1. A 3.4 kg cat is lifted from the floor to a height of 1.6 m. How much work is done in lifting the box?

$W = F\ d \cos \theta$

$W = (3.4\ kg)\ g\ (1.6\ m) \cos 0$

The F is the F applied upward to lift it, not the F of gravity.

$W = 53.3\ J$

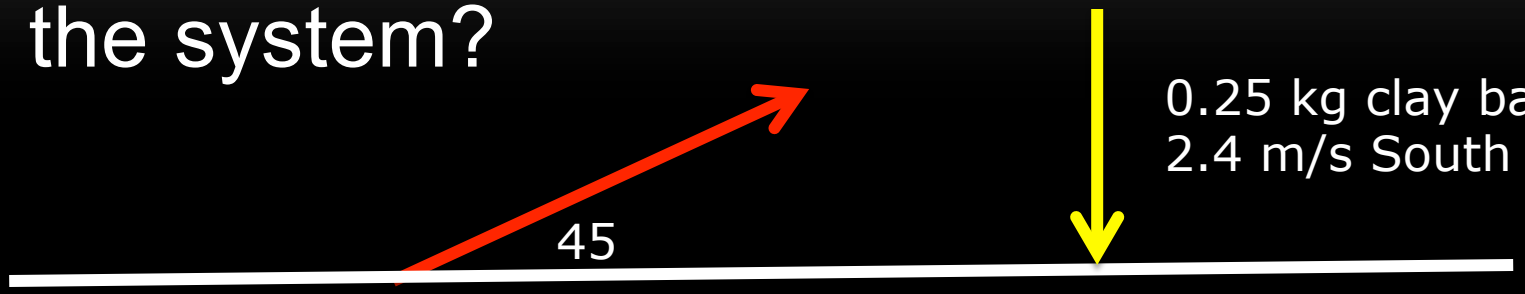
3. A ball is dropped from 8 meters above the ground. The ball has a mass of 0.39 kg. How fast it will be traveling when it hits the ground?

Use conservation of E. Initial E = PE, final E = KE

$(0.39\ kg)\ g\ (8\ m) = \frac{1}{2}\ (0.39\ kg)\ v^2$

V = 12.53 m/s

4. The block and clay ball collide and stick together. What is the final velocity of the system?



Apply conservation of momentum in each direction

4.

Initial

$p_x = (1.9\ kg)(3.9\ m/s) \cos 45 + 0$

$p_y = (1.9\ kg)(3.9\ m/s) \sin 45 - (0.25\ kg)(2.4\ m/s)$

Final

$p_x = (1.9 + 0.25)kg * v_{x,\ final}$

$p_y = (1.9 + 0.25)kg * v_{y,\ final}$

$p_{x,initial} = p_{x,final}$

$(1.9\ kg)(3.9\ m/s)\cos 45 + 0 = (1.9 + 0.25)kg * v_{x,final}$

$p_{y,initial} = p_{y,final}$

$(1.9\ kg)(3.9\ m/s)\sin 45 - (0.25\ kg)(2.4\ m/s) = (1.9 + 0.25)kg * v_{y,final}$

$v_{x,final} = 2.43\ m/s$ to the left

$v_{y,final} = 2.16\ m/s$, up

9. A skater is initially spinning at a rate of 1 rev/s with her arms outstretched. She brings her arms in to her chest, reducing her rotational inertia by 35%. What is her new rate of rotation?

L = Iw is conserved.

$(I_{init})(1 \text{ rev/s}) = (0.65\, I_{init})(w_{final})$

$W_{final} = 1.54$ rev/s

5. A bolt must be tightened to 90 N m. You have a 25 cm long wrench and can exert a maximum force of 150 N. You put a pipe over the end of the wrench to make it longer. How long must the pipe be?

$T = F\ l\ \sin\theta$

$90\ \text{N m} = (150\ \text{N})\ (25/100 + X)\ \sin 90$

$0.6\ \text{m} = (25/100 + X)$

$X = 0.35\ \text{m}$

6. A wheel has a moment of inertia of 2.75 * 10^{-6} kg m^2 and is rotating at a speed of 15,000 rad/s. How much work is done in bringing the wheel to rest?

W = change in KE = ½ I w^2

W = ½ (2.75 * 10^{-6} kg m^2)(15,000 rad/s)^2

W = 309.38 J

8. A 1200 kg car moving at 73 mph strikes a 950 kg at rest. Their bumpers join and the two cars are stuck together. What is the final speed of the cars?

Conservation of momentum

(1200 kg)(73 mi/hr) + 0 = (1200 + 950 kg) v_final

v_final = 40.7 mi/hr

11. A motorcycle has a speed of 13.0 m/s. If the diameter of one of the tires is 67.0 cm, what is the angular speed of that wheel?

Use $w = \theta / t$ or $v = w r$

$w = v / r = 13.0 \text{ m/s} / ((67.0/2) / 100.0)$

$w = 38.81 \text{ rad/sec}$

2. An object with a mass of 125 kg is moving at a velocity of 7.3 m/s. What is it's momentum?

$p = mv = (125\ kg)(7.3\ m/s)$

$p = 912.5\ kg\ m/s$

7. When a pitcher throws a ball, their arm rotates 1/4 of a revolution in 0.05 s. What is the angular velocity of the arm?

$w = \theta / t = (2 \pi * 0.25) / 0.05$

$w = 31.42$ rad/sec

10. A motorist drives a 1200 kg car on level ground. They accelerate from 20.0 m/s to 30.0 m/s in 7 seconds. What is the mechanical power supplied by the engine during this time?

P = W / t, W = change in KE

$$P = \frac{\frac{1}{2}(1200)(30)^2 - \frac{1}{2}(1200)(20)^2}{7 \text{ sec}}$$

P = 42.857 Watts