Harmonic oscillator equations mastering physics

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If you see this message, it means that we are having trouble downloading external resources on our site. If you're behind a web filter, please make sure the domains no.kastatic.org and no.kasandbox.org unlocked. Mastering Physics SolutionsChapter 13 Oscillations about equilibrium .1C Basketball player drips the ball with a steady period of T seconds. Is the movement of the ball periodic? Is it just harmonic? Explain. Solution: The movement of a particle that repeats in position and phase after a certain period of time. is defined as the periodic movement of the periodic movement in which the particle moves to and fr0 about a fixed point, so its acceleration is always directly proportional to its displacement from its middle position. defined as a simple harmonic movement. As the player drips the ball with a constant period, the movement is periodic. On the other hand. The position and speed of the ball do not vary sinusoidally with time, instead it changes linearly. Thus, movement is not a simple harmonic movement. Chapter 13 Fluctuations on Equilibrium No. 1P A small trolley on a 5.0-meter air track moves at a speed of 0.85 m/s. Bumpers at both ends of the track force the trolley to change direction and maintain the same speed. Find the period and frequency of this movement. Solution: Chapter 13 Oscillates about equilibrium .2C Man rides on a Ferris wheel that rotates at a constant angular speed if the sun is directly above the head. Is the shadow of man on earth undergoing periodic movement? Does it undergo a simple harmonious movement? Explain. Solution: The shadow of faces undergoes periodic movements with the same period as the period of rotation of the Ferris wheel In fact, if you take into account the connection between a uniform circular motion and a simple harmonic movement, we can say that the shadow demonstrates a simple harmonic movement when it moves back and forth on the earthChaster 13 oscillations about the equilibrium No. 2P Man in a rocking chair completes 12 cycles in 21. What is the period and frequency of rocking? Solution: Chapter 13 Oscillates about the equilibrium .3C air trolley bounces back and forth between the two ends of the airway. Is this movement intermittent? Is it just harmonic? Explain. Solution: Chapter 13 Oscillates about Equilibrium No 3P While fishing on cata, a fisherman suddenly notices that a bobber (floating device) is attached to his line bouncing up and down with a frequency of 2.6 Hz. What is the period of beaver movement? Solution: Chapter 13 Fluctuations on Equilibrium No.4C, if the mass of M and the mass of 2 m fluctuate on identical springs with the same amplitudes, they both have the same maximum kinetic energy. How can that be? Shouldn't a large mass have more kinetic energy? Explain. Solution: Chapter 13 Fluctuations about Balance No. 4P If you dribble basketball with a frequency of 1.77 Hz, how long will it take for you to complete 12 drips? Solution: Chapter 13 Fluctuations About An object that oscillates with a simple harmonic motion completes the cycle at a time T. If the amplitude of an object is doubled, the time it takes for a single cycle is still T, even if the object covers twice the distance. How can that be? Explain. Solution: Chapter 13 Oscillations about equilibrium No. 5P You take a pulse and observe 74 heartbeats per minute. What is the period and frequency of your heartbeat? Solution: Chapter 13 Fluctuations on Balance No.6C Position of an object undergoing a simple harmonic movement is given to x'A cos (Bt). Explain the physical significance of Constant A and B. What is the frequency of movement of this object? Solution: Chapter 13 Fluctuations on Balance No.6P (a) Your heart beats 1.45 Hz Wi. How many beats happens per minute? (b) If your heart rate increases, will the number of beats increase per minute, decrease or remain the same? (c) How many beats occurs per minute if the frequency increases to 1.55 Hz? Solution: Chapter 13 Fluctuations on Balance No.7C The speed of an object undergoing a simple harmonic movement is given v q s sin (Dt). Explain the physical significance of Constant C and D. What is the amplitude and period of movement of this object? Solution: Chapter 13 Oscillations about Equilibrium No.7P You turn your car's engine up to 2700 rpm (turnover/min). What is the period and frequency of the engine? (b) If you change the engine life by 0.044 s, how many revs will it do? Solution: Frequency is the number of cycles (or revs) per second. Time is a period, sunk the time to complete one cycle. Given that the engine frequency of the car - 2700 rpm Chapter 13 Fluctuations on Balance No.8C Pendulum Bob in the picture of the leak of sand on the strip chart. What impact does this sand loss have on the pendulum period? Explain. Solution: The pendulum period does not depend on the mass of its bean. Thus, this period should not be affected. Chapter 13 Oscillations on Equilibrium No.8P Mass moves back and forth in a simple harmonious motion with amplitude A and period T.A. (a) From the point of view of A, how far does mass move in time T? (b) How far does it travel during 5T/2? Solution: Chapter 13 Oscillations about the equilibrium of soldiers on the march are often ordered to break the cadence in their stride when crossing the bridge. Why is this a good idea? Solution: Soldiers march across the bridge. If the natural frequency of the bridge is equal to the frequency of soldiers, the bridge vibrates with greater amplitude due to resonance. This can cause the bridge to collapse immediately. Because of this, all soldiers at the crossing of the bridge are ordered to break the cadence on their steps. Chapter 13 Oscillations on Equilibrium No 9P Mass moves back and forth in a simple harmonious motion with amplitude A and period T. (a) In terms of T, how long it takes for the mass to move through the total distance (b) How long does it take to move mass over a total distance of 3A? Solution: Chapter 13 Fluctuations on Equilibrium No.10P Position of Mass, Oscillating on the Spring, is given x th (3.2 cm) cos'2't/ (0.58 s) . (a) What is the period of this movement? (b) What is the first time that a mass is in the position of x No 0? Solution: Chapter 13 Fluctuations on Equilibrium No.11P The position of mass oscillating on the spring is given x (7.8 cm) cos'2't/ (0.68 s) (a) What is the frequency of this movement? (b) When is the mass first at x -7.8 cm position? Solution: Chapter 13 Fluctuations on Balance No. 12 Solution: Chapter 13 Fluctuations on Equilibrium No. 13P Amass on Spring are desecrated with a simple harmonic movement of amplitude A on equilibrium x 0. Its maximum vmax speed and its maximum acceleration amax. (a) What is the mass speed at x 0? (b) What is the acceleration of mass in x 0? (c) What is the mass speed at x th A? (d) What is the acceleration of mass in x th A? Solution: Chapter 13 Fluctuations on Equilibrium No 14P Mass fluctuates on spring with a period of 0.73 s and amplitude 5.4 cm. Write the equation, giving x as a function of time, assuming that the mass begins with x-a during t 0. Solution: Chapter 13 Fluctuations on equilibrium q.15p Atom in a molecule oscillates about its equilibrium position with a frequency of 2.00 × 1014 Hz and a maximum displacement of 3.50 nm. a) Write the expression, yes x as a function of time for this atom, assuming that x th A on t 0. b) If instead we assume that x No 0 on t 0, will your position expression use a sinus function or cosine function over time? Explain. Solution: Chapter 13 Fluctuations on Equilibrium No 16P Mass fluctuates on the spring with the period T and amplitude 0.48 cm. Mass is in the equilibrium position x No 0 at t 0 and moves in a positive direction. Where is the mass at that time (a) t/8, (b) t t/4, (c) t/2and (d) t 3T/4? (e) Guide results for parts (a) through (d) with a vertical axis representing position and a horizontal axis representing time. Solution: Chapter 13 Fluctuations on Equilibrium No.17P The weight position on the spring is given x th (6.5 cm) cos'2't/ (0.88 s). a) What is the period, T, this movement? (b) Where is the mass in t 0.25 s? c) Show that the mass is in the same place at 0.25 s and T seconds, as at 0.25 s. Solution: Chapter 13 Fluctuations on Equilibrium No 18P Mass, attached to the spring, fluctuates with a period of 3.35 s. (a) If the mass starts with a rest at x 0.0440 m and the time t 0, where is it at that time t 6.37 s? (b) Is the mass moving in a positive or negative direction x at t 6.37 s? Explain. Solution: Chapter 13 Fluctuations on Equilibrium No.19P The Object moves with a simple harmonic movement of period T and amplitude A. Over one full cycle, for what period of time more than A/2? Solution: Chapter 13 Fluctuations on Equilibrium No.20P The Object moves with a simple harmonic movement of period T and amplitude A. In one full cycle, for what period of time does the object's speed exceed vmax/2? Solution: Chapter 13 Fluctuations on Balance No.21P Object, performing a simple harmonic movement, has maximum vmax speed and maximum amax acceleration. Find (a) amplitude and (b) the period of this movement. Express your answers in terms of vmax and amax. Solution: Chapter 13 Fluctuations on equilibrium No.22P ball rolls along a circular track radius of 0.62 m with a constant angular speed of 1.3 rad/s in the direction of counterclockwise. If the corner position of the ball at t No 0 is θ and 0, Find x component of the position of the ball during 2.5 s, 5.0 s and 7.5 s. Let the θ 0 correspond to the positive direction x. Solution: Chapter 13 Fluctuations on Balance No.23P Object performing a simple harmonic movement, has a maximum speed of 4.3 m/s and a maximum acceleration of 0.65 m/s2. Find (a) amplitude and (b) the period of this movement. Solution: Chapter 13 Oscillations about equilibrium No. 24P Baby rocks back and forth on the porch swing with a amplitude of .204 m and a period of 2.80 s. Assuming that the movement is about simple harmonic, find the maximum speed of the child. Solution: Chapter 13 Fluctuations on Equilibrium No 25P 30.0-g goldfinch lands on a slender branch, where it oscillates up and down with a simple harmonic movement of amplitude 0.0335 m and a period of 1.65 s. a) What is the maximum acceleration of the finch? Express your answer as a fraction of the acceleration of gravity, (b) What is the maximum speed of the golden fin? c) At a time when goldfinch is experiencing maximum acceleration, is its speed maximum or minimum? Explain. Solution: c) For maximum acceleration, the speed in simple harmonious motion becomes zero. Chapter 13 Fluctuations on Balance No.26P Solution: Chapter 13 Fluctuations on Equilibrium No. 27P vibrating structural beam in a spaceship can cause problems if the frequency of vibration is quite high. Even if the vibration amplitude is only a fraction of a millimeter, the acceleration of the beam can be several times greater than the acceleration due to gravity. As an example, find the maximum acceleration of the beam, which vibrates with a amplitude of 0.25 mm at a speed of 110 vibrations per second. Give your answer as a multiple of g. Chapter 13 Oscillation on equilibrium No. 28P peg on a turning circle moves at a constant tangent speed of 0.77 m/s in a radius of 0.23 m. The peg casts a shadow on the wall. Find the following amounts associated with shadow movement: (a) period, b) amplitude, c) maximum speed and (d) maximum acceleration. Solution: Chapter 13 Fluctuations on Equilibrium No.29P Pistons in the Internal Combustion Engine pass motion about simple harmonic. If the amplitude of movement is 3.5 cm and the engine is running at a speed of 1700 rpm, find (a) maximum acceleration of pistons and b) their maximum speed. Solution: Chapter 13 Fluctuations on Equilibrium No.30P 0.84-kilogram air raft attached to the spring and allowing to fluctuate. If the air trolley is unbalanced (10.0 cm) cos (2.00 s'1)t π, find (a) maximum kinetic energy of the trolley and b) the maximum force exerted on it by the spring. Solution: Chapter 13 Fluctuations on Balance No 31P Solution: Chapter 13 Fluctuations on Balance No. 32P If the mass m is attached to this spring. Period of its oscillations T. If two such sources are connected from end to end and the same mass m attached, a) is the resulting time of oscillation greater than, less or equals T? (b) Choose a better explanation from the following: I. Connecting two springs together causes spring to suffer, which means that vibrations take less time. II. The period of oscillation does not depend on the length of the spring, only on its constant strength and the mass attached to it. III. The longer spring stretches the easier, and therefore takes longer to complete the fluctuations. Solution: Chapter 13 Oscillations on the Equilibrium No.33P Old car with worn shock absorbers fluctuates with this frequency when it hits the speed bump. If the driver adds a couple of passengers to the car and gets into another speed bump, a) the frequency of the car's vibrations is greater than, less, or equal to what was before? (b) Choose the best explanation from the following: I. The increase in spring mass increases its period and therefore reduces its frequency. The frequency depends on the strength of the constant spring, but does not depend on the mass. III. Adding mass causes spring to fluctuate faster, which increases the frequency. Solution: a) The car's oscillation rate is lower than before. b) The increase in mass increases the period of fluctuations of the car and, therefore, the frequency decreases. Option I is correct. Chapter 13 Equilibrium Fluctuations No.34P Solution: (a) When both blocks are configured to fluctuate, block 1 is equal to block 2. b) These two blocks experience the same power to restore this movement out of balance and therefore have equal periods of oscillation. Chapter 13 Fluctuations on Balance No. 35P Solution: Chapter 13 Fluctuations on Equilibrium No. 36P 0.46-kg mass attached to the spring undergoes a simple harmonic movement with a period of 0.77 s. What is the constant strength of spring? Solution: Chapter 13 Fluctuations About Balance No.37P System A consists of a mass M attached to a spring with a force of constant k;The B system has a mass of 2 m attached to the spring with a power of constant k;the C system has a mass of 3 m attached to the spring with a constant strength of 6k; and the D system has a mass of m Rank these systems in order to increase the oscillation period. Solution: Chapter 13 Fluctuations on Balance No 38P Solution: Chapter 13 Fluctuations on Equilibrium No. 39P When a 0.50-kilogram mass is attached to a vertical spring, the spring stretches for 15 cm. How much mass should be attached to the spring to result in a 0.75-kilogram period of oscillation? Solution: Chapter 13 Fluctuations on Equilibrium No.40P Spring with a constant strength of 69 N/m is attached to a weight of 0.57 kg. Assuming that the amplitude of motion is 3.1 cm, determine the following quantities for this system: (a) q, b) vmax, (c) T. Solution: Chapter 13 Oscillations on Balance No.41P Two people with a total weight of 125 kg are jumping into an old car with worn shock absorbers. This results in a compression of springs at 8.00 cm. When the car hits the road, it fluctuates up and down with a period of 1.65 s. Find a) the total load supported by springs and b) the weight of the car. Solution: Chapter 13 Fluctuations on Equilibrium No. 42P 0.85-kilogram weight attached to vertical force spring, constantly hovering 150 H/m with a maximum speed of 0.35 m/s. Find the following amounts associated with mass movement: a) period, b) amplitude, c) maximum acceleration. Solution: Chapter 13 Fluctuations on Equilibrium No. 43P When a .213-kilogram weight is attached to a vertical spring, this causes the spring to stretch to a distance d. If the mass is currently slightly shifted from equilibrium, it is established that it is 102 oscillations in 56.7 s. Find the distance of stretching, d. Solution: Chapter 13 Fluctuations on equilibrium No.44P Springs 511-kilogram motorcycle have an effective constant of strength 9130 N/m. (a) If a person sits on a motorcycle, does its period of oscillation increase, or remains the same? (b) At what percentage and in what direction is the period of oscillation changing when a 112-kilogram person rides a motorcycle? Solution: Chapter 13 Fluctuations on Equilibrium No.45P If the mass m is attached to this spring, its period of oscillation T. If two such sources are connected from end to end, and the same mass of m attached, a) its period is longer than, less, or just like with one spring? (b) Check your response to part (a) by calculating a new period, T', from the perspective of the old period T. Solution: Chapter 13 Fluctuations on Equilibrium No 46P How much work is required to stretch the spring to 0.133 m if its constant strength is 9.17 N/m? Solution: Chapter 13 Oscillation on equilibrium of 0.321-kilogram weight 0.321 kg is attached to a spring with a constant strength of 13.3 N/m. If the mass is shifted by 0.256 m from equilibrium and released, what is its speed when it is 0.128 m from equilibrium? Solution: Chapter 13 Fluctuations on Balance No.48P Find the total mechanical energy of the system described in the previous problem. Solution: Chapter 13 Fluctuations on Balance No.49P 1.8 kg Attached to the aspring oscillates with a amplitude of 7.1 cm and a frequency of 2.6 Hz. What is his energy of movement? Solution: Chapter 13 Oscillation on the equilibrium of 0.40-kilogram weight 0.40 kg is attached to the spring with the strength of the constant 26 H/m and released from rest at a distance of 3.2 cm from the equilibrium position of the spring. a) Give a strategy that allows you to find the speed of mass when it is halfway to an equilibrium position. b) Use your strategy to find this speed. Solution: Chapter 13 Fluctuations on Equilibrium No.51P (a) What is the maximum mass speed in the previous problem? (b) How far is the mass from the equilibrium position when its speed is half the maximum speed? Solution: Chapter 13 Fluctuations on Equilibrium No.52P Grapes Is placed in the spring scale in the supermarket. Grapes fluctuate up and down with a period of 0.48 s, and spring in the scale has the strength of a constant of 650 H/m. What is a) the mass and b) weight of grapes? Solution: (a) The period of the spring mass of the system is directly proportional to the square root of the mass and inversely proportional to the square root of the spring constant force. The time period is given by the Ratio 13 Fluctuation Ratio of Balance No 53P What is the maximum rate of grapes in the previous problem if their amplitude of oscillations is 2.3 cm? Solution: Chapter 13 Equilibrium 54P Block 0.505 kg glides on a frictionless horizontal surface at a speed of 1.18 m/s. The block collides with an unstretched spring and compresses it by 23.2 cm before resting. (a) What is the constant of strength this spring? b) For how long does the unit stay in contact with the spring before it comes to rest? (c) If the spring power constant is increased, does it document the time it takes to stop the increase, decrease, or remain the same? Explain. Solution: Chapter 13 BalanceAlization No. 55P Bullet 2.25 g is embedded in a 1.50kg unit that attaches to a spring strength of a constant 785 N/m. If the maximum compression speed is 5.88 cm, find a) the initial speed of the bullet and (b) time for the bullet block system to come to rest. Solution: Chapter 13 Fluctuations on Balance No 56P Solution: Chapter 13 Fluctuations on Balance No. 57P Grandfather Clock keeps the right time at sea level. If the clock is delivered to the top of a nearby mountain as well) do you expect them to keep the right time, run slowly, or run fast? (b) Choose a better explanation from the following: I. Gravity is weaker at the top of the mountain, leading to a longer period of oscillation. The length of the pendulum is unchanged, and therefore its period remains the same. III. Additional gravity of the mountain leads to a decrease in the period. Solution: Chapter 13 Fluctuations about equilibrium No.58P Pendulum L length has a period T. How long should the pendulum be if its period should be 2T? Solution: 13 Fluctuations on Equilibrium No 59P Solution: Chapter 13 Fluctuations on Equilibrium No 60P Simple pendulum length 2.5 m makes 5.0 full oscillations in 16 s. What is the acceleration of gravity in the location of the pendulum? Solution: Chapter 13 Oscillates on the Equilibrium No.61P Grand Pendulum with a 200-pound gilded bob 12 inches in diameter on display in the lobby of the United Nations building. Pendulun is 75 feet long. It is used to show the rotation of the Earth - for this reason it is called the Foucault pendulum, what is the least amount of time it takes for Bob to swing from a position of maximum movement to the equilibrium position of the pendulum? (Suppose the acceleration due to gravity is g 9.81 m/s2 in a UN building.) Solution: Chapter 13 Equilibrium Fluctuations No. 62P Find the length of a simple pendulum that has a period of oi 1.00 s. Suppose the acceleration of gravity is 9.81 m/s2. Solution: Chapter 13 Fluctuations on Equilibrium No.63P If the pendulum in the previous problem were to be taken to the moon, where the acceleration of gravity g/6, (a) will its period increase, decrease, or remain the same? (b) Check the result partially (a) by calculating the pendulum period on the moon. Solution: Chapter 13 Oscillates about equilibrium No.64P Hula hoop hanging from peg. Find the period hoop as it gently rocks back and forth on the peg. (For the hoop with the axis on the rim I and 2mR2, where R is the radius of the hoop.) Solution: Chapter 13 Fluctuations on Balance No.65P Solution: Chapter 13 Fluctuations on Equilibrium No.66P Consider a meter stick that oscillates back and forth about the pivot point at one of its ends. (a) Is the L-1.00m long period larger than, smaller, or the same as the metrostik period? Explain. (b) Find the length of L of a simple pendulum, which has a period equal to the period of metrology. Solution: Chapter 13 Fluctuations on Equilibrium No. 67P At the construction site for a new skyscraper, a uniform beam of steel is suspended at one end. If the beam swings back and forth with a period of 2.00 s, what is its length? Solution: Chapter 13 Oscillates about equilibrium No.68P (a) Find a child's leg period as it swings about the hip joint. Suppose the leg is 0.55 m long and can be considered as a homogeneous rod. (b) Assess the speed of the child's walk. Solution: Chapter 13 Fluctuations on Equilibrium No. 69P Suspended from the ceiling of the elevator is a simple pendulum length L. What period of this pendulum if the elevator (a) accelerates upwards with acceleration a, or b) accelerates downwards with an acceleration of which is more than zero, but smaller g? Give your answer from the point of view of L, g and a. Solution: Chapter 13 Fluctuations on Balance No.70GP The object is subjected to a simple harmonica with period T. Over time 3T/2 object moves through 12D. From the point of view of D, what is the amplitude of the movement of the object? Solution: Chapter 13 Oscillations about the equilibrium No.71GP Mass on the line moves with simple harmonic movement. If the period of movement doubles, with the force constant, and the amplitude remains the same, then what multiplier factor changes the following quantities: (a) angular frequency, b) frequency, c) maximum speed, (d) maximum acceleration, (e) total mechanical energy? Solution: Chapter 13 Fluctuations on Equilibrium No.72GP If the amplitude of a simple harmonic oscillator doubles, by what multiplier factor the following quantities change: (a) angular frequency, b) frequency, (c) period, (d) maximum. speed, (e) maximum acceleration, (f) total mechanical energy? Solution: Chapter 13 Fluctuations on Equilibrium No.73GP Mass m is suspended from the ceiling of the elevator by the spring force of the constant k. When the elevator is at rest, the period of mass T. Does the period increase, decrease or remain unchanged when the elevator a) moves up at a constant speed or b) moves upwards with constant acceleration? Solution: Chapter 13 Oscillates on Balance No.74GP Pendulum L suspended from the elevator ceiling. When the elevator is at rest, the period of the pendulum T. Does the period increase, decrease or remain unchanged when the elevator a) moves up at a constant speed or b) moves up with constant acceleration? Solution: Chapter 13 Fluctuations on equilibrium of 1.75GP 1.8-kilogram weight is attached to the spring with the strength of the constant 59 H/m. If the mass is released at a speed of 0.25 m/s at a distance of 8.4 cm from the equilibrium position of the spring, what is its speed when it is halfway to an equilibrium position? Solution: We can find the speed of mass attached to spring at any time using energy conservation. Initially, the mass has both potential energy and kinetic energy. Now our interest is to know the speed of the block when it is halfway from its equilibrium point. In accordance with Energy Conservation Chapter 13 Fluctuations on Balance No. 76GP, the Astronaut uses a body mass measurement device (BMMD) to determine its mass. What is the mass of the cosmonaut, given that the constant of power of THE BMMD is 2600 H/m, and the period of oscillation - 0.85 s? (See the discussion on page 427 for more information about BMMD.) Solution: Chapter 13 Fluctuations on Equilibrium No.77GP Typical atom in solid can fluctuate with a frequency of 1012 Hz and amplitude of 0.10 angstrom (10-11 m). Find the maximum acceleration of the atom and compare it with the acceleration of gravity. Solution: Chapter 13 Oscillations on Equilibrium q.78GP Sunspots vary in number depending on the time exhibiting approximately 11-year cycle. Galileo made the first European observations of sunspots in 1610, and daily observations were begun in zurich in 1749. We are currently well into the there is a cycle. What is the frequency of the sunspot cycle? Give your answer in Hz. Solution: Chapter 13 Fluctuations on Balance No. 79GP Solution: Chapter 13 Fluctuations on Balance No 80GP Object, undergoing a simple harmonic movement with period T is in the position of x No 0 at the time t No 0. At that time t 0.25T the position of the object is positive. State, whether x positive, negative or zero in the following time: a) t 1.5T, b) t 2T, (c) t 2.25T, and (d) t 6.75T. Solution: Chapter 13 Fluctuations on Balance No. 81GP Maximum speed of 3.1-kg mass attached to aspring is 0.68 m/s, and the maximum force exerted on the mass of 11 N. (a) Whatis amplitude movement for this mass? (b) What is the constant of the power of spring? What is the frequency of this system? Solution: Chapter 13 Fluctuations on Equilibrium No.82GP Acceleration Block attached to the spring, given q (0.302 m/s2) cos (No2.41 rad/s't). What is the frequency of the block? What is the maximum speed of the block? (c) What is the amplitude of the block's movement? Solution: Chapter 13 Fluctuations on Balance No 83GP Solution: Chapter 13 Fluctuations on Equilibrium No 84GP 9.50-g Bullet, moving horizontally at the initial v0 speed, embedding itself in the 1.45-kg pendulum bob, which is originally at rest. The pendulum is 0.745 m long after the collision, the pendulum swings to one side and stops when it has gained a vertical height of 12.4 cm(a) The kinetic energy of the bullet-bele system immediately after the collision is more than, less, or the same as the kinetic energy of the system just before the collision? Explain. (b) Find the initial speed of the bullet. (c) How long does it take for the bean bullet system to rest for the first time? Solution: Chapter 13 Oscillating about equilibrium No.85GP 1.44-g spider hovers on its web, which has a damping constant of 3.30 × 10-5 kg/s. How long does it take for the amplitude of spider enumeration to reduce by 10.0 percent? Solution: Chapter 13 Fluctuations on Balance No.86GP Object is subjected to a simple harmonious movement with period T and amplitude A. From the point of view of T, how long does it take an object to travel from x x A to x x a/2? Solution: Chapter 13 Fluctuations on Equilibrium No.87GP Find a oscillation period of 0.32 kg and a radius of 0.15 m if it rotates about a small hole drilled near its rim. Solution: Chapter 13 Fluctuations on Equilibrium No.88GP Calculate the ratio of kinetic energy to the potential energy of a simple harmonic oscillator when its displacement is half of its amplitude. Solution: Let the object of mass m oscillate under a simple harmonic motion with amplitude A. When shifting half of the amplitude at this speed of the position of the object is chapter 13 Oscillation of equilibrium No.89GP A 0.363 kg of mass slides on the frictionless floor at a speed of 1.24 m/s. Massive blows and compresses the spring with the power of the constant 44.5 N/m. a) How far documents mass travel after contact with the spring before it comes to rest? b) How long does spring take to stop mass? Solution: Chapter 13 Fluctuations on Equilibrium No 90GP Large rectangular barge floating on the lake, hovers up and down with a period of 4.5 s. Find the damping constant for the barge, given that its weight is 2.44 × 105 kg and that its amplitude of oscillation decreases by 2.0 times in 5.0 minutes. Solution: Chapter 13 Fluctuations on Balance No 91GP Solution: Chapter 13 Fluctuations on Balance No 92GP Solution: 3.31NChapter 13 Fluctuations on Balance No 93GP 0.45 kg The Crow lands on a slender branch and bobs up and down with a period of 1.5 s. The eagle flies up to the same branch, scaring off the crow, and lands. The eagle now bobs up and down with a period of 4.8 s. Considering the branch as the ideal spring, find a) the effective power of the branch constant and b) the mass of the eagle. Solution: Chapter 13 Fluctuations on Balance No.94GP Solution: Chapter 13 Fluctuations on Balance No 95GP Solution: Chapter 13 Fluctuations on Equilibrium No 96GP When the mass m is attached to a vertical spring with the force of constant k, it stretches spring to the amount of L. Calculate (a) period of this mass and b) period of simple pendulum length L. Solution: Chapter 13 Oscillations on Balance No.97GP Solution: The total mechanical energy of an object in a simple harmonic motion equals the sum of kinetic and potential energies. For a mass experiencing a simple harmonic movement to spring with the force of constant (k) Chapter 13 Fluctuations on Equilibrium No.98GP Solution: Chapter 13 Fluctuations on Balance No 99GP Solution: Chapter 13 Fluctuations about Balance No 100PP Insects are ectothermic, which means that their body temperature is largely determined by the temperature of their surroundings. This can have a number of interesting consequences. For example, the coloration of the wing in some species of butterflies is determined by the temperature of the environment, as well as the body color of several types of dragonflies. In addition, the frequency of beat the wing of the beetles receiving the flight varies with temperature due to changes in the resonance frequency of their chest. The origin of these temperature effects can be traced back to the fact that molecules have higher speeds and greater energy as temperatures rise (see chapters 16 and 17). For example, molecules that collide and react as part of the metabolic process will do so faster when reactions occur at a higher temperature. As a result, the rate of development, heart rate, wing beats, and other processes all occur faster. One of the most interesting thermal effects is the temperature dependence on chirp speed in some insects. This behaviour has been observed in cone-shaped grasshoppers, as well as in several types of cricket. A The exact link between chirp speed and temperature is found in a snow tree cricket (Oecanthus fultoni Walker), which chirps at a speed that follows the expression N and T No 39, where N is the number chirp in 13 seconds, and T is the numerical temperature value in degrees Fahrenheit. This formula, which is known as the Dolbouse Act, is built on a pattern (green line) along with data points (blue dots) for snow tree cricket. Solution: Chapter 13 Fluctuations on Balance No. 101PP Insects are ectothermic, which means that their body temperature is largely determined by the temperature of their surroundings. This can have a number of interesting consequences. For example, the coloration of the wing in some species of butterflies is determined by the temperature of the environment, as well as the body color of several types of dragonflies. In addition, the frequency of beat the wing of the beetles receiving the flight varies with temperature due to changes in the resonance frequency of their chest. The origin of these temperature effects can be traced back to the fact that molecules have higher speeds and greater energy as temperatures rise (see chapters 16 and 17). For example, molecules that collide and react as part of the metabolic process will do so faster when reactions occur at a higher temperature. As a result, the rate of development, heart rate, wing beats, and other processes all occur faster. One of the most interesting thermal effects is the temperature dependence on chirp speed in some insects. This behaviour has been observed in cone-shaped grasshoppers, as well as in several types of cricket. A particularly accurate link between chirp speed and temperature is found in a snow tree cricket (Oecanthus fultoni Walker), which chirps at a rate that follows the expression N and T No 39, where N is the number chirp in 13 seconds, and T is the numerical temperature in degrees Fahrenheit. This formula, which is known as the Dolbouse Act, is built on a pattern (green line) along with data points (blue dots) for snow tree cricket. Solution: Chapter 13 Fluctuations on Balance No. 102PP Insects are ectothermic, which means that their body temperature is largely determined by the temperature of their surroundings. This can have a number of interesting consequences. For example, the coloration of the wing in some species of butterflies is determined by the temperature of the environment, as well as the body color of several types of dragonflies. In addition, the frequency of beat the wing of the beetles receiving the flight varies with temperature due to changes in the resonance frequency of their chest. The origin of these temperature effects can be traced back to the fact that molecules have higher speeds and greater energy as temperatures rise (see chapters 16 and 17). For example, molecules that collide and react as part of the metabolic process will do so faster when reactions occur at a higher temperature. As a result, the pace of development rates, wing strikes and other processes occur faster. One of the most interesting thermal effects is the temperature dependence on chirp speed in some insects. This behaviour has been observed in cone-shaped grasshoppers, as well as in several types of cricket. 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plane while maintaining its amplitude of movement equal to 30.0 m. a) If we want to reduce the maximum acceleration of the plane, should we increase or decrease the period? Explain. (b) Find the period that results in a maximum acceleration of 1.0 g. Solution: Chapter 13 Fluctuations on Equilibrium No.105IP Suppose that the constant of spring strength doubles, but the weight and speed of the unit is still 0.980 kg and 1.32 m/s, respectively. a) What kind of multiplier factor do you expect maximum compression spring change? Explain. Find a new maximum spring compression. (c) Find the time it takes to rest the mass after contact with the spring. Solution: Chapter 13 Fluctuations on Equilibrium No.106IP If the initial unit speed increases, does the total unit time is in Wi-a spring contact increase, decrease, or stay the same? (b) Find total contact times for v0 and 1.65 m/s, m 0.980 kg, and k q 245 N/m. Solution: Solution: Solution:

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