Physics Galaxy
Telegram Test Series

DPYQ NEET Level Practice Test-3 for JEE Main & NEET Aspirants

Topic : SHM, WAVES & GRAVITATION

Time: 90Min Marking: +4 –1

Section - A : All questions are compulsory MCQs

1. Two heavy objects of masses m and M are situated in air and the gravitational force between them is F. The space around the masses is now filled with a liquid of specific gravity 5. The gravitational force will now be :

(A) $3F$ (B) F

(C) $F/3$ (D) $F/9$

2. The acceleration due to gravity on the planet A is 16 times the acceleration due to gravity on planet B. A man jumps to a height of 4 m on the surface of A. What is the height of jump by the same person on the planet B ?

(A) 256 m (B) 4 m

(C) 16 m (D) 32 m

3. Imagine a new planet having the same density as that of earth but it is 9 times bigger than the earth in size. If the acceleration due to gravity on the surface of earth is g and that on the surface of the new planet is g', then :

(A) $g' = 3g$ (B) $g' = 9g$

(C) $g' = g/9$ (D) $g' = 27g$

4. Weight of the object on the surface of earth is 400 N. How much will it weigh half way down to the centre of the earth ?

(A) 150 N (B) 200 N

(C) 250 N (D) 100 N

5. A body weighs 160 N on the surface of the earth. What is the gravitational force on it, at a height equal to one third of the radius of the earth ?

(A) 160 N (B) 60 N

(C) 90 N (D) 30 N

6. With what velocity should a particle be projected so that its height becomes equal to double that of radius of earth ?

(A) $\left(\frac{GM}{R}\right)^{1/2}$ (B) $\left(\frac{8GM}{R}\right)^{1/2}$

(C) $\left(\frac{4GM}{3R}\right)^{1/2}$ (D) $\left(\frac{4GM}{R}\right)^{1/2}$

7. A particle of mass M is situated at the centre of spherical shell of same mass and radius a. The gravitational potential at a point situated at $a/4$ distance from the centre will be :

(A) $-\frac{4GM}{a}$ (B) $-\frac{5GM}{a}$

(C) $-\frac{2GM}{a}$ (D) $-\frac{GM}{a}$

8. Infinite number of objects, each of mass 2 kg are situated on x-axis at distances 1 m, 2 m, 4 m, 8 m, …, respectively, from the origin. The resulting gravitational potential due to this system at the origin will be :

(A) $-G$ (B) $-\frac{8}{3}G$

(C) $-\frac{4}{3}G$ (D) $-4G$

9. The escape velocity from the Earth's surface is v. The escape velocity from the surface of another planet having a radius, two times that of Earth and same mass density is :

(A) v (B) $2v$

(C) $3v$ (D) $4v$

10. A geostationary satellite is orbiting the earth at a height of $3R$ above that surface of the earth, R being the radius of the earth. The time period of another satellite in hours at a height of R from the surface of the earth is :

(A) 5 (B) 10

(C) $6\sqrt{2}$ (D) $\frac{6}{\sqrt{2}}$

11. The potential energy of a simple harmonic oscillator when the particle is one third of its amplitude is :

(A) $2/3\,E$ (B) $1/9\,E$

(C) $1/4\,E$ (D) $1/3\,E$

12. The time period of a mass suspended from a spring is T. If the spring is cut into four two parts and the same mass is suspended from one of the parts, then the new time period will be :

(A) $T/\sqrt{2}$ (B) T

(C) $T/2$ (D) $\sqrt{2}T$

13. Two springs of spring constant k_1 and k_2 are joined in parallel. The effective spring constant of the combination is given by :

(A) $\sqrt{k_1 k_2}$ (B) $(k_1 + k_2)/2$

(C) $k_1 + k_2$ (D) $k_1 k_2/(k_1 + k_2)$

14. A particle executing simple harmonic motion of amplitude 5 cm has maximum speed of 62.8 cm/s. The frequency of its oscillation is :

(A) 1 Hz (B) 3 Hz

(C) 2 Hz (D) 4 Hz

15. A particle executes simple harmonic oscillation with an amplitude a. The period of oscillation is T. The minimum time taken by the particle to travel $\frac{1}{\sqrt{2}}$ of the amplitude from the equilibrium position is :

(A) $T/8$ (B) $T/12$

(C) $T/2$ (D) $T/4$

16. Two simple Harmonic Motions of angular frequency 50 and 5000 rad s^{-1} have the same displacement amplitude. The ratio of their maximum accelerations is :

(A) $1 : 10^3$ (B) $1 : 10^4$

(C) $1 : 10$ (D) $1 : 10^2$

17. A simple pendulum performs simple harmonic motion about $x = 0$ with an amplitude and time period T. The speed of the pendulum at $x = a/3$ will be :

(A) $\frac{\pi a\sqrt{3}}{T}$ (B) $\frac{\pi a\sqrt{3}}{2T}$

(C) $\frac{\pi a}{T}$ (D) $\frac{4\sqrt{2}\pi a}{3T}$

18. Time period of oscillation of a mass M suspended from a spring of negligible mass is T. If along with it another mass $2M$ is also suspended, the period of oscillation will now be :

(A) $\sqrt{3}\,T$ (B) T

(C) $T/\sqrt{3}$ (D) $2T$

19. A particle executes linear simple harmonic motion with an amplitude of 4 cm. When the particle is at midway from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is :

(A) $\frac{\sqrt{5}}{\pi}$ (B) $\frac{\sqrt{5}}{2\pi}$

(C) $\frac{4\pi}{\sqrt{5}}$ (D) $\frac{4\pi}{\sqrt{10}}$

20. A pendulum is hung from the roof of a sufficiently high building and is moving freely to and fro like a simple harmonic oscillator. The acceleration of the bob of the pendulum is 80 m/s^2 at a distance of 5 m from the mean position. The time period of oscillation is :

(A) 2 s (B) π s

(C) 2π s (D) $\pi/2$ s

21. The equation of a wave is represented by $y = 2 \times 10^{-4} \sin\left(100t - \frac{x}{20}\right)$ m, then the velocity of wave will be :

(A) 200 m/s (B) 4 m/s

(C) 2000 m/s (D) 20 m/s

22. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at distance of 3 m and 2 m respectively from the source. The ratio of the intensities of the waves at P and Q is :

(A) 3 : 2 (B) 2 : 3

(C) 9 : 4 (D) 4 : 9

23. A transverse wave is represented by $y = A \sin(\omega t - kx)$. For what value of the wavelength is the wave velocity equal to the maximum particle velocity ?

(A) A (B) $\frac{\pi A}{2}$

(C) πA (D) $2\pi A$

24. Sound waves travel at 280 m/s through a warm air and at 2800 m/s through brass. The wavelength of a 700 Hz acoustic wave as it enters brass from warm air :

(A) Decreases by a factor 10 (B) Increases by a factor 20

(C) Increases by a factor 10 (D) Decreases by a factor 20

25. A wave travelling in the $+ve$ x-direction having maximum displacement along y-direction as 2 m, wavelength π m and frequency of $\frac{1}{2\pi}$ Hz is represented by :

(A) $y = \sin(x - 2t)$ (B) $y = 2\sin(2x - t)$

(C) $y = \sin(10\pi x - 20\pi t)$ (D) $y = 2\sin(x - t)$

26. A uniform rope of length L and mass m_1 hangs vertically from a rigid support. A block of mass m_2 is attached to the free end of the rope. A transverse pulse of wavelength λ_1 is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is λ_2. The ratio λ_2/λ_1 is :

(A) $\sqrt{\frac{m_1}{m_2}}$ (B) $\sqrt{\frac{m_1 + m_2}{m_2}}$

(C) $\sqrt{\frac{m_2}{m_1}}$ (D) $\sqrt{\frac{m_1 + m_2}{m_1}}$

27. A string is stretched between fixed points separated by 75.0 cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequencies between these two. The lowest resonant frequency for this string is :
(A) 105 Hz (B) 155 Hz
(C) 205 Hz (D) 10.5 Hz

28. An air column, closed at one end and open at the other, resonates with a tuning fork when the smallest length of the column is 100 cm. The next larger length of the column resonating with the same tuning fork is :
(A) 300 cm (B) 100 cm
(C) 150 cm (D) 200 cm

29. The fundamental frequency in an open organ pipe is equal to the third harmonic of a closed organ pipe. If the length of the closed organ pipe is 30 cm, the length of the open organ pipe is :
(A) 20 cm (B) 8 cm
(C) 13.2 cm (D) 16 cm

30. Two sound waves with wavelength 5.0 m and 6 m respectively, each propagate in a gas with velocity 330 m/s. We expect the following number of beats per second :
(A) 12 (B) 0
(C) 11 (D) 6

31. A tuning fork of frequency 256 Hz makes 4 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per sec. When the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was :
(A) 260 Hz (B) 252 Hz
(C) 254 Hz (D) 258 Hz

32. An unknown source gives 4 beats/s, when sounded with a source of known frequency 250 Hz. The second harmonic of the source of unknown frequency gives five beats per second, when sounded with a source of frequency 513 Hz. The unknown frequency is :
(A) 254 Hz (B) 246 Hz
(C) 240 Hz (D) 260 Hz

33. An observer moves towards a stationary source of sound with a speed $1/4^{th}$ of the speed of sound. The wavelength and frequency of the source emitted are λ and f respectively. The apparent frequency and wavelength recorded by the observer are respectively :
(A) 1.25 f, 1.25 λ (B) 1.25 f, λ
(C) f, 1.25 λ (D) 0.8 f, 0.8 λ

34. A train traveling with speed 30 m/s towards a hill sounds a horn of frequency 600 Hz. If the velocity of sound in air is 330 m/s, the frequency of reflected sound as heard by driver is :
(A) 500 Hz (B) 550 Hz
(C) 555.5 Hz (D) 720 Hz

35. A siren emitting a sound of frequency 500 Hz moves away from an observer towards a cliff at a speed of 15 ms^{-1}. Then, the frequency of sound that the observer hears in the echo reflected from the cliff is :
(Take velocity of sound in air = 330 ms^{-1}) :
(A) 524 Hz (B) 500 Hz
(C) 478 Hz (D) 515 Hz

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Section - B : In actual NEET paper you will be given choice to attempt any 10 out of 15 questions in this section but for this test paper, students are advised to solve all question to compare their preparation with the provided benchmarking

1. The height at which the weight of a body becomes $1/9^{th}$, its weight on the surface of earth (radius R), is :
(A) $5R$ (B) $15R$
(C) $3R$ (D) $2R$

2. The Earth is assumed to be a sphere of radius R. A platform is arranged at a height $3R$ from the surface of the Earth. The escape velocity of a body from this platform is fv, where v is its escape velocity from the surface of the Earth. The value of f is :

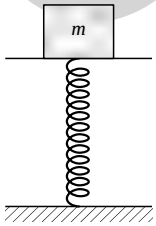
(A) $\sqrt{2}$ (B) $\frac{1}{\sqrt{2}}$

(C) $\frac{1}{3}$ (D) $\frac{1}{2}$

3. A remote-sensing satellite of earth revolves in a circular orbit at a height of 3.4×10^6 m above the surface of earth. If earth's radius is 6.4×10^6 m and $g = 9.8$ ms^{-2}, then the orbital speed of the satellite is :
(A) 6.38 km s^{-1} (B) 7.76 km s^{-1}
(C) 8.56 km s^{-1} (D) 9.13 km s^{-1}

4. When an oscillator completes 50 oscillations, its amplitude is reduced to 1/2 of initial value. What will be its amplitude, when it completes 200 oscillations ?
(A) 1/8 (B) 1/16
(C) 1/4 (D) 1/2

5. A mass of 5.0 kg is put on a flat pan attached to a vertical spring fixed on the ground as shown in the figure. The mass of the spring and the pan is negligible. When pressed slightly and released the mass executes a simple harmonic motion. The spring constant is 200 N/m. What should be the minimum amplitude of the motion so that the mass gets detached from the pan (take $g = 10$ m/s^2) ?



(A) 10.0 cm
(B) Any value less than 12.0 cm
(C) 4.0 cm
(D) 25.0 cm

6. A body of mass m is attached to the lower end of a spring whose upper end is fixed. The spring has negligible mass when the mass m is slightly pulled down and released, it oscillates with a time period of 3 s. When the mass m is increased by 1 kg, the time period of oscillations doubles. The value of m in kg is :
(A) 2/3 (B) 1/3
(C) 1/2 (D) 9/16

7. If the tension and diameter of a sonometer wire of fundamental frequency n is tripled and density is one third then its fundamental frequency will become :

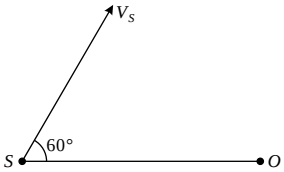
(A) $n/4$ (B) $\sqrt{2}n$

(C) n (D) $n/\sqrt{2}$

8. The number of possible natural oscillations of air column in a pipe closed at one end of length 1.7 m whose frequencies lie below 1250 Hz are (velocity of sound = 340 ms^{-1}) :
(A) 10 (B) 13
(C) 11 (D) 12

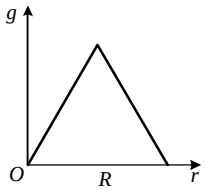
9. A car is moving towards a high cliff. The driver sounds a horn of frequency f. The reflected sound heard by the driver has frequency $2f$. If v is the velocity of sound, then the velocity of the car, in the same velocity units, will be :
(A) $v/\sqrt{2}$ (B) $v/3$
(C) $v/4$ (D) $v/2$

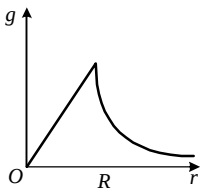
10. A source of sound S emitting waves of frequency 200 Hz and an observer O are located at some distance from each other. The source is moving with a speed of 20 ms^{-1} at an angle of 60° with the source observer line as shown in the figure. The observer is at rest. The apparent frequency observed by the observer is (velocity of sound in air 330 ms^{-1}) :

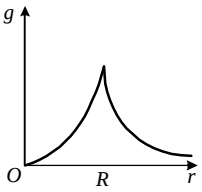


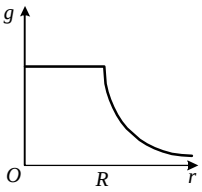
(A) 97 Hz (B) 100 Hz
(C) 103 Hz (D) 206 Hz

11. Starting from the centre of the planet having radius R, the variation of g (acceleration due to gravity) is shown by :

(A) 

(B) 

(C) 

(D) 

12. The radii of circular orbits of two satellites *A* and *B* of the earth, are 16 *R* and *R*, respectively. If the speed of satellite *A* is 3 *V*, then the speed of satellite *B* will be :

(A) 3 *V*/2 (B) 3 *V*/4
(C) 6 *V* (D) 12 *V*

13. A point performs simple harmonic oscillation of period *T* and the equation of motion is given by $x = a \sin(\omega t + \pi/4)$. After the elapse of what fraction of the time period the velocity of the point will be equal to half of its maximum velocity ?

(A) *T*/24 (B) *T*/12
(C) *T*/8 (D) *T*/6

14. Two points are located at a distance of 10 m and 20 m from the source of oscillation. The period of oscillation is 0.15 sec and the velocity of the wave is 300 m/s. What is the phase difference between the oscillations of two points ?

(A) π (B) $\pi/6$
(C) $4\pi/9$ (D) $2\pi/3$

15. The two nearest harmonics of a tube closed at one end and open at other end are 240 Hz and 280 Hz. What is the fundamental frequency of the system ?

(A) 10 Hz (B) 20 Hz
(C) 30 Hz (D) 40 Hz

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ANSWER KEY

SECTION-A

1. (B)	**2.** (D)	**3.** (B)	**4.** (B)
5. (C)	**6.** (C)	**7.** (B)	**8.** (D)
9. (B)	**10.** (C)	**11.** (B)	**12.** (A)
13. (C)	**14.** (C)	**15.** (A)	**16.** (B)
17. (D)	**18.** (A)	**19.** (D)	**20.** (D)
21. (C)	**22.** (D)	**23.** (D)	**24.** (C)
25. (B)	**26.** (B)	**27.** (A)	**28.** (A)
29. (A)	**30.** (C)	**31.** (B)	**32.** (A)
33. (B)	**34.** (D)	**35.** (A)	

SECTION-B

1. (D)	**2.** (D)	**3.** (A)	**4.** (B)
5. (D)	**6.** (B)	**7.** (C)	**8.** (D)
9. (B)	**10.** (D)	**11.** (A)	**12.** (D)
13. (A)	**14.** (C)	**15.** (B)	