M.7.4 Energy

When we do work, such as pushing a wheel barrow, we get tired or use up the quantity known as energy. Energy does not disappear, but is either

1) transferred to another object
or 2) transformed into another kind.

Thus we formulate the principle of **conservation of energy** which states that

Energy is neither created or destroyed

we say that

Work done by an object = transfer of energy from that object
and Work done on an object = transfer of energy to that object

or $W = \Delta E$

The units for energy are the same as the units for work, the Joule (J).

M.7.5 Kinetic Energy

We define kinetic energy as the energy a body has when it is in motion. We can derive an expression for kinetic energy.
Recall from unit 2

Kinetic Energy (E_k) = $\frac{1}{2}mv^2$

In fact work done = change in kinetic energy = Final K.E. – Initial K.E

$\Delta E_k = \frac{1}{2} mv^2 - \frac{1}{2} mu^2$

Example:
A body of mass 4 Kg with a speed of 3 ms^{-1} accelerates to a speed of 6 ms^{-1}. What is
a) the change in K.E.
b) the work done on the body

M.7.6 Gravitational Potential Energy

When an object is raised above the surface of the Earth energy is stored.

$U_g = m\,g\,h$ (Joule)

This holds for objects close to the Earth.

For large changes of distance (height) a force-distance graph must be used.

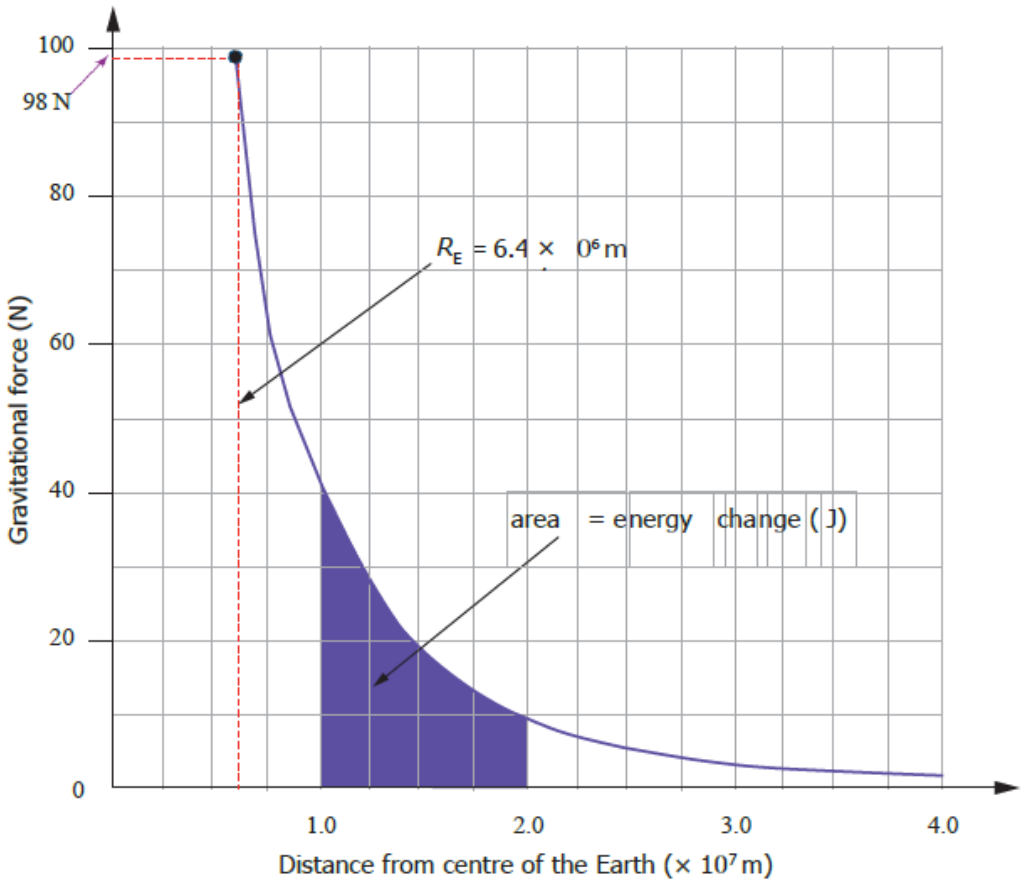

FIGURE 7.4.2 Plot of the gravitational force acting on a 10 kg body as a function of distance from the Earth. The shaded area represents the work done in moving the body a distance of 1.0×10^7 m.

Note: These graphs are from the centre of the Earth (planet). If the question refers to a satellite that is at an altitude. This measurement is from the surface of the Earth (planet). Remember to add the radius to the altitude to get the radius of the orbit.

Example

Using the graph in Figure 7.4.2, calculate the work done against the gravitational force in moving the 10 kg object from a radius of 1.0×10^7 m to 2.0×10^7 m, and hence find the gravitational potential energy gained.

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