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General Physics-I, Quiz 1
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Q1-Solution

Q1. Suppose you sit on a chair made by spring that obeys Hooke's law. (a) If your weight is m = 60 kg, how much the spring will be compressed (b) If you want to compress it 2 times than now, how much weight you should gain? (c) Find out the amount of work need to do by an external agent for that 2 times compression of the spring from its initial position? Here, spring constant, k = $4x10^4$ N/m [20+20+20=60]

Solution:

(a) Using Hook's law we get , F=kx, where F is force , x is distance covered by spring when it stretched or compressed by F.

so , the distance cover by the compression of the spring is ,

$x=\frac{F}{k}=\frac{mg}{k}=\frac{60kg?\ .8m/s^2}{3?\ 0^4N/m}=1.96cm\sim 2cm$

(b) Here the X= 2x =2? = 4 cm

Therefore the total mass will be, $m=\frac{kx}{g}=\frac{3?\ 0^4N/m?\ .04m}{9.8m/s^2}=122.5kg$

So the weight you need to gain = (122.5-60)= 62.5 kg

(c) The work need to do , $W=\frac{1}{2}kX^2=\frac{1}{2}?\ ?\ 0^4N/m?(0.04m)^2=24J$

Q2. Electric car is the future vehicle for transportation. Suppose you buy a new Tesla Model-3 car which have a battery power is 400 kW. Once you charge, it can provide 10 hrs continuous riding. How much distance can you cover during the time? Let the mass of your car is 250 kg and the energy consumed by the engine is totally equal to kinetic energy of the car. [40]

Solution:

We know that Energy , E = Power荻ime = P荻

Here given as , P= 400kW and t= 10 hrs= 10? 600 s =36000s

so , the total energy will be consumed by the car is

E = 400? 6000=1.5? 0^8 J

If we consider the total enery is used to convert kinetic energy of the car , then we get, $E=\frac{1}{2}mv^2$

$\Rightarrow v=\sqrt{2E/m}$= S荻 where S= distance

$\Rightarrow S=\sqrt{2E/m}荻=\sqrt{(2?\ .5?\ 0^8\ J)/250kg}?\ 6000s$

So,distance will be coverd,S = 3.9 ? 0^4 km

You may use the backside of the paper