Key

Work-Energy Theorem Practice Problems

1. A squirrel (mass 0.9 kg) is running across the road at a speed 4.0 m/s. What is the squirrel's kinetic energy?

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

$KE = \frac{1}{2}(.09\,kg)(4.0\,m/s)^2$

$\boxed{KE = 0.72\,J}$

2. A kangaroo is hopping about downtown Sydney, looking for some grub. If its legs exert a force of 760 N and his legs push a distance of 40 cm, how much work do the kangaroo's legs do?

KHDkgdcm

$F = 760N$

$d = 40cm = .4m$

$W = ?$

$W = Fd$

$W = (760N)(.4m)$

$\boxed{W = 304\,J}$

3. A bird (with mass 1.5 kg) is flying in the air at a speed of 10 m/s. The bird approaches a building with mirrored windows and, sadly, runs straight into the building.
   a. What is the bird's kinetic energy when flying?

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

$KE = \frac{1}{2}(1.5\,kg)(10\,m/s)^2$

$\boxed{KE = 75\,J}$ ← initial

   b. What is the bird's kinetic energy after running into the window?

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

$KE = \frac{1}{2}(1.5\,kg)(0\,m/s)^2$

$\boxed{KE = 0\,J}$ ← final

   c. How much work does the window do on the bird?

$W = \Delta KE$

$W = KE_f - KE_i$

$0J - 75J$

$\boxed{W = -75\,J}$

4. A spider monkey (mass 40 kg) is frolicking through the jungle at a speed of 3.0 m/s. All of a sudden, a jaguar appears and tries to eat the monkey. The monkey begins to run frantically—now he has a speed of 14.0 m/s. How much work does the monkey do to increase its speed?

$m = 40\ kg$
$V_i = 3.0\ m/s$
$V_f = 14.0\ m/s$
$W = ?$

$W = \frac{1}{2}mV_f^2 - \frac{1}{2}mV_i^2$
$W = \frac{1}{2}(40\ kg)(14.0\ m/s)^2 - \frac{1}{2}(40\ kg)(3.0\ m/s)^2$
$3920 - 180$
$W = 3740\ J$

5. A 4,000 kg elephant is riding a bicycle at a speed of 4.0 m/s. Out of nowhere, a zebra runs out in the elephant's path and he must slam on his brakes. If the bicycle's brakes exert a force of 1.4 kN, how far will it take to stop the bicycle?

$m = 4000\ kg$
$V_i = 4.0\ m/s$
$F = 1.4\ kN = 1400\ N$
$d = ?$

$Fd = \frac{1}{2}mV_f^2 - \frac{1}{2}mV_i^2$
$(1400N)(d) = \frac{1}{2}(4000kg)(0\ m/s)^2 - \frac{1}{2}(4000kg)(4.0)^2$
$(1400N)(d) = -\frac{1}{2}(4000kg)(4.0)^2$
$\frac{1400(d)}{1400} = \frac{-32000}{1400}$
$d = -22.9\ m$

BONUS: A car is driving 25 km/hr. When it locks up her brakes it takes the car 16 meters to stop. Assuming the braking force is the same all the time, how far will it take to stop the car when it's going 75 km/hr?

$d = ?$ @ $75\ km/hr$
$V = 25\ \frac{km}{hr}$
$d = 16m$