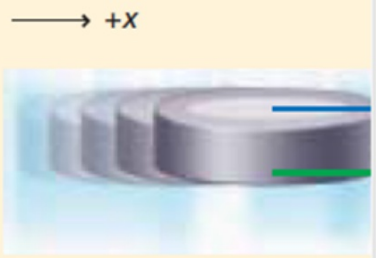
EXAMPLE Problem 1

Work and Energy A 105-g hockey puck is sliding across the ice. A player exerts a constant 4.50-N force over a distance of 0.150 m. How much work does the player do on the puck? What is the change in the puck's energy?

1 Analyze and Sketch the Problem



- Sketch the situation showing initial conditions.
- Establish a coordinate system with $+x$ to the right.
- Draw a vector diagram.

Known: .105 kg
$m = 105\ \text{g}$
$F = 4.50\ \text{N}$
$d = 0.150\ \text{m}$

Unknown:
$W = ?$
$\Delta KE = ?$

$W = F\Delta d$
$= (4.50)(.150)$
$= .675\ \text{J}$

$W = \Delta KE = .675\ \text{J}$

1. Refer to Example Problem 1 to solve the following problem.

a. If the hockey player exerted twice as much force, 9.00 N, on the puck, how would the puck's change in kinetic energy be affected?

b. If the player exerted a 9.00-N force, but the stick was in contact with the puck for only half the distance, 0.075 m, what would be the change in kinetic energy?

(1) a) $F = 9.00\ N$

$m = .105\ kg$

$\Delta d = .150\ m$

$\Delta KE = \_\_\_\ J$

$\Delta KE = W = F\Delta d$

$= (9.00)(.150)$

$\Delta KE = 1.35\ J$

b) $F = 9.00\ N$

$\Delta d = .075\ m$

$\Delta KE = W = F\Delta d$

$= (9.00)(.075)$

$= .675\ J$

$\Delta KE \uparrow, F \uparrow$ } direct prop.

$\Delta KE \uparrow, \Delta d \uparrow$ }

2. Together, two students exert a force of 825 N in pushing a car a distance of 35 m.

a. How much work do the students do on the car?

b. If the force was doubled, how much work would they do pushing the car the same distance?

(a) $W = F \Delta d$

$= (825)(35)$

$= 28875\ J$

$2.9 \times 10^4\ J$ or $29000\ J$

(b) $W = (1650)(35)$

$= 57750\ J$

$= 5.8 \times 10^4\ J$ or $58000\ J$

3. A rock climber wears a 7.5-kg backpack while scaling a cliff. After 30.0 min, the climber is 8.2 m above the starting point.

a. How much work does the climber do on the backpack?

b. If the climber weighs 645 N, how much work does she do lifting herself and the backpack?

c. What is the change in the climber's energy?

(a) $W = F\Delta d = mgh = (7.5)(9.8)(8.2) = 602.7\ J$

$= 6.0 \times 10^2\ J$

(b)

(c)