Name: _____

Period: _____

28

Identify W_{in} and W_{out} for each situation

A. An object is pushed up a ramp. There is friction on the ramp. $W - W_f = E_p$

$W_{in} =$ W $\quad W_{out} =$ E_p

B. An object is against a compressed spring. The spring is released and pushes the object, but the object rubs against the ground.

$W_{in} =$ PE_{el} $\quad W_{out} =$ E_K

C. An object is launched into the air with an initial velocity. It goes to the top. There is air friction.

$W_{in} =$ E_K $\quad W_{out} =$ E_p

D. An object is at the top of a ramp. It slides down the ramp. There is friction.

$W_{in} =$ E_p $\quad W_{out} =$ E_K

E. An object is accelerated by a force, but because of friction it is not moving as fast afterwards as it should.

$W_{in} =$ W $\quad W_{out} =$ E_K

F. An object is dropped. There is air friction.

$W_{in} =$ E_p $\quad W_{out} =$ E_K

A 6 kg object is at rest on a table. It is pushed for 20 m with a 3 N force. It is moving 4 m/s afterwards. $0 + W - W_f = E_K$

A. $W_{in} = W = Fd = 3(20) = 60\text{J}$

B. $W_{out} = E_K = \frac{1}{2}mv^2 = \frac{1}{2}(6)16 = 6(8) = 48\text{J}$

C. Calculate efficiency.

$\frac{48}{60} = \frac{8}{10} = \frac{80}{100} = 80\%$

$60 - 48 =$

D. How much energy was lost to friction? 12J (20%)

A 2 kg object is moving 6 m/s. It compresses a spring 1 meter that has a spring constant of 8 N/m. $E_K - W_f = PE_{el}$

A. $W_{in} = E_K = \frac{1}{2}(2)(6^2) = 36\text{J}$

B. $W_{out} = PE_{el} = \frac{1}{2}(8)1^2 = 4\text{J} = \frac{1}{2}kx^2$

C. Calculate efficiency.

$\frac{4}{36} = 11\%$

D. Where did the energy go? Friction in spring

A 3 kg object falls off an 8 m tall ledge. Due to friction it is only going 11 m/s at the ground. $E_p - W_f = E_K$

A. $W_{in} = E_p = mgh = 3(10)(8) = 240\text{J}$

B. $W_{out} = E_K = \frac{1}{2}mv^2 = \frac{1}{2}(3)(11^2) = 181.5\text{J}$

C. Calculate efficiency.

$\frac{181.5}{240} = 75\%$

$240 - 181.5$

D. How much energy was lost to friction? 58.5J

A 2 kg object is pushed up a 12 m long ramp by a 7 N force to get the object to the top of a 3 m tall table.

A. $W_{in} = W = 7(12) = 84\text{J}$

B. $W_{out} = E_p = mgh = 2(10)(3) = 60\text{J}$

C. Calculate efficiency.

$\frac{60}{84} = 71\%$

D. How much thermal energy was created? 24J

A 6 kg object is at the top of a 2 m tall ramp. Due to friction it is only moving 5 m/s at the bottom.

A. $W_{in} = E_p = mgh = 6(10)2 = 120\text{J}$

B. $W_{out} = E_K = \frac{1}{2}(6)25 = 75\text{J}$

C. Calculate efficiency.

$\frac{75\text{J}}{120} = 62.5\%$

D. How much thermal energy was created? $120 - 75$

A 6 kg object is moving 1 m/s. It is pushed by a 4 N force for 20 m. It is going 5 m/s afterwards.

A. $W_{in} = W = 4(20) = 80\text{J}$

B. $W_{out} = \Delta E_K = \frac{1}{2}6(5)^2 - \frac{1}{2}(6)1^2 = 3(25) - 3 =$ $75 - 3 = 72\text{J}$

C. Calculate efficiency.

$\frac{72}{80} = 90\%$

D. How much thermal energy was created? 8J