# conservation of energy - practice problems

1. A 2.0 kg cart rolls down a smooth classroom track and drops 1.5 m in height. The track is curved, but ignore friction. How much gravitational potential energy does it lose, and how much kinetic energy does it gain?

2. A spring launcher releases a cart. The spring energy decreases by 18 J while the cart stays at the same height. How much does the cart's kinetic energy change?

3. A 0.50 kg ball is dropped from rest from a 3.0 m shelf in a storage room. Ignoring air resistance, what speed does it have just before it reaches the floor?

4. A 2.0 kg cart starts from rest at the top of a 1.2 m frictionless ramp. What speed does it have at the bottom?

5. A skateboarder moves at 6.0 m/s at the bottom of a smooth hill. The board has 54 mm wheels, but ignore losses. How high can the skateboarder coast before stopping?

6. A 4.0 kg cart moving at 5.0 m/s climbs a frictionless track. At a point 0.80 m higher, how much kinetic energy does the cart still have?

7. A 1500 g toy car starts from rest at the top of a 0.90 m track. Ignoring losses, what is its speed at the bottom?

8. A ball is thrown straight upward at 12 m/s from a student's hand. Ignoring air resistance, how high above the hand does it rise?

9. A cart is moving at 8.0 m/s at the bottom of a track. What is its speed after it climbs 2.0 m higher?

10. A 0.20 kg ball is released from rest 80 cm above the floor. Ignoring air resistance, what kinetic energy does it have just before it hits the floor?

11. A 200 N/m spring is compressed 0.10 m and launches a 0.50 kg cart on a level frictionless track. What speed does the cart have after leaving the spring?

12. A spring launcher stores 6.0 J of energy and launches a 0.75 kg glider on a level frictionless track. What speed does the glider have?

13. A 0.30 kg cart is launched by a spring compressed 15 cm. The spring constant is 120 N/m. What launch speed should the cart have?

14. A 2.0 kg cart starts from rest and rolls down a 5.0 m long ramp. What is its speed at the bottom?

15. A 0.60 kg cart moving at 2.0 m/s compresses a 150 N/m spring on a level frictionless track. How far does the spring compress before the cart stops?

16. A spring with k = 80 N/m is compressed 0.25 m and launches a 0.50 kg cart up a frictionless ramp. If the cart leaves the spring at the bottom of the ramp, how high does it rise before stopping?

17. A 0.25 kg ball is launched upward by a spring and leaves the spring moving at 7.0 m/s. How high above the launch point does it rise?

18. A 2.0 kg cart starts at rest 5.0 m above the bottom of a frictionless track. How fast is it moving when it is still 1.5 m above the bottom?

19. A 70 kg skier starts from rest at the top of a 12 m hill. Ignoring friction, what speed does the skier have at the bottom, and why did the mass not matter?

20. A 0.40 kg ball moving at 3.0 m/s is 1.2 m above the floor. If it later reaches the floor with no energy lost, what is its speed there?

21. A cart moves at 7.0 m/s at the bottom of a frictionless track. It reaches the top of a hill moving at 3.0 m/s. How high is the hill?

22. A 0.50 kg glider moving at 2.0 m/s reaches a compressed spring and stops after compressing it 0.20 m. What is the spring constant?

23. A 1.2 kg ball is thrown straight upward at 5.0 m/s. A motion sensor shows the ball stops rising after 0.51 s. Use motion from earlier in the course to find the height, then check the result with energy.

24. A 900 kg car is moving at 18 km/h on a level road. If all of its kinetic energy could be stored in a spring with k = 20 000 N/m, how far would the spring compress?

25. A 0.20 kg cart starts at rest on a spring compressed 10 cm. The spring constant is 180 N/m. The cart leaves the spring and climbs a frictionless track. What speed does it have after rising 0.50 m?

26. A 0.50 kg cart starts at rest on a spring compressed 20 cm. The spring constant is 250 N/m. The cart leaves the spring, climbs a frictionless hill, and is still moving at 3.0 m/s at the top. How high is the hill?

27. A 0.30 kg block slides down from rest, drops 1.4 m in height, and then compresses a 400 N/m spring on a frictionless track. How far does the spring compress when the block first stops?

28. Two carts collide elastically on a level track. A 0.40 kg cart moving right at 3.0 m/s hits a 0.40 kg cart at rest. What are their final velocities?

29. Two equal-mass pucks collide elastically on frictionless ice. Puck A moves right at 4.0 m/s, and puck B moves left at 1.0 m/s before the collision. What are their velocities after the collision?

30. A 2.0 kg cart moving right at 4.0 m/s collides elastically with a 6.0 kg cart at rest on a low-friction track. After the collision, the 2.0 kg cart bounces left at 2.0 m/s. Use momentum from earlier and energy from this page to find the 6.0 kg cart's final speed, then check that kinetic energy is conserved.