Delete problem 42

In problem 51, make the block on the incline have right angles between its sides.

In problem 53, the scale on the axes and he axis labels are too small.

In 65 change answer c to "neither positive nor negative." Then the correct answer is changed to d.

the correct answer to 69 is c, not a.

In 72 and 73 all the loops should have the same height whether they are close together or more separated.

New Problems:

1. A luge containing two athletes has a total mass of 130 kg. It starts at the top of a mountain with an 800 m elevation and travels a distance of 2000 m before reaching the bottom of the hill. The work, in J, that the force of gravity does on the luge in its descent is

   a. -2.55×10^{6}.
   b. -1.02×10^{6}.
   c. $+1.02\times10^{6}$.
   d. $+2.55\times10^{6}$.
   e. $+2.04\times10^{9}$.
   answer: b

2. A freight car loaded with ore is sitting on a 5° incline when its brakes fail. After traveling 150 m on a frictionless track, it reaches level ground where it strikes a massive safety spring of spring constant $k = 18{,}500$ N/m. When its velocity has decreased to zero, an automatic latch will catch the car. At that instant, the equation that can be solved for the car's kinetic energy before striking the spring is

   a. $\frac{1}{2}mv_f^2 + mgh_f = \frac{1}{2}mv_i^2 + mgh_i$.
   b. $\frac{1}{2}mv_f^2 + mgh_f = \frac{1}{2}mv_i^2$.
   c. $\frac{1}{2}mv_f^2 + mgh_f = \frac{1}{2}mv_i^2 + \frac{1}{2}kx_{\max}^2$.
   d. $\frac{1}{2}mv_f^2 + mgh_f - \frac{1}{2}kx_{\max}^2 = +mgh_i$.
   e. $\frac{1}{2}mv_f^2 + mgh_f - \frac{1}{2}kx_f^2 = \frac{1}{2}mv_i^2 + mgh_i - \frac{1}{2}kx_i^2$.
   Answer: a

3. A freight car loaded with ore is sitting on a 5° incline when its brakes fail. After traveling 150 m on a frictionless track, it reaches level ground where it strikes a massive safety spring of spring constant $k = 18{,}500$ N/m. When its velocity has decreased to zero, an automatic latch will catch the car. When the car's kinetic energy just before striking the spring is known, the equation that can be solved for the car's elastic potential energy at the instant when its velocity is zero is

a. $\frac{1}{2}mv_f^2 = \frac{1}{2}kx_{\max}^2$.
b. $\frac{1}{2}mv_f^2 + mgh_i = \frac{1}{2}kx_{\max}^2$.
c. $\frac{1}{2}mv_f^2 + mg\frac{x_{incline}}{\sin\theta} = \frac{1}{2}kx_{\max}^2$.
d. $\frac{1}{2}mv_f^2 + mgh_i + mg\frac{x_{incline}}{\sin\theta} = \frac{1}{2}kx_{\max}^2$.
e. $\frac{1}{2}mv_f^2 + mgh_i = \frac{1}{2}kx_{\max}^2 + mg\frac{x_{incline}}{\sin\theta}$.

Answer: c

4. Associated with the gravitational force $F = mg$, we have gravitational potential energy *mgh*. The reason why we do not have potential energy $\mu_k mgx$ associated with the kinetic frictional force $F = \mu_k mg$ is that
   a. no form of energy can be proportional to *x*.
   b. no form of mechanical energy can be proportional to *x*.
   c. non-conservative forces can also be proportional to x^2.
   d. forces can only be of the form $F = +cx$.
   e. a frictional force converts mechanical energy into internal thermal energy.

   Answer: e.

5. After a sky diver reaches terminal velocity, the force of gravity
   a. no longer performs work on the sky diver.
   b. work performed by the force of gravity is converted into gravitational potential energy *U*.
   c. gravitational potential energy is no longer available to the system of the sky diver plus the Earth.
   d. gravitational potential energy is converted into thermal energy.
   e. thermal energy is converted into gravitational potential energy.

   Answer: d

6. A baseball is thrown with initial velocity $\vec{\mathbf{v}} = (8.00\hat{\mathbf{i}} + 19.6\hat{\mathbf{j}})$ m/s. What is its kinetic energy in joules when thrown?

   a. 4.8
   b. 33.6

c. 57.1
d. 67.2
e. 33,600
Answer: b

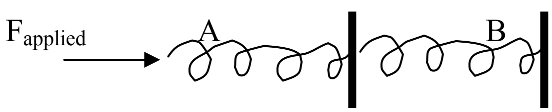
7. A baseball is thrown with initial velocity $\vec{\mathbf{v}} = (8.00\hat{\mathbf{i}} + 19.6\hat{\mathbf{j}})$ m/s. What is its kinetic energy when at the highest point of its trajectory?

$\frac{1}{2}m(8)^2$

a. 4.8
b. 33.6
c. 57.1
d. 67.2
e. 33,600

Answer: a

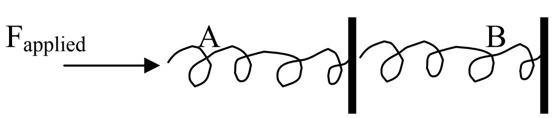
8. A thin plate of negligible mass is attached to the end of spring A, which has k = 1380 N/m. The end with the plate is pressed against an identical spring B fastened t a wall until the force exerted on the end of A is 225 N. How much work in J has been done on spring B by spring A?



a. 9.15
b. 18.3
c. 36.6
d. 73.3
e. 225
answer: b

The drawing needs to have smoother but identical springs with it made clear that there is a wall to the right of B.

9. 9. A thin plate of negligible mass is attached to the end of spring A, which has k = 1380 N/m. The end with the plate is pressed against an identical spring B fastened t a wall until the force exerted on the end of A is 225 N By how much has spring B been compressed from its unstretched length?



a. 0.0815 m
b. 0.163 m
c. 0.326 m
d. 1.63 m
e. 6.13 m

Answer: b

Need the same figure corrected as in 9.

10. A 485 g book drops off the top of a 2.00 m high bookcase. How much power in W is the gravitational force delivering to the book at the instant when it has fallen 1.50 m?

   a. 4.75
   b. 7.13
   c. 25.8
   d. 53.1
   e. 140

Answer: c

11. A mechanical door opener is used to deliver a constant 50 W of power to a spring with k = 620 N/m for 3.1 s. What is the compression of the spring in cm at the end of that time period?

   a. 31
   b. 40
   c. 50
   d. 71
   e. 101

   Answer: d

12. A mechanical door opener is used to deliver power to a spring with spring constant k for t seconds. The equation we would use tofind the compressions of the spring at the end of the t seconds is

a. $P = kx$.
b. $Pt = kx$.
c. $\frac{P}{t} = \frac{1}{2}kx^2$.
d. $P = \frac{1}{2}kx^2$.
e. $Pt = \frac{1}{2}kx^2$.

Answer: e