

Title	Gravitational potential energy			
Ingredients	Sketch			
	At/Through	t	Near Earth's surface	
	Owner	Earth and another object system		"Environment"
	Quantity	Gravitational mass	Height	Gravitational potential energy
	Variable	m_G	h	U_G
	Giver			
Recipe	Diagram the relationship			
	Graphically present quantities	<p style="text-align: center;"><u>Gravitational potential energy bar chart</u></p>		
	Mathematical relationship	$U_G = m_G g h$		

The top half of this sheet consists of an **“Ingredients”** section with a row labeled “Sketch”, a row labeled “At/Through”, a row labeled “Owner”, a row labeled “Quantity”, a row labeled “Variable”, and a row labeled “Giver.”

Sketch: A sphere labeled $m\text{-sub-G}$ is above and nearby, but not touching, a horizontal surface. A label immediately under the surface reads, “Earth”. The dashed system bubble surrounds the sphere, the surface, and the label “Earth”. A dashed vertical axis indicates that the $+h$ direction points up the page. A tickmark at the height of the surface is labeled 0. The tickmark labeled 0 can actually be drawn anywhere on the vertical axis. Choosing to label the surface of the Earth as having zero height is just a common choice.

Remaining rows of Ingredients section are used for a flowchart illustrating the following:

There are two Owners: the System and the “Environment”. The System consists of the Earth and another object. The other object is Near Earth’s surface. At time t , the other object owns the Quantity Gravitational mass denoted by the Variable $m\text{-sub-G}$. At time t , the other object also owns the Quantity Height denoted by the Variable h . At time t , the entire Earth-and-other-object system owns the Quantity Gravitational potential energy denoted by the Variable $U\text{-sub-G}$. Near the Earth’s surface, the Environment owns the Quantity Gravitational acceleration, denoted by the Variable g , given by Giver Earth.

The bottom half of this sheet consists of a **“Recipe”** section with a row labeled “Diagram the relationship”, a row labeled “Graphically present quantities”, and a row labeled “Mathematical relationship”.

Diagram the relationship

A flowchart arrow shows that gravitational mass $m\text{-sub-G}$ contributes to gravitational potential energy $U\text{-sub-G}$. Another arrow shows that gravitational acceleration g contributes to gravitational potential energy $U\text{-sub-G}$. Another arrow shows that height h also contributes to gravitational potential energy $U\text{-sub-G}$.

Graphically present quantities

Gravitational potential energy bar chart

Plot E on the vertical axis. Draw a tickmark labeled 0. At the height of this tickmark, draw a horizontal segment to the right, labeled underneath as $U\text{-sub-G}$. From and extending upward from this labeled segment, draw a shaded rectangular bar.

Mathematical relationship

$U\text{-sub-G} = m\text{-sub-G} \text{ times } g \text{ times } h$