Old-Exam.Questions-Chapt-15

T072

Q27. A block of mass 20 g is attached to a horizontal spring with spring constant of 25 N/m. The other end of the spring is fixed. The block is pulled a distance 10 cm from its equilibrium position (x = 0) on a frictionless horizontal table and released. The frequency of the resulting simple harmonic motion is (Ans: 5.6 Hz)

Q28. A horizontal spring is fixed at one end. A block attached to the other end of the spring undergoes a simple harmonic motion on a frictionless table. Which one of the following statements is correct? (Ans: The frequency of the motion is independent of the amplitude of oscillation.

Q29. A simple pendulum consists of a mass m = 6.00 kg at the end of a light cord of length L. The angle θ between the cord and the vertical is given by $\theta = 0.08\cos\left[\left(4.43\,t + \pi\right)\right]$, where t is in second and θ is in radian. Find the length L. (Ans: 0.50 m)

Q30. A block attached to an ideal horizontal spring undergoes a simple harmonic motion about the equilibrium position (x = 0) with an amplitude x_m = 10 cm. The mechanical energy of the system is 16 J. What is the kinetic energy of the block when x = 5.0 cm? (Ans: 12 J)

T071

Q12. A 2.00 kg uniform meter stick (L = 1.00 m) is pivoted at one of its end and made to oscillate in a vertical plane about this end. The period of oscillation is: (Ans: 1.64 s)

Q13. A 0.20 kg object attached to a horizontal spring whose spring constant is 500 N/m executes simple harmonic motion. If its maximum speed is 5.0 m/s, the amplitude of its oscillation is:(Ans: 0.10 m)

Q14. A 3.0 kg block, attached to a spring, executes simple harmonic motion according to the relation: $x = 2.0\cos(50\,t)$, where x is in m and t is in s. The spring constant of the spring is: (Ans: 7.5×10^3 N/m)

Q15. A particle is in simple harmonic motion along the x axis. The amplitude of the motion is x_m . When it is at x = 10 cm, its kinetic energy K = 6.0 J and its potential energy U = 4.0 J (measured with U = 0 at

x = 0). When it is at x = -5.0 cm, the kinetic and potential energies are: (Ans: K = 9.0 J and U = 1.0 J)

T062

Q14. The displacement of a particle oscillating along the x-axis is given as a function of time according to the equation: x(t)=0.50cos(πt+π/2). The magnitude of the maximum acceleration of the particle is: (Ans: 4.9 m/s^2)

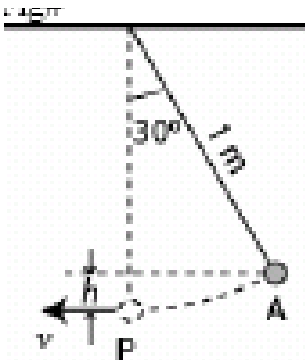
Q15. A block of mass 2.0 *kg* attached to a spring oscillates in simple harmonic motion along the *x* axis. The limits of its motion are $x = -20$ *cm* and $x = +20$ *cm* and it goes from one of these extremes to the other in 0.25 *s*. The mechanical energy of the block-spring system is: (Ans: 6.3 *J)*

Q16. The mechanical energy of a block-spring system executing simple harmonic motion is 8.0 *J* and the amplitude x_m=12 *cm*. When *K* = 6.0 *J*, the displacement of the block is: (Ans: *x* = 6.0 *cm)*

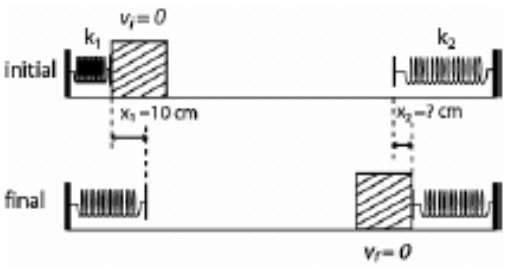
Q17. A physical pendulum consists of a uniform solid disk (radius *R* = 10.0 *cm*) supported in a vertical plane by a pivot located at a distance *d* = 5.0 *cm* from the center of the disk. The disk is made to oscillate in a simple harmonic motion of period T. Find T. (Ans: 0.78 *s)*

T061

Q6. A simple pendulum consists of a 2.0 *kg* mass attached to a 1.0 *m* long string. It is released from rest at an angle of 30º (point A) as shown in Fig 3. Its speed (*v*) at the lowest point *P* is: (Ans: 1.6 m/s)



Q7. Two springs of spring constants k_1 = 40 *N/m* and k_2 = 160 *N/m* are fixed opposite to each other on a frictionless floor as shown in Fig. 4. A 0.50 *kg* block, not attached to any of the springs, oscillates between the two springs. If the block compresses the first spring by a maximum distance of 10 *cm* then it will compress the second spring by a maximum distance of: (Ans: 5.0 *cm)*



T052

Q27. A mass m_1 = 1.0 kg is connected to a spring (with spring constant equal to *k*) and oscillates on a horizontal frictionless table with a period of 1.0 s. When m_1 is replaced with another unknown mass m_2, the period changes to 2.0 s. Find the value of m_2.n (Ans: 4.0 kg)

Q28. A 0.500 kg block is connected to a spring (k = 20.0 N/m) and oscillates on a horizontal frictionless table. Calculate the maximum kinetic energy of the block if the amplitude of the simple harmonic motion is 3.00 cm. (Ans: 9.00×10^{-3} J)

Q29. If the displacement of a block-spring system is described by the following equation: x(t)=0.2cos(10t) where *x* is in *m*, and *t* is in *s*. What is the speed of the block when its displacement is *x* = 0.1 m? (Ans: 1.73 m/s)

Q30. **A** simple pendulum has a period of 10.0 s if the free fall acceleration is *g*. What would its period be if the free fall acceleration is *g*/2? (Ans: 14.1 s)

T051

Q27. In simple harmonic motion, the magnitude of the acceleration is greatest when: (Ans: the displacement is maximum)

Q28. A particle is in simple harmonic motion along the x axis. The amplitude of the motion is x_m. At one point in its motion its kinetic energy is K = 5 J and its potential energy measured with U = 0 at x = 0) is U = 3 J. When it is at x = x_m, the kinetic and potential energies are: (Ans: K = 0 and U = 8J)

Q29. A 0.25-kg block oscillates at the end of the spring with a spring constant of 200N/m. If the system has an energy of 6.0 J, then the amplitude of the oscillation is: (Ans: 0.24m)

Q30. A simple pendulum has length *L* and period *T*. As it passes through its equilibrium position, the string is suddenly clamped at its midpoint (See Fig. 9). (Ans: $\frac{T}{\sqrt{2}}$)

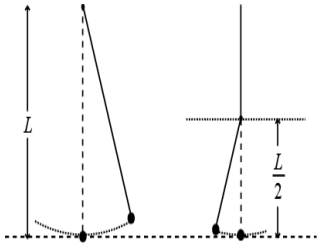


Figure 9

T042

Q12. A block of mass 0.50 kg is attached to a horizontal spring (k = 160 N/m). The block is pulled a distance 20 cm from its un-stretched position on a frictionless horizontal surface. What is the magnitude of its maximum acceleration? (Ans: 64 m/s**2)

Q13. A simple pendulum of length = L1 on Earth oscillates with a period = T. Another pendulum of length = L2 on the Moon oscillates with a period = 2*T. Find the ratio L1/L2. (Take g on Moon = (1/6)*g on Earth.) (Ans: 3/2)

Q14. A block-spring system has an amplitude of 4.0 cm and a maximum speed of 0.60 m/s. What is the frequency of oscillation? (Ans: 2.39 Hz)

Q15. A particle oscillates according to the equation: x = 0.20 cos(pi*t), where pi = 3.14. What is the period of the motion? (Ans: 2.0 s)

T041

Q12. A simple pendulum of length 1.55 m has a period (T) on the surface of Earth. What is the length of the pendulum to have the same period (T) on the surface of Moon where g = 1.67 m/s**2? A1 0.26 m

Q13**.** A block-spring system oscillates with simple harmonic motion according to the equation x = 0.20 cos(10 * t + Pi/2), where x is in m and t is in s. The mass of the block is 2.0 kg. Find the total energy of the system. (Ans: 4.0 J)

Q14**.** A 2.0-kg mass connected to a spring of force constant 8.0 N/m is displaced 5.0 cm from its equilibrium position and released. It oscillates on a horizontal, frictionless surface. Find the speed of the mass when it is at 3.0 cm from its equilibrium position. (Ans: 0.08 m/s)

Q15**.** Which of the following equations represent a simple harmonic motion [F is the force and x is a displacement]? : 1) F = -2 x; 2) F = 5 x; 3) F = - 10 x; 4) F = 3 x**2; 5) F = -3 x**2 (Ans: 1 & 3).

T032

Q27. In a simple harmonic motion, the magnitude of the acceleration is: (Ans: proportional to the displacement)

Q28. A 3.0 kg block, attached to a spring, executes simple harmonic motion according to x = 2*cos(50*t) where x is in meters and t is in seconds. The spring constant of the spring is: (Ans: 7500 N/m)

Q29. A particle is in simple harmonic motion along the x axis. The amplitude of the motion is Xm. At one point in its motion its kinetic energy is K = 5 J and its potential energy is U = 3 J. When it is at X = X_m, the kinetic and potential energies are: (Ans: K = 0 J and U = 8 J)

Q30. The period of a simple pendulum is 1.0 s on Earth where the acceleration of gravity is g. When brought to a planet where the acceleration of gravity is g/16, its period becomes: (Ans: 4.0 s)

T031

Q12**.** A 5.0 kg mass stretches a spring by 10 cm when the mass is attached to the spring. The mass is then displaced downward an additional 5.0 cm and released. Its position (y) in m from its equilibrium position as a function of time (t) is: (Ans: y = 0.05 cos (10 * t))

Q13. A particle (m = 0.2 kg) is attached to a spring. The motion of the particle is described by x = 0.10 cos (10*t +PI/3) where x is m and t is in s. What is the mechanical energy of the particle? A1 0.1 J

Q14. The frequency of small oscillations of a simple pendulum of length (L) on the surface of Earth is (f). What will be its frequency on the surface of the Moon if we increase its length to become (2L)? (Take: g (Moon) = 0.17 g(Earth)) (Ans: 0.29 * f)

Q15. A mass m = 2 kg is attached to a spring having a force constant k = 300 N/m. The mass is displaced from its equilibrium position and released. Its period of oscillation (in s) is approximately (Ans: 0.5)