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National Institute of Open Schooling
Senior Secondary
Lesson 13 – Simple Harmonic Motion
WORKSHEET – 13

Q.1 You are familiar with motion in a straight line, projectile motion and circular motion. These motions are defined by the path followed by the moving object. But some objects execute motion which is repeated after a certain interval of time. Name the type of motion and give examples from your surroundings.

Q.2 A particle of 2.5kg mass moves as function of time as $y = 4\cos(1.33\pi + \pi/5)$ meters. Define and calculate Displacement, Amplitude, Time Period, Frequency andAngular Frequency for given function.

Q.3 A particle is said to execute Simple Harmonic Motion if it moves to and fro about a fixed point periodically, under the action of a force F which is directly proportional to its displacement x from the fixed point and the direction of the force is opposite to that of the displacement. Observe the following functions and pick out the function/functions represent which represent Simple Harmonic Motion. Give justification for your answer.

a. $y = \sin(\omega t)$
b. $y = \sin(\omega t) + \cos(3\omega t)$
c. $y = \sin(\omega t) + 3\cos(\omega t)$

Q.4 Take a pendulum of any length and let the pendulum to oscillate freely about the point of suspension. Calculate periodic time of the pendulum. Now increase the length of the pendulum by 35%. Calculate the percentage increase in the periodic time of the pendulum.

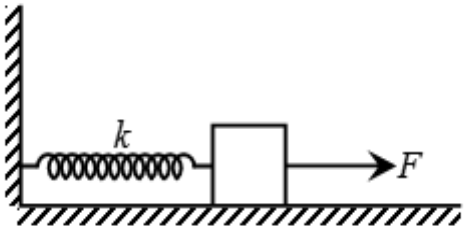
Q.5 Put an oscillating simple pendulum of period T inside a lift which is accelerating downwards. Observe the effect on time period of oscillating simple pendulum?

Q.6. Consider a particle executing linear Simple Harmonic Motionbetween two points A and B. The separation between A and B is 10 cm as shown in figure.

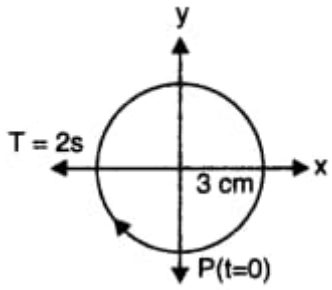
Taking the direction from A to B as the positive direction, give the signs of velocity, acceleration and force on the particle when it is

a. at the end A,
b. at the end B,
c. at 2 cm away from B going towards A
d. at 3 cm away from A going towards B and
e. at 4 cm away from B going towards A

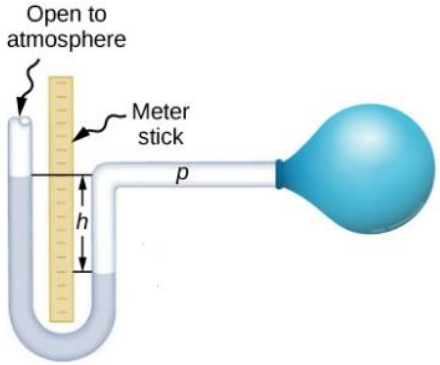
Q.7 Consider a spring with a spring constant 1500 Nm^{-1} is mounted on a horizontal table as shown in figure. A mass of 4 kg is attached to the free end of the spring. The mass is then pulled sideways to a distance of 2.0 cm and released. Determine (i) the frequency of oscillations, (ii) maximum acceleration of the mass, and (iii) the maximum speed of the mass.



Q.8 Obtain the corresponding simple harmonic motions of the x-projection of the radius vector of the revolving particle P for circular motion shown in the figure.



Q.9 Consider a U-tube partially filled with mercury of which one end 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.



Q.10 Take two springs with spring constant 'K'. Firstly connect the springs in series and then in parallel. Find out the ratio of the frequencies of the vertical Oscillations for these two cases.