#19 Conservation of Energy Pre-class

Due: 11:00am on Friday, October 5, 2012

Note: You will receive no credit for late submissions. To learn more, read your instructor's Grading Policy

Exercise 7.31

A block with mass m is attached to an ideal spring that has force constant k.

Part A

The block moves from x_1 to x_2, where $x_2 > x_1$. How much work does the spring force do during this displacement?

Express your answer in terms of the given quantities.

ANSWER:

$$W = -\frac{1}{2}kx_2^2 + \frac{1}{2}kx_1^2$$

Correct

Part B

The block moves from x_1 to x_2 and then from x_2 to x_1. How much work does the spring force do during the displacement from x_2 to x_1?

Express your answer in terms of the given quantities.

ANSWER:

$$W = \frac{1}{2}kx_2^2 - \frac{1}{2}kx_1^2$$

Correct

Part C

What is the total work done by the spring during the entire $x_1 \rightarrow x_2 \rightarrow x_1$ displacement?

Express your answer in terms of the given quantities.

ANSWER:

W = 0

Correct

Part D

Explain why you got the answer you did.

ANSWER:

3693 Character(s) remaining

After further review of the entire system, it was determined that the sum of the forces was equal to zero.

Submitted, grade pending

Part E

The block moves from x_1 to x_3, where $x_3 > x_2$. How much work does the spring force do during this displacement?

Express your answer in terms of the given quantities.

ANSWER:

$$W = -\frac{1}{2}kx_3^2 + \frac{1}{2}kx_1^2$$

Correct

Part F

The block then moves from x_3 to x_2. How much work does the spring force do during this displacement?

Express your answer in terms of the given quantities.

ANSWER:

$$W = \frac{1}{2}kx_3^2 - \frac{1}{2}kx_2^2$$

Correct

Part G

What is the total work done by the spring force during the $x_1 \rightarrow x_3 \rightarrow x_2$ displacement?

Express your answer in terms of the given quantities.

ANSWER:

$$W = -\frac{1}{2}kx_2^2 + \frac{1}{2}kx_1^2$$

Correct

Part H

Compare your answer to the answer in part (a), where the starting and ending points are the same but the path is different.

ANSWER:

3721 Character(s) remaining

The delta distance in part G is the exact same as the delta distance in part A.

Submitted, grade pending

Conservation of Energy Ranking Task

Six pendulums of various masses m are released from various heights h above a tabletop, as shown in the figures below. All the pendulums have the same length and are mounted such that at the vertical position their lowest points are the height of the tabletop and just do not strike the tabletop when released. Assume that the size of each bob is negligible.

Part A

Rank each pendulum on the basis of its initial gravitational potential energy (before being released).

Rank from largest to smallest To rank items as equivalent, overlap them.

Hint 1. Gravitational potential energy

Gravitational potential energy U is defined as the product of the mass of the object, the acceleration due to gravity, and the height of the object above a reference level, summarized as

$$U = mgh.$$

ANSWER:

Correct

Part B

Rank each pendulum on the basis of the maximum kinetic energy it attains after release.

Rank from largest to smallest To rank items as equivalent, overlap them.

Hint 1. Kinetic energy

Each pendulum begins at rest (i.e., kinetic energy of zero). The maximum kinetic energy for a pendulum will occur when it is at the lowest point in its motion. At this point, all of the pendulums will be the same height above the tabletop. The kinetic energy then will equal the change in potential energy from the initial point to the point just above the tabletop.

ANSWER:

Correct

Part C

Rank each pendulum on the basis of its maximum speed.

Rank from largest to smallest To rank items as equivalent, overlap them.

Hint 1. The role of mass

Both kinetic energy and gravitational potential energy are proportional to mass. Thus, a pendulum with larger mass has a larger potential energy upon release, and a larger kinetic energy at its lowest point. Since the kinetic energy is equal to the change in potential energy, you may write down the equation $mg\Delta h = {}^{1}/_{2}mv^{2}$. Notice that mass may be canceled from both sides. Thus, the final speed depends upon the change in

height but is independent of mass.

The situation is similar to that of an object in free fall. In free fall, although larger masses are acted upon by a larger gravitational force, a larger mass also has more inertia. These two effects cancel out. All objects fall with the same acceleration, and therefore reach the same velocity after falling equal distances.

ANSWER:

Correct

Exercise 7.29

A 0.61 $-\mathrm{kg}$ book slides on a horizontal table. The kinetic friction force on the book has magnitude 1.1 N .

Part A

How much work is done on the book by friction during a displacement of 2.8 m to the left?

Express your answer using two significant figures.

ANSWER:

W = -3.1 J

Correct

Part B

The book now slides a distance 2.8 m to the right, returning to its starting point. During this second displacement of 2.8 m , how much work is done on the book by friction?

Express your answer using two significant figures.

ANSWER:

W = -3.1 J

Correct

Part C

What is the total work done on the book by friction during the complete round trip?

Express your answer using two significant figures.

ANSWER:

W = -6.2 J

Correct

Part D

On the basis of your answer to part (C), would you say that the friction force is conservative or nonconservative?

ANSWER:

- conservative
- nonconservative

Correct

Part E

Explain

ANSWER:

3700 Character(s) remaining

Energy is not conserved because energy was transferd from the book to the table and was not stored.

Submitted, grade pending

Score Summary:

Your score on this assignment is 98.3%.
You received 14.75 out of a possible total of 15 points.