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Hence, the time period increases as: Since a wristwatch does not work on the principle of a simple pendulum, it is not affected by the acceleration due to gravity during free fall. Its working depends on spring action. Hence the frequency of oscillation of this simple pendulum is zero. If the pendulum makes small oscillations in a radial direction about its equilibrium position, what will be its time period? The bob of the simple pendulum will experience the acceleration due to gravity and the centripetal acceleration provided by the circular motion of the car. The cork is depressed slightly and then released. Ignore damping due to viscosity of the liquid. As a result, some extra water of a certain volume is displaced. Hence, an extra up-thrust acts upward and provides the restoring force to the cork. One end of a U-tube containing mercury is connected to a suction pump and the other end to atmosphere. A small pressure difference is maintained between the two columns. Show that, when the suction pump is removed, the column of mercury in the U-tube executes simple harmonic motion. Show that when the ball is pressed down a little and released, it executes SHM. Obtain an expression for the time period of oscillations assuming pressure-volume variations of air to be isothermal [see Fig. As a result of this depression, there would be a decrease in the volume and an increase in the pressure inside the chamber. The negative sign indicates that pressure increases with a decrease in volume The restoring force acting on the ball, In simple harmonic motion, the equation for restoring force is: You are riding in an automobile of mass kg. Assuming that you are examining the oscillation characteristics of its suspension system. The suspension sags 15 cm when the entire automobile is placed on it. The equation for the restoring force for the system:

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Chapter 2 : NCERT Solutions for Class 11 Physics in PDF form Updated for

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You have already learnt about some of them, e. Both these motions are non-repetitive. We have also learnt about uniform circular motion and orbital motion of planets in the solar system. In these cases, the motion is repeated after a certain interval of time, that is, it is periodic. In your childhood you must have enjoyed rocking in a cradle or swinging on a swing. Both these motions are repetitive in nature but different from the periodic motion of a planet. Here, the object moves to and fro about a mean position. The pendulum of a wall clock executes a similar motion. Examples of such periodic to and fro motion abound: Such a motion is termed as oscillatory motion. In this chapter we study this motion. The study of oscillatory motion is basic to physics; its concepts are required for the understanding of many physical phenomena. In musical instruments like the sitar, the guitar or the violin, we come across vibrating strings that produce pleasing sounds. The membranes in drums and diaphragms in telephone and speaker systems vibrate to and fro about their mean positions. The vibrations of air molecules make the propagation of sound possible. In a solid, the atoms vibrate about their equilibrium positions, the average energy of vibrations being proportional to temperature. AC power supply give voltage that oscillates alternately going positive and negative about the mean value zero. The description of a periodic motion in general, and oscillatory motion in particular, requires some fundamental concepts like period, frequency, displacement, amplitude and phase. These concepts are developed in the next section. Suppose an insect climbs up a ramp and falls down it comes back to the initial point and repeats the process identically. If you draw a graph of its height above the ground versus time, it would look something like Fig. If a child climbs up a step, comes down, and repeats the process, its height above the ground would look like that in Fig. When you play the game of bouncing a ball off the ground, between your palm and the ground, its height versus time graph would look like the one in Fig. Note that both the curved parts in Fig. These are examples of periodic motion. Thus, a motion that repeats itself at regular intervals of time is called periodic motion. The period T is shown in each case. Very often the body undergoing periodic motion has an equilibrium position somewhere inside its path. When the body is at this position no net external force acts on it. Therefore, if it is left there at rest, it remains there forever. If the body is given a small displacement from the position, a force comes into play which tries to bring the body back to the equilibrium point, giving rise to oscillations or vibrations. For example, a ball placed in a bowl will be in equilibrium at the bottom. If displaced a little from the point, it will perform oscillations in the bowl. Every oscillatory motion is periodic, but every periodic motion need not be oscillatory. Circular motion is a periodic motion, but it is not oscillatory. There is no significant difference between oscillations and vibrations. It seems that when the frequency is small, we call it oscillation like the oscillation of a branch of a tree , while when the frequency is high, we call it vibration like the vibration of a string of a musical instrument. Simple harmonic motion is the simplest form of oscillatory motion. This motion arises when the force on the oscillating body is directly proportional to its displacement from the mean position, which is also the equilibrium position. Further, at any point in its oscillation, this force is directed towards the mean position. In practice, oscillating bodies eventually come to rest at their equilibrium positions, because of the damping due to friction and other dissipative causes. However, they can be forced to remain oscillating by means of some external periodic agency. We discuss the phenomena of damped and forced oscillations later in the chapter. Any material medium can be pictured as a collection of a large number of coupled oscillators. The collective oscillations of the constituents of a medium manifest themselves as waves. Examples of waves include water waves, seismic waves, electromagnetic waves. We shall study the wave phenomenon in the next chapter. The smallest interval of time after which the motion is repeated is called its period. Let us denote the period by the symbol T.

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Chapter 3 : NCERT Solutions for Class 11 Physics

Oscillations - CBSE Notes for Class 11 Physics â€¢ Periodic Motion Motions, processes or phenomena, which repeat themselves at regular intervals, are called periodic. â€¢ Oscillatory Motion The motion of a body is said to be oscillatory motion if it moves to and fro about a fixed point after regular intervals of time.

This decreases the effective value of g. Hence, the time period increases as: Where, l is the length of the simple pendulum c The time shown by the wristwatch of a man falling from the top of a tower is not affected by the fall. Since a wristwatch does not work on the principle of a simple pendulum, it is not affected by the acceleration due to gravity during free fall. Its working depends on spring action. Hence the frequency of oscillation of this simple pendulum is zero. A simple pendulum of length l and having a bob of mass M is suspended in a car. The car is moving on a circular track of radius R with a uniform speed v. If the pendulum makes small oscillations in a radial direction about its equilibrium position, what will be its time period? The bob of the simple pendulum will experience the acceleration due to gravity and the centripetal acceleration provided by the circular motion of the car. Cylindrical piece of cork of density of base area A and height h floats in a liquid of density. The cork is depressed slightly and then released. Ignore damping due to viscosity of the liquid. As a result, some extra water of a certain volume is displaced. Hence, an extra up-thrust acts upward and provides the restoring force to the cork. One end of a U-tube containing mercury is connected to a suction pump and the other end to atmosphere. A small pressure difference is maintained between the two columns. Show that, when the suction pump is removed, the column of mercury in the U-tube executes simple harmonic motion. An air chamber of volume V has a neck area of cross section a into which a ball of mass m just fits and can move up and down without any friction Fig. Show that when the ball is pressed down a little and released, it executes SHM. Obtain an expression for the time period of oscillations assuming pressure-volume variations of air to be isothermal [see Fig. Let the ball be depressed by x units. As a result of this depression, there would be a decrease in the volume and an increase in the pressure inside the chamber. The negative sign indicates that pressure increases with a decrease in volume. You are riding in an automobile of mass kg. Assuming that you are examining the oscillation characteristics of its suspension system. The suspension sags 15 cm when the entire automobile is placed on it. Estimate the values of a the spring constant k and b the damping constant b for the spring and shock absorber system of one wheel, assuming that each wheel supports kg. The equation for the restoring force for the system:

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Chapter 4 : Important questions for class 11 Physics Chapter 13 Oscillations

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A simple pendulum is just a pendulum made out of a small object attached to a light string. If the pendulum is displaced from equilibrium, it swings back and forth, and its motion is periodic. The questions we want to consider are: Online Physics Notes for Class 11 To answer these questions, one starts with the equation relating forces and motion. I am going to use a different variable than the textbook. I will specify the position of the particle by the distance, along an arc, that the particle is from the equilibrium position. See the figure at the end of this section. I think this will be easier for us to make reference to the spring equation and avoid using torque. The negative sign means that the force of gravity is a restoring force. The equation for the simple pendulum is NOT of this form. Thus, the motion of a simple pendulum is NOT simple harmonic. A sinusoidal restoring force does not produce perfect sinusoidal motion. Only a linear restoring force gives perfect sinusoidal motion. This is easy to demonstrate. For simple harmonic motion, the period does not depend on the amplitude. Pendula with a larger amplitude larger xmax have a longer period than ones with a smaller amplitude smaller xmax. Energy considerations for Simple Harmonic Motion To obtain an expression for the total mechanical energy that a simple harmonic oscillator has, we need an expression for the potential energy for the force acting. The work done by the spring force when an object moves from the position x1 to the position x2 is: If the only force acting on the object is the force of the spring, then the net work is the work done by the spring. In this case, we have: In this expression, x is the position of the object and v is the speed of the object at the position x. We recognize the first term to be the potential energy and the second term to be the kinetic energy of the object. The sum, which is the total mechanical energy, remains constant. Substituting into the above equation, we have: We also provide the best course for bank exams as per student requirements visit our site www.

Chapter 5 : NCERT Solutions for Class 11 Physics Chapter 14 â€“ Oscillations | AglaSem Schools

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A particle is in linear simple harmonic motion between two points, A and B, 10 cm apart. Take the direction from A to B as the positive direction and give the signs of velocity, acceleration and force on the particle when it is a at the end A, b at the end B, c at the mid-point of AB going towards A, d at 2 cm away from B going towards A, e at 3 cm away from A going towards B, and f at 4 cm away from B going towards A. Which of the following relationships between the acceleration a and the displacement x of a particle involve simple harmonic motion? If instead of the cosine function, we choose the sine function to describe the SHM: A spring balance has a scale that reads from 0 to 50 kg. The length of the scale is 20 cm. A body suspended from this balance, when displaced and released, oscillates with a period of 0. What is the weight of the body? A spring having with a spring constant N is mounted on a horizontal table as shown in Fig. A mass of 3 kg is attached to the free end of the spring. The mass is then pulled sideways to a distance of 2. Determine i the frequency of oscillations, ii maximum acceleration of the mass, and iii the maximum speed of the mass. In what way do these functions for SHM differ from each other, in frequency, in amplitude or the initial phase? The radius of the circle, the period of revolution, the initial position, and the sense of revolution i. Obtain the corresponding simple harmonic motions of the x-projection of the radius vector of the revolving particle P, in each case. Plot the corresponding reference circle for each of the following simple harmonic motions. For simplicity, the sense of rotation may be fixed to be anticlockwise in every case: A force F applied at the free end stretches the spring. Each end of the spring in Fig. The piston in the cylinder head of a locomotive has a stroke twice the amplitude of 1. The acceleration due to gravity on the surface of moon is 1. What is the time period of a simple pendulum on the surface of moon if its time period on the surface of earth is 3. Answer the following questions: A simple pendulum executes SHM approximately. Why then is the time period of a pendulum independent of the mass of the pendulum? For larger angles of oscillation, a more involved analysis shows that T is greater than. Think of a qualitative argument to appreciate this result. Does the watch give correct time during the free fall? A simple pendulum of length l and having a bob of mass M is suspended in a car. The car is moving on a circular track of radius R with a uniform speed v. If the pendulum makes small oscillations in a radial direction about its equilibrium position, what will be its time period? Cylindrical piece of cork of density of base area A and height h floats in a liquid of density. The cork is depressed slightly and then released. Show that the cork oscillates up and down simple harmonically with a period Where is the density of cork. Ignore damping due to viscosity of the liquid. One end of a U-tube containing mercury is connected to a suction pump and the other end to atmosphere. A small pressure difference is maintained between the two columns. Show that, when the suction pump is removed, the column of mercury in the U-tube executes simple harmonic motion. An air chamber of volume V has a neck area of cross section a into which a ball of mass m just fits and can move up and down without any friction Fig. Show that when the ball is pressed down a little and released, it executes SHM. Obtain an expression for the time period of oscillations assuming pressure-volume variations of air to be isothermal [see Fig. You are riding in an automobile of mass kg. Assuming that you are examining the oscillation characteristics of its suspension system. The suspension sags 15 cm when the entire automobile is placed on it. Estimate the values of a the spring constant k and b the damping constant b for the spring and shock absorber system of one wheel, assuming that each wheel supports kg. Show that for a particle in linear SHM the average kinetic energy over a period of oscillation equals the average potential energy over the same period. A circular disc of mass 10 kg is suspended by a wire attached to its centre. The wire is twisted by rotating the disc and released. The period of torsional oscillations is found to be 1. The radius of the disc is 15 cm. Determine the torsional spring constant of the wire. A body describes simple harmonic motion with amplitude of 5 cm and a period of 0. Find the acceleration and velocity of the body when the displacement is a 5 cm, b 3 cm, c 0 cm. A mass attached to a spring is free to oscillate, with angular velocity , in a horizontal plane without friction or damping. Ncert solution class 11 physics includes text book solutions from both part 1 and part 2.

Chapter 6 : NCERT Solutions For Class 11 Physics Oscillations | myCBSEguide | CBSE Papers & NCERT

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Which of the plots represent periodic motion? What is the period of motion in case of periodic motion? Take the direction from A to B as the positive direction and give the signs of velocity, acceleration and force on the particle when it is a at the end A b at the end B c at the mid-point of AB going towards A d at 2 cm away from B going towards A e at 3 cm away from A going towards B and f at 4 cm away from B going towards A. If instead of the cosine function, we choose the sine function to describe the SHM: The length of the scale is 20 cm. A body suspended from this balance, when displaced and released, oscillates with a period of 0. What is the weight of the body? A mass of 3 kg is attached to the free end of the spring. The mass is then pulled sideways to a distance of 2. In what way do these functions for SHM differ from each other, in frequency, in amplitude or the initial phase? The radius of the circle, the period of revolution, the initial position, and the sense of revolution i. Obtain the corresponding simple harmonic motions of the x-projection of the radius vector of the revolving particle P, in each case. For simplicity, the sense of rotation may be fixed to be anticlockwise in every case: A force F applied at the free end stretches the spring. Each end of the spring in Fig. What is the time period of a simple pendulum on the surface of moon if its time period on the surface of earth is 3. A simple pendulum executes SHM approximately. Why then is the time period of a pendulum independent of the mass of the pendulum? Think of a qualitative argument to appreciate this result. Does the watch give correct time during the free fall? The car is moving on a circular track of radius R with a uniform speed v. If the pendulum makes small oscillations in a radial direction about its equilibrium position, what will be its time period? The cork is depressed slightly and then released. Ignore damping due to viscosity of the liquid. A small pressure difference is maintained between the two columns. Show that, when the suction pump is removed, the column of mercury in the U-tube executes simple harmonic motion. Show that when the ball is pressed down a little and released , it executes SHM. Obtain an expression for the time period of oscillations assuming pressure-volume variations of air to be isothermal [see Fig Assuming that you are examining the oscillation characteristics of its suspension system. The suspension sags 15 cm when the entire automobile is placed on it. Estimate the values of a the spring constant k and b the damping constant b for the spring and shock absorber system of one wheel, assuming that each wheel supports kg. The wire is twisted by rotating the disc and released. The period of torsional oscillations is found to be 1. The radius of the disc is 15 cm. Determine the torsional spring constant of the wire. Find the acceleration and velocity of the body when the displacement is a 5 cm, b 3 cm, c 0 cm.

Chapter 7 : NCERT Textbook Chapter 14 - Oscillations, Class 11, Physics | EduRev Notes

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Chapter 8 : NCERT Physics Notes for Class Oscillations - The Simple Pendulum

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Chapter 9 : NCERT Solutions for Class 11 Physics Chapter Oscillations

Oscillations with a constant amplitude with time are called un-damped oscillations. Forced Oscillations Oscillations of any object with a frequency different from its natural frequency under a periodic external force are called forced *oscillations.*