

(S2) GPE and KE: What Goes Up  
and What Comes Down

TODAY'S  
DATE

E.Q.: Does the steepness of a roller  
coaster influence the thrill factor?  
Why or why not?

gravitational potential energy (GPE) - the energy  
a body possesses as a  
result of its position in  
a gravitational field.

kinetic energy (KE) - the  
energy an object possesses  
because of its speed

GPE	vs.	KE
<ul style="list-style-type: none"><li>• depends on height above ground + mass of object</li></ul>		<ul style="list-style-type: none"><li>• depends on speed of object + mass of object</li></ul>
<ul style="list-style-type: none"><li>• <math>GPE = mgh</math> where <math>m = \text{mass}</math> <math>g = \text{strength of gravitational field}</math> <math>h = \text{height}</math></li></ul>		<ul style="list-style-type: none"><li>• <math>KE = \frac{1}{2}mv^2</math> where <math>m = \text{mass}</math> <math>v = \text{velocity}</math></li></ul>

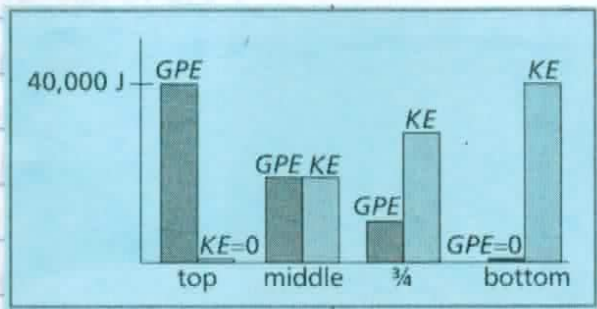
near the surface of the Earth  
 $g = 9.8 \text{ N/kg}$  or  $9.8 \text{ m/s}^2$

mechanical energy the sum of kinetic energy and potential energy  
 e.g.; roller coaster

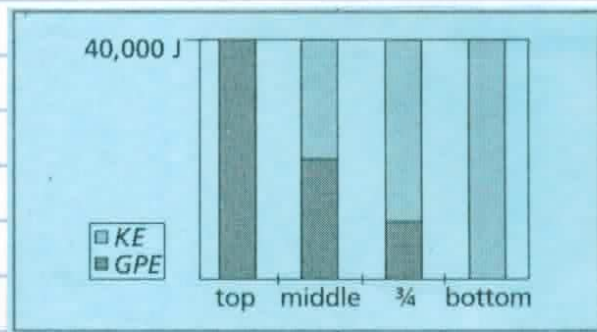
Mass of car = 200 kg and  $g = 10 \text{ N/kg}$  or  $10 \text{ m/s}^2$  (approximate value)

Position of car (height) (m)	GPE (J) = $mgh$	KE (J) = $\frac{1}{2}mv^2$	GPE + KE (J)
top (20 m)	40,000	0	40,000
bottom (0 m)	0	40,000	40,000
halfway down (10 m)	20,000	20,000	40,000
three-quarters way down (5 m)	10,000	30,000	40,000

at any point in the roller coaster the mechanical energy must equal 40,000 J (in real life, there is some loss of energy to the environment due to friction, sound, etc.)



← energy bar chart



← energy stacked bar chart

joule (J) - the SI unit for all forms of energy; equivalent units for the joule are

$$\frac{\text{kg} \cdot \text{m}^2}{\text{s}^2} \text{ or } \text{N} \cdot \text{m}$$