Worksheet 7.3 - Kinetic Energy

1. A 3.0 kg ewok is traveling at a constant speed of 7.5 m/s. What is its kinetic energy?

$E_K = \frac{1}{2}mv^2 = \frac{1}{2}(3.0\,kg)(7.5\,m/s)^2$

$= \boxed{84\,J}$

2. The kinetic energy of a 20.0 N droid is 5.00×10^2 J. What is the speed of the droid?

$m = \frac{F_g}{g} = 2.04\,kg$

$E_K = \frac{1}{2}mv^2 \qquad v = \sqrt{\frac{2E_K}{m}} = \sqrt{\frac{2(500\,J)}{2.04\,kg}}$

$= \boxed{22.1\,m/s}$

3. A 10.0 N lightsaber is accelerated from rest at a rate of 2.5 m/s^2. What is the kinetic energy of the lightsaber after it has accelerated over a distance of 15.0 m.

$m = \frac{F_g}{g} = 1.02\,kg$

$v = \sqrt{2ad}$

$= \sqrt{2(2.5)(15)}$

$= 8.660\,m/s$

$E_K = \frac{1}{2}mv^2$

$= \frac{1}{2}(1.02)(8.660)^2$

$= \boxed{38\,J}$

4. A 1200.0 N Wookie jumps off a cliff on Earth. What is its kinetic energy after it falls for 4.50 s?

$v = v_0 + at$

$= 0 + (-9.8)(4.50)$

$= -44.1\,m/s$

$m = \frac{F_g}{g} = 122.4\,kg$

$E_K = \frac{1}{2}mv^2 = \frac{1}{2}(122.4)(-44.1)^2$

$= \boxed{119\,000\,J}$

5. An 8.0 kg bantha poodoo is dropped from a height of 7.0 m. What is the kinetic energy of the poodoo just before it hits the ground? (No kinematics!)

E_p: $E_{p_i} = mgh_i = (8.0\,kg)(9.8\,N/kg)(7.0\,m)$

$= 548.8\,J$

all of the $E_p \rightarrow E_K$

$\downarrow E_{K_f}$

$E_{K_f} = E_{p_i} = \boxed{550\,J}$

6. A 9.00 kg object falls off of a 1.2 m high table. If all of the objects potential energy is converted into kinetic energy just before it hits the floor, how fast is it moving? (Solve without using kinematics)

$E_{p_i} = mgh_i = (9.00\,kg)(9.8\,N/kg)(1.2\,m) = 105.8\,J$

$E_{K_f} = \frac{1}{2}mv_f^2 \qquad v = \sqrt{\frac{2E_K}{m}} = \sqrt{\frac{2(105.8\,J)}{9.00\,kg}}$

$= \boxed{4.8\,m/s}$

7. Solve #6 using kinematics this time. Is there any difference?

$v^2 = v_0^2 + 2ad$

$v = \sqrt{2ad} = \sqrt{2(-9.8)(1.2)}$

$= \boxed{4.8\,m/s}$

8. A golfer wishes to improve his driving distance. Which would have more effect:

(a) *doubling the mass* of his golf club or

(b) *doubling the speed* with which the clubhead strikes the ball?

Explain your answer.

(b) Since $E_K = \frac{1}{2}mv^2$

- $E_K \propto m$; if you double m you double E_K
- $E_K \propto v^2$; if you double v you increase E_K by 4 times.

1) 84 J 2) 22.1 m/s 3) 38 J 4) 119 000 J 5) 550 J 6) 4.8 m/s 7) 4.8 m/s (down) 8) b