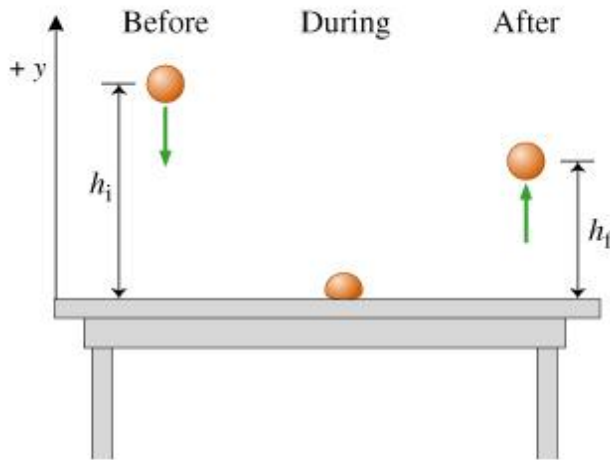


2425 Review Problems for Chapters 6 – 9.

Lianxi Ma, Summer 09

1. Your job is to lift 30-kg crates a vertical distance of 0.90 m from the ground onto the bed of a truck. (a) How much work you have done if you have loaded 10 crates onto the truck? If you loaded these 10 crates in 1.0 minute, what is your power output? (b) How many crates would you have to load onto the truck in one minute for the average power output you use to lift the crates to equal 0.50 hp? (c) How many crates need to be lifted in a minute for an average power output of 100 W?

2. As shown in the figure, a superball with mass m equal to 50 grams is dropped from a height of $h_i = 1.5$ m. It collides with a table, then bounces up to a height of $h_f = 1.0$ m. The duration of the collision (the time during which the superball is in contact with the table) is $t_c = 15$ ms. In this problem, take the positive y direction to be upward, and use $g = 9.8$ m/s² for the magnitude of the acceleration due to gravity. Neglect air resistance.



- Find the y component of the momentum, $p_{i,y}$, of the ball immediately before the collision.
- Find the y component of the momentum of the ball immediately after the collision, that is, just as it is leaving the table.
- Find the y component of the time-averaged force $F_{\text{ave},y}$, in newtons, that the table exerts on the ball.
- Find the change in the kinetic energy of the ball during the collision, in joules.

3. A hunter on a frozen, essentially frictionless pond uses a rifle that shoots 4.20 g bullets at 950 m/s. The mass of the hunter (including his gun) is 70.5 kg, and the hunter holds tight to the gun after firing it.

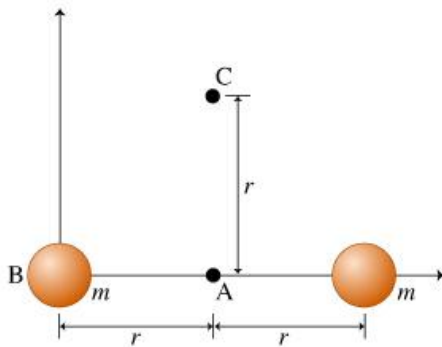
- (a) Find the recoil velocity of the hunter if he fires the rifle horizontally.
- (b) Find the recoil velocity of the hunter if he fires the rifle at 58.0° above the horizontal.

4. A particle of mass $m = 5.00$ kg is at rest at $t = 0.00$ second. A horizontal net force $F_{\text{net}}(t) = 6.00t^2 - 4.00t + 3.00$ is acting on the particle between $t = 0$ seconds and $t = 5.00$ seconds. Find the speed v of the particle at $t = 5.00$ seconds.

5. At time $t = 0$ a grinding wheel has an angular velocity of 21.0 rad/s. It has a constant angular acceleration of 25.0 rad/s^2 until a circuit breaker trips at time $t = 1.90$ s. From then on, the wheel turns through an angle of 430 rad as it coasts to a stop at constant angular deceleration.

- (a) Through what total angle did the wheel turn between $t = 0$ and the time it stopped?
- (b) At what time does the wheel stop?
- (c) What was the wheel's angular acceleration as it slowed down?

6. (a) Calculate I_{cm} , the moment of inertia about the center of mass. (b) Calculate I_B , the moment of inertia about an axis through point B. Point B coincides with (the center of) one of the spheres (see the figure). (c) Calculate I_C , the moment of inertia about an axis through point C. Point C is located a distance r from the center of mass (see the figure). (d) Calculate kinetic energy when it rotates about an axis through C with $\omega = 120$ rpm and $m = 1.0$ kg, $r = 0.50$ m.



Answers

1. (a) $2.65 \times 10^3 \text{ J}$; 44 W. (b) 84. (c) 23/min.
2. (a) -0.271 kg m/s ; (b) 0.221 kg m/s ; (c) 32.8 N; (d) -0.245 J .
3. (a) -0.0556 m/s ; (b) -0.0300 m/s .
4. 43.0 m/s
5. (a) 515 rad; (b) 14.5 s; (c) -5.46 rad/s^2 .
6. (a) $2mr^2$; (b) $4mr^2$; (c) $4mr^2$; (d) 79.0 J.