Name________________________________Date______________

Period______________________________ Points available: 20

Physics

Worksheet – Work, KE, PE, and Conservation

Work Problems:

1. Why does gravity do no work on the space shuttle as it orbits the Earth?

Force is ⊥ to disp.

2. Can work be done on an object that remains at rest? Explain your answer.

No. either have to change velocity or position

3. How much work must be done to stop 1,250kg car traveling 105km/hr?
4. A 1,250kg car accelerates from 15m/s to 27ms in 5 seconds. What was the net force acting on the car to cause this acceleration? What was the net work done to the car? How far did the car travel during this time?
5. A boy is pulling his 30kg brother in a sled at a constant speed. The boy is pulling on a rope that makes an angle of 20° with the ground. The friction force is 45N. If the boy pulls his brother for 45 meters, how much work does he do against friction? What is the tension in the rope?
6. A 1,400kg car is pushed up a 5° hill at a constant speed. The hill is 150m long. How much work is done against gravity to get the car to the top of the hill? If the μ_k is 0.20, how much work is done to get it to the top of the hill?

Kinetic Energy:

7. Describe the evidence that exists to prove that work has been done to an object.

Change in energy, either potential or kinetic

8. An 88g arrow is fired from a bow whose string exerts an average force of 110N on the arrow over a distance of 78cm. What is the speed of the arrow as it leaves the bow?
9. How much kinetic energy does a 65kg runner have if he is running at 5.3m/s? How much work is done to accelerate the same runner from 5.3m/s to 9.5m/s?
10. The speed of a hockey puck sliding across the ice decreases from 45.00m/s to 44.67m/s in 16m. What is μ_k between the puck and the ice?

Work, PE, KE, Conservation

Work:

3.

K
$m = 1250 kg$
$V = 29.2 \frac{m}{s}$

U
W

$W = \Delta KE$

$= KE_f - KE_i$

$= 0 - \frac{1}{2} m v_i^2$

$= -\frac{1}{2}(1250) 29.2^2$

$\boxed{W = -531684 J}$

4.

K	U
$m = 1250 kg$	F
$V_i = 15 \frac{m}{s}$	W
$V_f = 27 \frac{m}{s}$	d
$t = 5 s$	$a = 2.4 \frac{m}{s^2}$

$F = ma$

$= 1250(2.4$

$\boxed{F = 3000 N}$

$a = \frac{\Delta U}{\Delta t} = \frac{12}{5}$

$=$

~~d~~ $V_f^2 = V_i^2 + 2ad$

$27^2 = 15^2 + 2(2.4) d$

$\boxed{d = 105 m}$

$W = F \cdot d$

$= 3000(105)$

$\boxed{W = 315,000 J}$

5.

$W = F \cdot d$

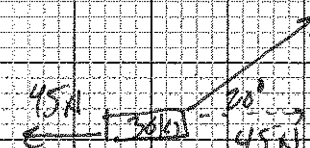
$= 45(45$

$\boxed{W = 2025 J}$

$F_T \cos \theta = Adj$

$F_T \cos 20 = 45$

$\boxed{F_T = 47.9 N}$



6.

K	U
$m = 1400 kg$	W_g
$\theta = 5°$	W_{Tot}
$d = 150 m$	
$\mu_k = 0.2$	

$W_g = F \cdot d$

$= F_{gx} \cdot d$

$= 11~~9~~96(150$

$\boxed{W_g = 179,366 J}$

$W_{fr} = F_{fr} \cdot d$

$= \mu mg \cos\theta \cdot d$

$= .2(1400)9.8) \cos 5 (150$

$=$ ~~410033~~

$\boxed{W_{fr} = 410034 J}$

$F_{gx} = mg \sin\theta$

$= 1400(9.8) \sin 5$

$F_{gx} = 1196 N$

$W_T = W_g + W_f = 179366 + 410034$

$\boxed{W_T = 589,500 J}$

Kinetic

8.

K	U
$m = .0881\,kg$	V_f
$F = 110\,N$	
$d = .78\,m$	

$W = \Delta KE$

$Fd = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$110(.78) = \frac{1}{2}(.088)V_f^2 - 0$

$\boxed{V_f = 44.2\,\frac{m}{s}}$

9.

K	U
$m = 65\,kg$	KE
$V_i = 5.3\,\frac{m}{s}$	W
$V_f = 9.5\,\frac{m}{s}$	

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

$= \frac{1}{2}(65)(5.3)^2$

$\boxed{KE = 913\,J}$

$W = \Delta KE$

$= KE_f - KE_i$

$= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$= \frac{1}{2}(65)(9.5)^2 - \frac{1}{2}(65)(5.3)^2$

$\boxed{W = 2020\,J}$

10.

K	U
$V_i = 45\,\frac{m}{s}$	μ_k
$V_f = 44.67\,\frac{m}{s}$	
$d = 16\,m$	

$W = \Delta KE$

$-F \cdot d = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$-\mu mg\cos\theta\, d = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$\mu\, 9.8(16) = \frac{1}{2}44.67^2 - \frac{1}{2}45^2$

$\boxed{\mu = 0.094}$

Potential

12.

K	U
# = 15 flights	W
h = 3.2 m	
m = 56	

$W = \Delta PE$

$= mgh$

$= 56(9.8)(3.2)15$

$W = 26342\ J$

13.

K	U
W = 80 J	h
m = 1.85 k	

$W = \Delta PE$

$80 = mgh$

$80 = 1.85(9.8)h$

$h = 4.4\ m$

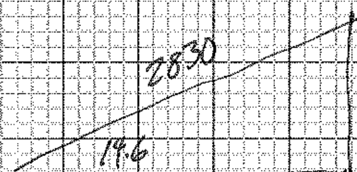
14.

K	U
m = 75 kg	PE
d = 2830	W
$\theta = 14.6°$	

$PE = mgh$

$= 75(9.8)(713)$

$PE,\ W = 524055\ J$



$h = 2830 \sin 14.6$

Conservation

17.

K	U
h = 4.3	V

$PE = KE$

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

$9.8(4.3) = \frac{1}{2}v^2$

$V = 9.2 \frac{m}{s}$

18.

K	U
v = 5.3	h

$KE = PE$

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

$h = 1.43\ m$

19.

K	U
h = 70 m	V

$PE = KE$

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

$V = 37 \frac{m}{s}$

20.

K	U
m = 21.7	
h = 3.5	
v_f = 2.2	

Energy lost $= PE_i - KE_f$

$= mgh - \frac{1}{2}mv_f^2$

$E_{lost} = 691.8\ J$

21.

$E_f = PE_i + KE_i$

$\frac{1}{2}mv^2 = mgh + \frac{1}{2}mv^2$

$V_f = 198.54 \frac{m}{s}$

22.

$PE = KE$

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

$9.8(1.5) = \frac{1}{2}v^2$

Energy lost: 25%

$V = 5.4 \frac{m}{s}$