SOME ENERGY/WORK QUESTIONS (Energy2Probs)

1) What are some different units for energy?

See notes

2) What are the types of energy and how are they measured?

See notes

3) What are the types of mechanical energy?

Gravitational Potential, Elastic Potential, Kinetic.

4) Describe the energy changes in a jack in a box (a bobble head on a spring with friction). How would this look on a graph?

5) Which type of mechanical energy does NOT depend on position?

Kinetic Energy depends only on mass and speed.

6) Give a typical amount of Calories of mechanical energy likely to be used by a typical teenager per week. How would this be calculated?

Anywhere from 12,000 Cal to 30,000 Calories.
Energy =Kinetic plus GPE plus Work or add up all activities.

7) What is the work done if I lift a 20 kg object 3 meters, then carry it at a constant speed horizontally for 5 meters?

*Work is Force times Dis in direction of motion. Force of Gravity=Weight= 20*9.8=196N*
*Work = 196N*3 m= 588 Joules. No work is done by carrying it horizontally.*

8) What is the purpose of a simple machine?

To multiply force (or sometimes to multiply time/distance). Work in usually equals work out.

9) Explain why all simple machines are really either levers or ramps:

Ramps: Planes, Screws, Wedges
Levers: :levers, wheel/axle, pulley, gear

10) A parachutist with a mass of 40.0 kg jumps out of an airplane at an altitude of 5000 m. After the parachute deploys, the parachutist lands with a velocity of 6.00 m/s. Using the work–kinetic energy theorem, find the energy that was lost to air resistance during this jump.

GPE + KE = GPE + KE
$Mgh + \frac{1}{2} mv^2 = mgh + \frac{1}{2} mv^2$
$40*9.8*5000 + 0 = 0 + \frac{1}{2} (40)(6)^2$
1,960,000 Joules start, 720 Joules end, lost 1959280 Joules!

11) A lever with an effort arm of 4 cm, and a resistance arm of 8 cm is attached to a 2 string pulley holding a 4 kg mass. If it takes 60 Newtons of force to push on the lever to lift the mass then find:
Work In: Work Out: Ideal mech Advantage: Actual Mech Advantage: Efficiency

Lever IMA= 4/8=.5, Pulley IMA = 2:1, machine IMA = 1:1
*Actual Mech Advant= Fout/Fin = (4)*9.8/ 60 = 39.2/60 = .6533*
Efficiency = AMA/IMA= .6533/1 = 65.33 %

12) A force of 1250 N is needed to move a crate weighing 3270 N up a ramp that is 4.55 m long. If the elevated end of the ramp is 0.750 m high, what is the efficiency of the ramp?

Efficiency=WorkOut/WorkIn = (3270.75)/(1250*4.55) = 2452.5 J / 5687.5 J = 43.1%*

13) A spring is pulled back from rest 20 cm with 40 N of force. If it hits a 3 kg mass, what is its starting elastic energy? How fast is it going when it leaves the spring? (no friction). How high does it go?

X=.2 m, F = 40N k = F/x=200 N/m, EPE = $1/2Kx^2 = \frac{1}{2}*(200)*(.2)^2 = 4$ Joules
*4 Joules = KE = $1/2mv^2 = \frac{1}{2}*(3)*v^2$, v = sqrt(2*4/3) = 1.633 m/s = v*
*4 Joules = GPE = 4 = mgh = 3*9.8*h, h = 4/(3*9.8)= 4/29.4=.136 m=h*

14)) A still person with a mass of 156 kilogram catches a 9 kilogram ball going 30 meters/second, which causes him to roll down a hill (starting at 1.636 m/s) . What is the total energy after the collision? If they are on the top of a 2 meter tall hill, what is the velocity at the bottom of the hill?

*Before collision E= GPEball+ KE ball+GPE person = 156*9.8*2+9*9.8*2+$1/2*9*30^2$*
= 3057.6 +176.4 + 4050=7284 Joules
*AFTER collision E = GPE + KE = 165*9.8*2 + ½ * 165* 1.636^2=3234J+220.8=*
3454.8 Joules
At bottom E= 3454.8J = KE=$1/2mv^2 = \frac{1}{2}*165*v^2$,
*V= sqrt (2*3454.8/165)=6.47 m/s*