (n – 1), n and (n + 1)Hz. They superpose on one another to produce beats. The number of beats produced per second is :

(A) n (B) 2 (C) 1 (D) 3n

3. A spherical ball of mass m_1 collides head on with another ball of mass m_2 at rest. The collision is elastic. The fraction of kinetic energy lost by m_1 is :

(A) $\frac{4m_1m_2}{(m_1+m_2)^2}$ (B) $\frac{m_1}{m_1+m_2}$ (C) $\frac{m_2}{m_1+m_2}$ (D) $\frac{m_1m_2}{(m_1+m_2)^2}$

4. Two equal masses are connected by a spring satisfying Hooke's law and are placed on a frictionless table. The spring is elongated a little and allowed to go. Let the angular frequency of oscillations be ω. Now one of the masses is stopped. The square of the new angular frequency is :

(A) ω^2 (B) $\frac{\omega^2}{2}$ (C) $\frac{\omega^2}{3}$ (D) $2\omega^2$

5. When a compressible wave is sent towards bottom of sea from a stationary ship it is observed that its echo is heard after 2s. If bulk modulus of elasticity of water is 2×10^9 N/m^2 , mean temperature of water is 4° and mean density of water is 1000 kg/m^3, then depth of sea will be

(A) 1014 m (B) 1414 m (C) 2828 m (D) 3000 m

6. The speed of sound in a mixture of n_1 = 2 moles of He, n_2 = 2 moles of H_2 at temperature T = $\frac{972}{5}$ K is $\eta \times 10$ m/s. Find η. (Take R = $\frac{25}{3}$ J/mole-K)

7. Match the statements in column-I with the statements in column-II.

Column-I	Column-II
(A) A tight string is fixed at both ends and sustaining standing wave	(p) At the middle, antinode is formed in odd harmonic
(B) A tight string is fixed at one end and free at the other end	(q) At the middle, node is formed in even harmonic
(C) Standing wave is formed in an open organ pipe. End correction is not negligible.	(r) At the middle, neither node nor antinode is formed
(D) Standing wave is formed in a closed organ pipe. End correction is not negligible.	(s) Phase difference between SHMs of any two particles will be either π or zero.

Answers Key

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1. (A) **2.** (C) **3.** (A) **4.** (B) **5.** (B)
6. 90 **7.** (A) p,q,s (B) r,s (C) s (D) r,s

Hint & Solutions

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1. $T_1 = 2\pi\sqrt{\frac{\ell_1}{g}}$

$T_2 = 2\pi\sqrt{\frac{\ell_2}{g}}$

$\frac{t}{T_1} = 30$ $\frac{T_2}{T_1} = \frac{5}{6}$

$\frac{t}{T_2} = 36$ $6T_2 = 5T_1$

$T_1^2 = \frac{88}{100} \times \frac{36}{11} \approx \frac{6 \times \sqrt{2}}{10} = \frac{6\sqrt{2}}{5}$

$\frac{6\sqrt{2}}{5} = 2\pi\sqrt{\frac{\ell_1}{g}}$

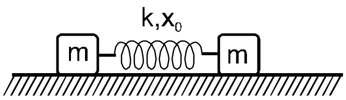
$\frac{36 \times 2}{25} = 4 \times 10 \times \frac{\ell_1}{10}$ **Ans. (A)**

2. f_1 f_2 f_3
1hz 2hz 3hz
t = 0 0 0
t = 1 sec. 1/2 sec. 1/3 sec. T = 1sec.
f = 1 hz. **Ans. (C)**

3. $u = v_1 + \frac{m_2}{m_1}v_2$ ....(1)

$v_2 - v_1 = u$ ....(2)

$\frac{k_{f_1} - k_{i_1}}{k_{i_1}} = 1 - \left(\frac{v_1}{u}\right)^2 = \frac{4m_1m_2}{(m_1+m_2)^2}$ **Ans. (A)**

4. 

$$\sqrt{\frac{k}{\mu}} = \omega \qquad \mu = \frac{m_1 m_2}{m_1 + m_2}$$

$$\omega = \sqrt{\frac{2k}{m}}$$

$$\omega_2 = \sqrt{\frac{k}{m}}$$

$$\omega_2^{\,2} = \frac{k}{m} = \frac{\omega^2}{2} .$$ **Ans. (B)**

5. $$\frac{2d}{v_s} = 2$$

$$\Rightarrow \ d = v_s$$

$$\Rightarrow \ d = \sqrt{\frac{B}{\rho}} = \sqrt{\frac{2\times10^9}{1000}} = 1414 \text{ m}$$

6. $$v = \sqrt{\frac{\gamma RT}{M}}$$

$$M = \frac{4\times2+2\times2}{4} = 3g$$

$$\gamma = 1+\frac{2}{f} = 1+\frac{2\times(2+2)}{2\times3+2\times5} = \frac{3}{2}$$

$$\therefore \ v = \sqrt{\frac{3}{2}\times\frac{25}{3}\times\frac{1000}{3}\times\frac{972}{5}} = 900 \text{ m/s}$$

Ans. 90

7. (A) Number of loops (of length $\lambda/2$) will be even or odd and node or antinode will respectively be formed at the middle.

Phase of difference between two particle in same loop will be zero and that between two particles in adjacent loops will be π.

(B) and (D) Number of loops will not be integral. Hence neither a node nor an antinode will be formed in in the middle.

Phase of difference between two particle in same loop will be zero and that between two particles in adjacent loops will be π.