Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Energy and Its Conservation

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. An elastic collision is one in which
a. kinetic energy before the collision equals kinetic energy after the collision.
b. kinetic energy after the collision is zero.
c. kinetic energy before the collision is less than kinetic energy after the collision.
d. kinetic energy before the collision is greater than kinetic energy after the collision.

____ 2. A superelastic collision is one in which
a. kinetic energy before the collision equals kinetic energy after the collision.
b. kinetic energy after the collision is zero.
c. kinetic energy before the collision is less than kinetic energy after the collision.
d. kinetic energy before the collision is greater than kinetic energy after the collision.

____ 3. An inelastic collision is one in which
a. kinetic energy before the collision equals kinetic energy after the collision.
b. kinetic energy after the collision is zero.
c. kinetic energy before the collision is less than kinetic energy after the collision.
d. kinetic energy before the collision is greater than kinetic energy after the collision.

____ 4. Which material is likely to experience a highly inelastic collision?
a. a steel ball on a steel plate
b. a car with compressed springs in its bumper
c. a lump of clay
d. a baseball thrown against a trampoline

____ 5. Which material is likely to experience a nearly elastic collision?
a. a water balloon
b. an egg
c. a steel ball bearing
d. a stick of butter

____ 6. Which is likely to experience a superelastic collision?
a. a falling grenade
b. two colliding bicycles
c. a falling egg
d. a falling water drop

____ 7. What is the proper unit for gravitational potential energy?
a. gravitons
b. joules
c. newtons
d. meters

____ 8. Which type of energy is associated with a body's height above the ground?
a. thermal energy
b. elastic potential energy
c. gravitational potential energy
d. rest energy

____ 9. A gymnast falls from a height onto a trampoline. For a moment, both the gymnast's kinetic energy and gravitational potential energy are zero. How is the gymnast's mechanical energy stored for that moment?
a. rest energy
b. chemical energy
c. elastic energy
d. thermal energy

____ 10. A snowball thrown at an ice cream truck at Valley Forge in January sticks to the side. Into what form of energy was the mechanical energy changed?

a. elastic energy
b. thermal energy
c. chemical energy
d. rest energy

Problem

11. Andrew throws a 0.11-kg ball toward Donald, who is standing on a ledge. The ball leaves Andrew's hands at a height of 0.24 m and Donald catches it at a height of 0.82 m. Calculate the gravitational potential energy of the ball relative to the ground before being thrown.
12. A warehouse worker pushed a cart weighing 4.50 kg to the top of an inclined plane. Initially, the cart was 0.670 m above the floor. If the top of the inclined plane is 2.70 m above the floor, calculate the work done by gravity as the worker pushed the cart to the top of the plane.
13. A student lifts a 1.2-kg bag from her desk, which is 0.59-m high, to a locker that is 2.9-m high. What is the gravitational potential energy of the bag relative to the desk?
14. A hemispherical bowl of radius 0.14 m is kept inverted on a tabletop. A 4.3-g matchbox slides off from rest from the top of the hemisphere. What is the speed of the matchbox when it reaches a point on the bowl at an angle of 16.0° to the horizontal?
15. A skier is pushed from the top of a hill so that he starts moving down the hillside sloped at 27.6° to the horizontal with an initial speed of 0.434 m/s. After traveling 80.4 m, he reaches the bottom of the valley. Due to inertia, he then continues 70.4 m up another hillside sloped at 20.7° to the horizontal. What is the skier's speed when he reaches the top of the hill? Assume that you can neglect friction.
16. A roller coaster car starts with an initial speed of 0.375 m/s from the top of a section of a track that is sloping down at 26.2° to the horizontal. After traveling 80.3 m, it reaches the end of that section of the track and continues up the next section of the track that slopes up at 22.4° to the horizontal. If this section of the track has a length of 73.2 m, will the car reach the top of the section? Assume that you can neglect friction and that the car has no source of power.
17. A 2.90×10^{-3}-kg bullet is fired with a velocity of 154 m/s toward a 5.44-kg stationary solid block resting on a surface that has a coefficient of friction 0.215. The bullet emerges with a reduced velocity of 20.2 m/s after passing through the block. What distance will the block slide before coming to rest? Assume that the block does not lose any mass.
18. A 2.10×10^{-3}-kg bullet is fired with a velocity of 108.6 m/s toward a 5.99-kg block moving at a speed of 0.280 m/s in the same direction. The bullet emerges with a speed of 20.7 m/s and with a small piece of the block with a mass of 0.0016 kg sticking to it. What is the kinetic energy lost in the collision?
19. A 0.390-kg piece of wood is at rest on a frictionless table. A 8.30-g bullet, moving with a speed of 495 m/s, strikes the piece of wood, and is embedded in it. After the collision, the piece of wood and the bullet move slowly down the table. What percentage of the system's original kinetic energy was lost?
20. A dart with a mass of 0.025 kg traveling with a speed of 13 m/s impacts a dart board and stops. What work was done by the dart board in stopping the dart? Into what form did the dart's kinetic energy change?
21. A 68 kg skydiver decelerates from 55 m/s to 5 m/s when the skydiver's parachute opens. What work is done on the skydiver by the parachute?

22. A pod of ten dolphins, with a total mass of 4500 kg, speeds up from 3.0 m/s to 7.3 m/s to catch up with a school of fish. What are the initial and final kinetic energies of the pod, and how much work was done by the pod to speed up?

23. A sea turtle lays eggs in a pit 0.60 meters deep. What is the gravitational potential energy of the first egg? The egg has a mass of 0.015 kg.

24. A sea turtle must crawl up a beach to lay eggs. Ignoring friction, what work must a 140 kg turtle do in lifting herself 2.5 meters above the level of the sea?

25. A baseball player once bet he could catch a ball dropped from the Washington Monument, 169 meters up.

    a) If the ball had a mass of .145 kg, what would be its gravitational potential energy be before falling?

    b) Ignoring air resistance, what would the speed of the ball be as the player caught it, 2 meters above the ground?

26. A basketball of mass 0.58 kg and a tennis ball of mass 0.058 kg are dropped from a height of 2.0 m. Ignoring air resistance, what are the kinetic energy and speed of each as they reach the floor?

27. A bowling ball suspended from the ceiling by a massless cable swings freely back and forth. If the ball's top speed is 5.0 m/s at 0.25 m from the floor, how high will the bowling ball be when its speed is zero? Ignore friction and air resistance. Why do you not need to know the mass of the bowling ball?

28. A 91 kg man wearing a Velcro suit running with a horizontal speed of 4.4 m/s leaps into the air and impacts a stationary car of mass 880 kg sitting on a railroad track. The car is covered in Velcro, as well, and the man and the car stick together.

    a) What was the initial KE of the system?

    b) What is the final speed of the system?

    c) What is the final KE of the system?

    d) What percentage of KE was lost?

29. A particle of mass 1.7×10^{-27} kg moves with a velocity of +99 m/s. A particle of mass 9.1×10^{-31} kg flies off the particle exactly in the direction of motion with a velocity of $+3 \times 10^{5}$ m/s.

    a) What is the new velocity of the first particle?

    b) What is the percent gain in kinetic energy?

    c) Hypothesize about the source of this energy