As a skydiver falls at constant terminal velocity, does her total mechanical energy (potential energy plus kinetic energy) remain constant? Why or why not? In what sense is total energy conserved or not in this situation? Explain.

Good discussion of how her energy changes

The skydivers kinetic energy would remain the same, while her potential and total mechanical energy would decrease, which means that when the skydiver is falling at a constant velocity, her mechanical energy doesn't remain conserved as air resistance is working on her. Her height is decreasing and there is a positive amount of work done by gravity, so the flow of energy must be balanced by a reduction in gravitational potential energy. Since mechanical energy doesn't remain conserved, then the total energy is not conserved because there is change in the total amount of mechanical energy.

Another good response

No, her total mechanical energy does not remain constant because of the external force of air resistance (friction) acting upon the motion of the skydiver as they fall (slowing the rate of them falling) . The total mechanical energy can be conserved only if internal forces are doing work and no work is done by external forces.

Interesting point: what is the sign of height?

The skydiver's mechanical energy would not remain constant. Since the formula for kinetic energy:

KE = -1/2mv^2

only relies on the value of the velocity and mass, which are both constant in this situation, the kinetic energy would be constant. However, the formula for potential energy incorporates the height:

PE = mgh

Since the skydiver is falling the height will be negative, therefore, changing the potential energy as the skydiver falls, making the potential energy not constant. Since mechanical energy is the sum of the potential and kinetic energy the mechanical energy would not be constant. In this situation total energy will be conserved because friction will also be a component of the total energy.

Reminder: 1 watt = 1 joule/s.

A typical electric bill specifies how much electricity a household consumes in units of kilowatt-hours abbreviated kW-hr (i.e., 1000 watts of power times 1 hour of time). What is the corresponding proper SI unit for the quantity expressed as 1 kW-hr? Calculate the conversion factor between the two units. If the going rate is 10 cents/kW-hr, estimate the cost of raising a piano from street level to a tenth floor apartment, neglecting the cost of labor, pizza, and/or donuts. Please explain your reasoning fully and carefully.

Proper relation between kW-hr and joules, but incorrect application

So, having to convert kilowatts into watts and hours into seconds; we know that 1 kilowatt= 1000 watts and 1 hour= 3600 seconds. 1000 watts*3600 sec= 3.6 megajoules.

To estimate the cost of raising a piano from street level to a tenth floor, we would first need to find the force of the piano and then find the distance from the street to the tenth floor; W=F*s. My estimation of the force applied to move the piano would be 300N and the distance from the street level to the tenth floor to be 50 meters, my estimation is 15000J. Multiplying 10 cents/kW-hr*15000= 1500, so the total cost would be $1500 to raise a piano from street level to the tenth floor.

Proper relation between kW-hr and joules, and correct application

1 watt- J/s, and one hour is 3600 seconds, so one kw-hr is 1000J* 3600s/s. Seconds clearly cancel so the unit is 3,600,000 Joules.

A grand piano probably weighs about 500 Kg and were gonna say the top floor is 100 m off the floor. Since the piano is at rest in both the initial and final states, the total kinetic energy must be zero, so the lifting force on the piano is equal in magnitude to the force of gravity exerted on it during the movement.

Gravitational force is F=m*g and work is W=displacement*force*cos(theta)

theta is 0 for gravity so we get the formula W=displacement*m*g

plugging in we get W= 100m*10N/Kg*500kg, so W=500,000 J

500000J/3,600,000J*10cents= about 1 cent.

Which of the following doesn't involve a conservative force?

a. Friction
b. Gravity
c. Springs
d. Republicans
e. Tories