PhyzGuide: POTENTIAL

a side-by-side comparison of gravitational and electrical potential

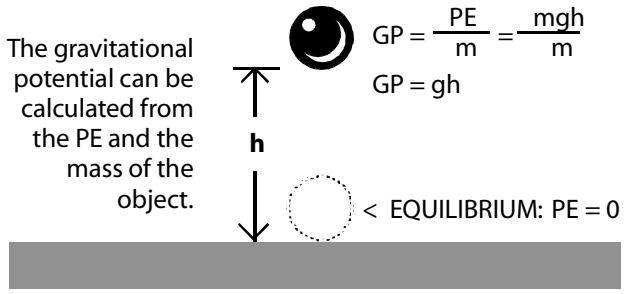
An object with mass elevated above a reference point on Earth has **gravitational potential energy.** An object with charge "elevated" above an equilibrium point in an electric field has **electrical potential energy.** (Electric equilibrium is attained, for example, when a positive charge reaches a negative plate, or vice versa.) In the case of electricity, it is useful to know how much potential energy per unit of charge is associated with a point in space. Potential energy per unit charge is called **electrical potential** (also called voltage and electromotive force). **Gravitational potential** is a less useful concept that describes how much potential energy per unit of mass is associated with a point in space. We study gravitional potential at this point only so that we can compare it to electrical potential.

GRAVITY

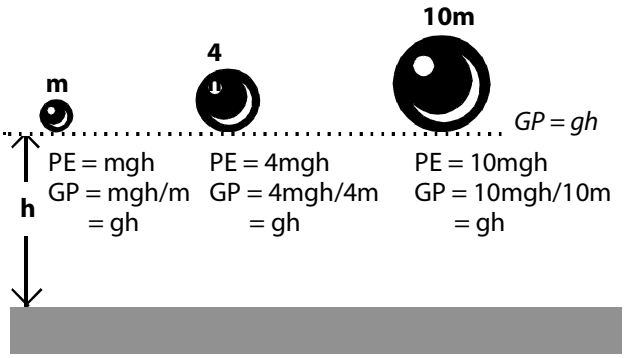
$$\text{grav. potential} = \frac{\text{gravitational potential energy}}{\text{mass}}$$

Potential in a Uniform Gravitational Field

A mass elevated above equilibrium in a gravitational field has gravitational potential energy.



All masses elevated above equilibrium by a distance *h* have equal gravitational POTENTIALS, although they may have different gravitational potential ENERGIES.



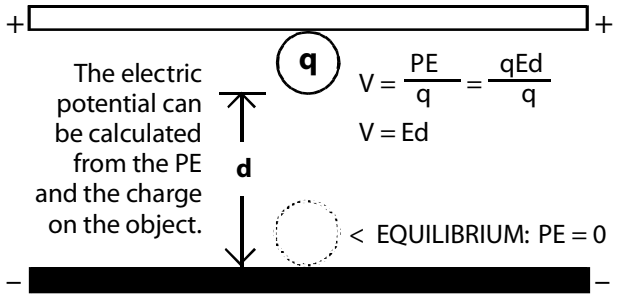
Regardless of mass, all objects have the same gravitational potential at a given height: *GP = gh*.

ELECTRICITY

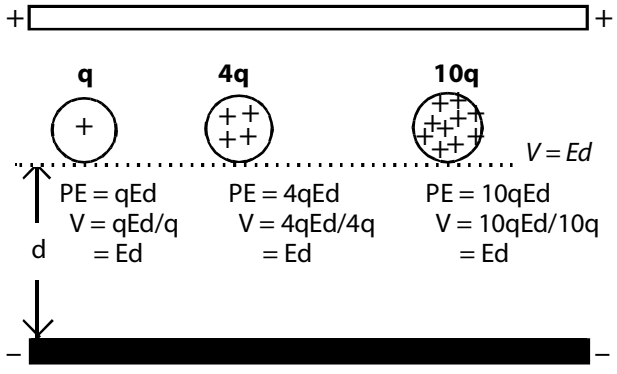
$$\text{electrical potential} = \frac{\text{electrical potential energy}}{\text{charge}}$$

Potential in a Uniform Electric Field

A charge elevated above equilibrium in an electric field has electric potential energy.



All charges elevated above equilibrium by a distance *d* have equal electric POTENTIALS, although they may have different electric potential ENERGIES.



Regardless of charge, all objects have the same electrical potential for a given plate separation distance: *V = Ed*. Since a tiny charge could traverse the *entire* distance between two plates, *d* is considered the entire distance between the plates.

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