Gravitational Potential Energy

Consider a mass M placed somewhere in space, and a second mass m that is a distance r from M. The two masses share **gravitational potential energy**, which is stored in their gravitational field. This energy is the work done in bringing the two masses to their current postitions from an infinite position. We consider M to be fixed in space and so it is just the small body of mass m that is moved.

The energy belongs to both of the masses and not one of them. No kinetic energy is involved as they are moved at a very small constant speed.

The work (gravitational potential energy) of the two masses when their centres are separated by a distance r.

$E_p = -\frac{GMm}{r}$

(G is the gravitational constant)

This energy is negative, which implies that the force of gravity is a force of attraction.

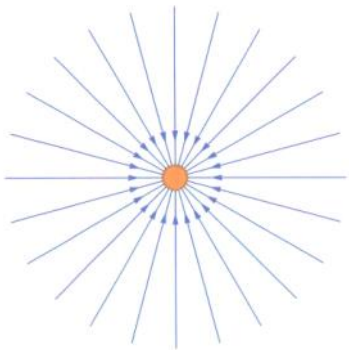

Figure 10.1 The gravitational field around a point mass is radial.

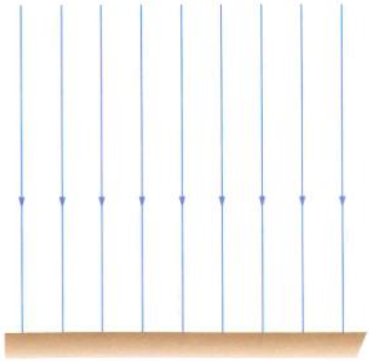

Figure 10.2 The gravitational field above a flat mass is uniform.

Preview from Notesale.co.uk
Page 3 of 13

If the total energy is positive, the object will follow a hyperbolic path and never return
If the total energy is zero, the object will follow a parabolic path to infinity, where it will never return
If the total energy is negative, the object will go into a circular or elliptical orbit (or crash into the planet if the launching speed is too low).

Preview from Notesale.co.uk
Page 11 of 13