Potential at Infinity

We got used to calculating potential energy on Earth…

What about in space? How much sense does it make to calculate a height from Earth when you are approaching Betelgeuse?

That place to measure from is infinity (∞).
E_P @ ∞ = 0J.

That energy will increase as the object approaches a mass.

$$E_P = -\frac{Gm_1m_2}{r}$$

NOTE: IS THE r SQUARED?

Calculate the E_P of a 5,000kg super pug at a distance of 3.0×10^7m from the Earth's center.

We can also calculate the work done / required…

Work / Energy Theorem:

$$W = \Delta E = E_{pf} - E_{p0}$$

A mass of 5,000kg is moved from 2.0×10^7m distance to 3.0×10^7m distance (from the center of Earth). Find the work done.

A 10kg pug on the surface of the Earth has 4.0×10^8J of work done on it, to what maximum height will it rise?

The Law of Conservation of Energy still applies. *remember from physics 11*

$$E_{p0} + E_{k0} = E_{pf} + E_{kf} + Q$$

We can disregard Q in space.

Typical situations where we can use this formula:

a) An object moving in space crashing into Earth (any planet)
b) An object moving in space to some closer distance to Earth
c) An object on the Earth moving into space

A comet of mass 1.0×10^7hg is 4.0×10^9m from Earth's center. It is moving at 2500 m/s and crashes into the Earth's surface. What is the impact speed?

$$E_{p0} + E_{k0} = E_{pf} + E_{kf} + Q$$

Hint: v_f=11.4km/s

A pug is blasted off of the moon at 1.3km/s from the surface. To what height will it rise before coming to a rest?
$m_{moon}=7.35 \times 10^{22}$kg
r_{moon}=2.48Mm

Hint: height=750km

Escape Velocity: is defined as the velocity at a planet's surface necessary To ESCAPE to infinity, you can stop when you reach infinity. Escape Velocity Is found using Conservation of Energy.

Orbital relationship between E_p and E_k.