Conservation of Energy Practice Part 3

1) State the law of conservation of energy.

2) A 200-kg boulder is 1000-m above the ground sitting on the edge of a cliff.

a) What is its potential energy when it is 1000-m above the ground?

b) What is its kinetic energy when it is 1000-m above the ground?

c) The boulder begins to fall. What is its potential energy when it is 500-m above the ground? Where did the "lost" potential energy go?

d) What is the kinetic energy of the boulder when it has fallen 500-m?

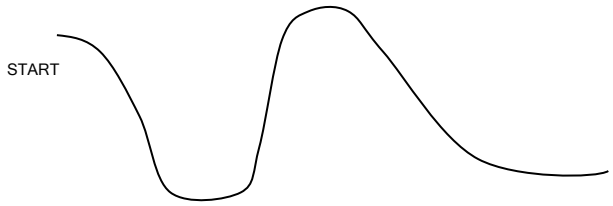
e) What is the kinetic energy of the boulder just before it hits the ground?

f) What is the impact speed of the boulder?

Ans: 2. a) 1.96×10^6 J b) 0 J c) 9.8×10^5 J, into KE

d) 9.8×10^5 J e) (1.96×10^6 J) f) (140 m/s)

3) A rollercoaster is designed as shown below. If the roller coaster starts at the top of the first hill from rest, describe what will happen to the rollercoaster. How could you fix this problem?



4) When you use a slingshot to fire a rock you stretch the rubber band storing potential energy. If you stretched the rubber band so that it had 100-J of potential energy,

a) With how much kinetic energy will the rock leave the slingshot?

b) With how much kinetic energy will the rock leave the slingshot if it loses 10-J to heat & sound?

c) if the rock has a mass of 25 g (convert to kg), how fast will it leave the slingshot in part (b)?

ANS: 4a) (100 J) b) (90 J) c) (84.9 m/s)

5) A rope-swing pendulum has 15-J of potential energy at the top of its swing.

a) What is its kinetic energy at the bottom of its swing?

b) At another time the pendulum has 8-J of potential energy. What is its kinetic energy?

c) If the pendulum has a mass of 0.25 kg, how fast is it moving in part (b)?

d) How fast will the pendulum be moving at the bottom of its swing?

6) A 1-kg ball is 10-m above a table when it is dropped. It bounces to a height of 7-m.

a) How much energy is transferred to heat & sound during the bounce? Ans: 29.4 J

b) Explain why this ball cannot bounce to a height of 12-m if it is dropped.

c) What could you do to make the ball bounce to a height of 12-m?

(see your notes for answers to part b and c)

7. An 8.0 kg flower pot falls from a window ledge 12.0 m above a sidewalk.

(a) What is the kinetic energy of the pot just as it reaches the sidewalk? Ans: 941 J

(b) Use energy to determine the speed of the pot just before it strikes the walk. Ans: 15.3 m/s

8. A 15.0 kg model plane flies horizontally at 12.5 m/s.

(a) Calculate its kinetic energy.

(b) The plane goes into a power dive and levels off at 20.4 m closer to the earth. How much potential energy did it lose during the dive?

(c) How much kinetic energy did the plane gain during the dive?

(d) What is its new kinetic energy?

(e) Neglecting frictional effects, what is its new horizontal velocity?

9. A partially - filled bag of cement having a mass of 16.0 kg falls 40.0 m into a river from a bridge.

(a) What is the kinetic energy of the bag as it hits the water? (6272 J)

(b) Using energy considerations only, what vertical velocity does it have?

(28 m/s)

10. A block weighing 98.0 N falls from a height of 64.0 m.

(a) What is the original potential energy of the block?

(b) What is the kinetic energy of the block just as it strikes the ground?

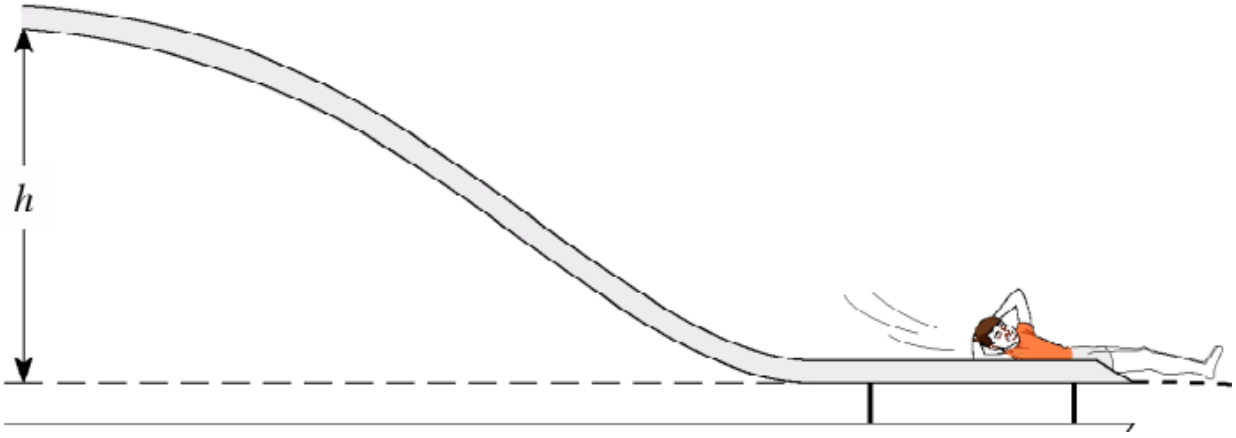
(c) What speed does the block have as it strikes the ground?

11. During the hammer throw at a track meet an 8.0 kg hammer is accidentally thrown straight up. If 784.0 J of work were done on the hammer to give its vertical velocity, how high will it rise? (10. m)

12. A 150 g test rocket is fired from SRT "Home of the Titans" field. Its fuel gives it a kinetic energy of 1960 J before it leaves its launch pad. How high will the rocket rise?
Hint: Don't forget to change mass to kg.

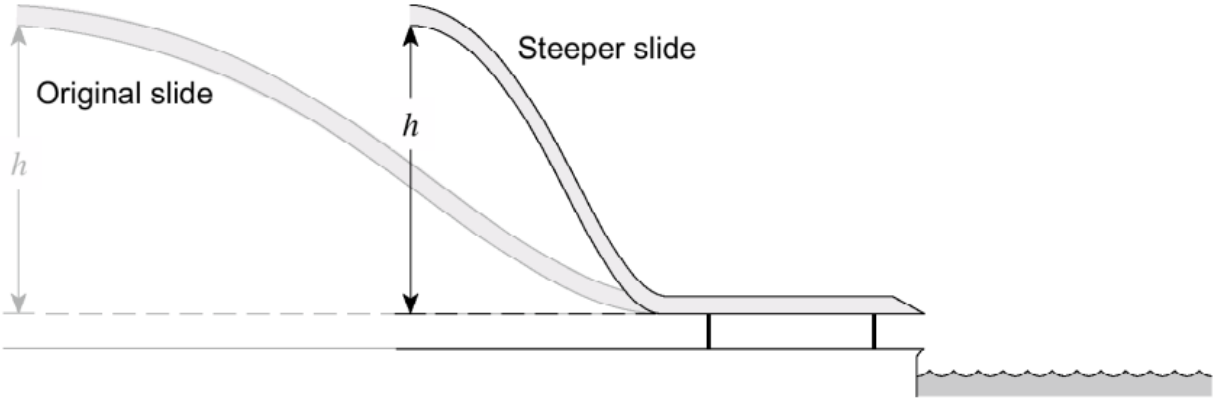
13. A skater on a lake pushes on a stationary 5.0 kg log to clear a skating area. If the skater does 600.0 J of work on the log and the log is nearly frictionless, what is the final speed given to the log? (15.5 m/s)

14. a) If the 55 kg slider is going 8.6 m/s at the bottom of the waterslide, find the height, h.



Ans: 3.77 m

b) Another slide has the same height, h, as the original slide but is much steeper.



The same person as in part (a) goes down this slide. How does their speed at the bottom compare to their speed in part (a)

(i) faster (ii) slower (iii) the same

Explain your answer using principles of physics.