Extension Worksheet – Topic 2, Worksheet 5

1 Define **gravitational potential**. [2]

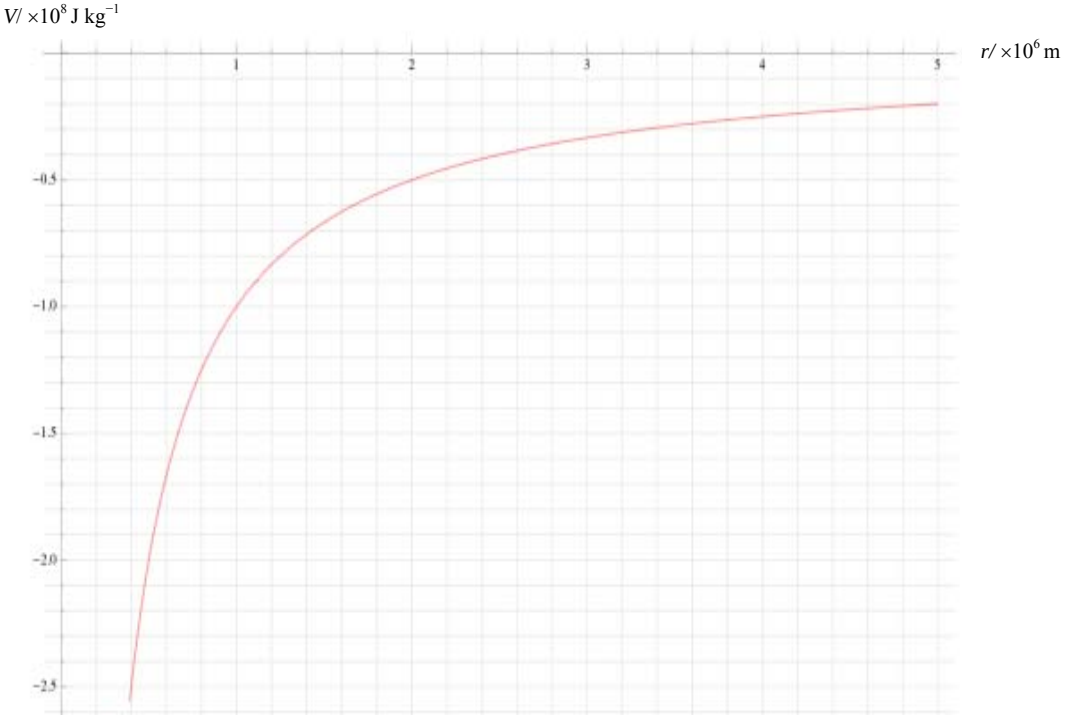
2 The gravitational potential energy of a small mass m placed a distance r from a large spherical mass M is $E_P = -\frac{GMm}{r}$. Explain why the sign of the energy is negative. [2]

3 Two points in a gravitational field are separated by a small distance Δr. The gravitational potential difference between the points is ΔV. Show that the magnitude of the average gravitational field strength in between the two points is $\frac{\Delta V}{\Delta r}$. [2]

4 The diagram shows two spherical bodies each of mass *M*.

On the diagram draw lines to show equipotential lines for this system of masses. [2]

5 The graph shows the variation with the distance r from the centre of a planet of radius 4.0×10^5 m of the gravitational potential created by the planet.

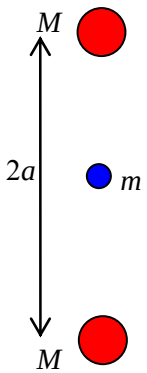


a Calculate the gravitational field strength at a distance of 2.0×10^6 m from the centre of the planet. [2]

b Calculate the work done to move a mass of 350 kg from the surface of the planet to a distance of 2.0×10^6 m from the centre. [2]

c Calculate the additional work to that in **b** that must be performed on the mass so that it is put in a circular orbit about the planet with an orbit radius of 2.0×10^6 m. [2]

6 The centres of two identical spherical bodies of mass M are separated by a distance $2a$. A particle of mass m is placed at the midpoint of the line joining the centres of the bodies as shown.



Calculate the energy that must be supplied to m such that it moves very far away from the two bodies. [2]