

## Gravitational Potential Energy in Space (Ep)

**Gravity is an attractive force.** Objects have mass and mass attracts other mass. That is gravity. Gravity is actually a weak force as far as fundamental forces go (electrostatic, weak nuclear and strong nuclear) but Earth is so huge that its gravitational field is significant and is very important to us! The earth is said to have a 'gravitational field'; the force of gravity extends outwardly in 3 dimensions and is able to influence objects at a distance. This force is felt without contact. Later we will see that charges (+/-) also have 'fields' of influence.

**It takes work to move an object away from Earth.** It takes positive work, actually. The force required and the displacement are in the same direction. +work (+W) transfers energy to the object, so as an object moves away from Earth, it is gaining gravitational potential energy (Ep).

**Earth is an energy well.** Earth is at the bottom of an energy well because it takes +work (adding energy) to move an object out of the well; the earth attracts objects.

-sketch the energy well – p. 285

Note: in grade 11,  $E_p = 0$  was 'ground'  
in grade 12,  $E_p = 0$  is infinity.

We have changed the reference point!

### 2 Fg Formulas

On Earth we can use the simplified formula  $F_g = mg$  where  $g = 9.8 \text{ N/kg}$

Out in space, we must use Newton's Universal Law of Gravity  $F_g = GMm/r^2$

Arbitrarily, let's say if an object is more than 200 km above the Earth's surface, you must use Newton's Universal Law of Gravitation.