



Visualizing Physical Quantities That Affect Kinetic and Potential Energy

Figure 3.11 shows how different physical quantities affect the mechanical kinetic and gravitational potential energy of a person and a sled. In the figure, gravitational potential energy (GPE) is being transformed into mechanical kinetic energy (KE) and back again as the sled travels down one hill and up another. Note that the gravitational potential energy of an object is always compared to a reference position. This can be any position you choose, but it is often the surface toward which the object is falling or might fall. In Figure 3.11, the reference position is the ground at the base of each hill.



At the starting point, the sled is sitting on the highest hill.

- The sled is not moving, so it has no KE.
- The sled is at the greatest height, so it has maximum GPE.



The sled is midway down the highest hill.

- The sled is increasing in speed. KE is increasing.
- Height above the reference point is decreasing, so GPE is decreasing.

Figure 3.11

Gravitational potential energy (GPE) is transformed into mechanical kinetic energy (KE) and back again in this sled run. After the sled stops on the second hill, it will slide backward down the hill as the remaining GPE is once again transformed into mechanical KE. **Analyzing:** Which physical quantity is not changing in this scenario for KE? for GPE?



The sled is at the bottom of the highest hill.

- The sled is at its greatest speed. It has maximum KE.
- The sled is at the reference point, so it has no GPE.