Energy and forces

Key words

asymptote
gradient
gravitational potential
tangent

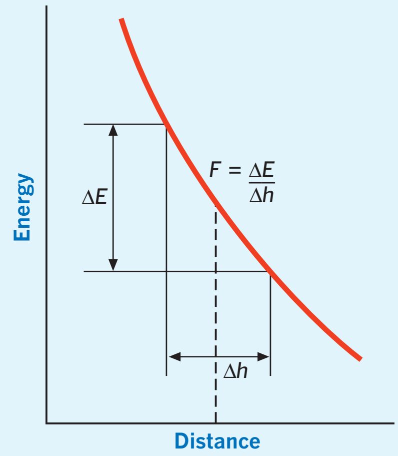
1 Gravitational forces

- The *gravitational potential energy*, E, of an object of weight F newtons which is h meters above the ground is given by E = F x h. Rearranging this equation gives $F = \frac{E}{h}$
- The *gradient* of the graph at any point is the gradient of the *tangent* at that point. As the curve is uniform, a good approximation is obtained by taking values equidistant from the point and calculating the ratio of the change in energy, ΔE, to the change in distance, Δh.
- As an object moves further away from Earth, the attraction it experiences as a result of Earth's gravitational field decreases. The curve is *asymptotic* and thus the force never actually becomes zero, but it becomes so small as to be insignificant.

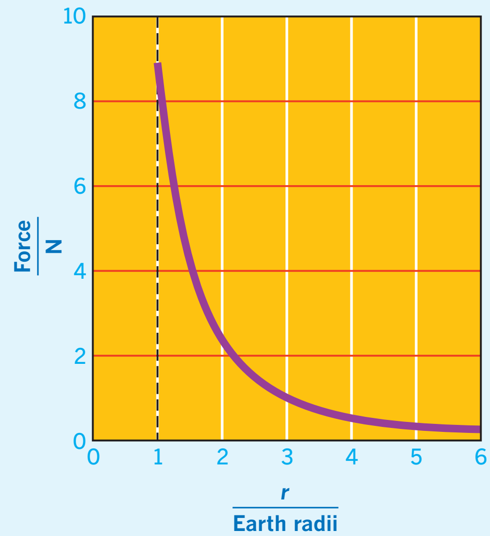
2 Repulsive and attractive forces between atoms

- As atoms move together, their outer electron shells exert a repulsive force on each other.
- At smaller separation distances. however, a force of attraction between atoms increases.
- The attractive and repulsive forces can be combined to give the net force for any separation distance.
- While the attractive force becomes zero for large separations, it decreases less rapidly than does the repulsive force, and there is a separation distance at which the attractive force operates after the repulsive force has become zero.
- At the equilibrium separation distance the repulsive force equals the attractive force and the atoms are stable.

1 Gravitational forces



The force of attraction on an object is calculated from the gradient of the energy-distance curve



The force-distance curve

2 Repulsive and attractive forces between atoms