1 **(a)** Define the *gravitational potential* at a point.

....

....

.... [1]

The gravitational potential at the surface of Earth is -62.6×10^6 J kg^{-1}, and that at the surface of moon is -28.1×10^6 J kg^{-1}.

(i) On Fig. 1.1, sketch a graph which shows the variation of the gravitational potential along a line from the surface of Earth to the surface of Moon. [2]

(ii) Hence sketch, on Fig. 1.2, a graph which shows the variation of the gravitational field strength along a line from the surface of Earth to the surface of Moon. [2]

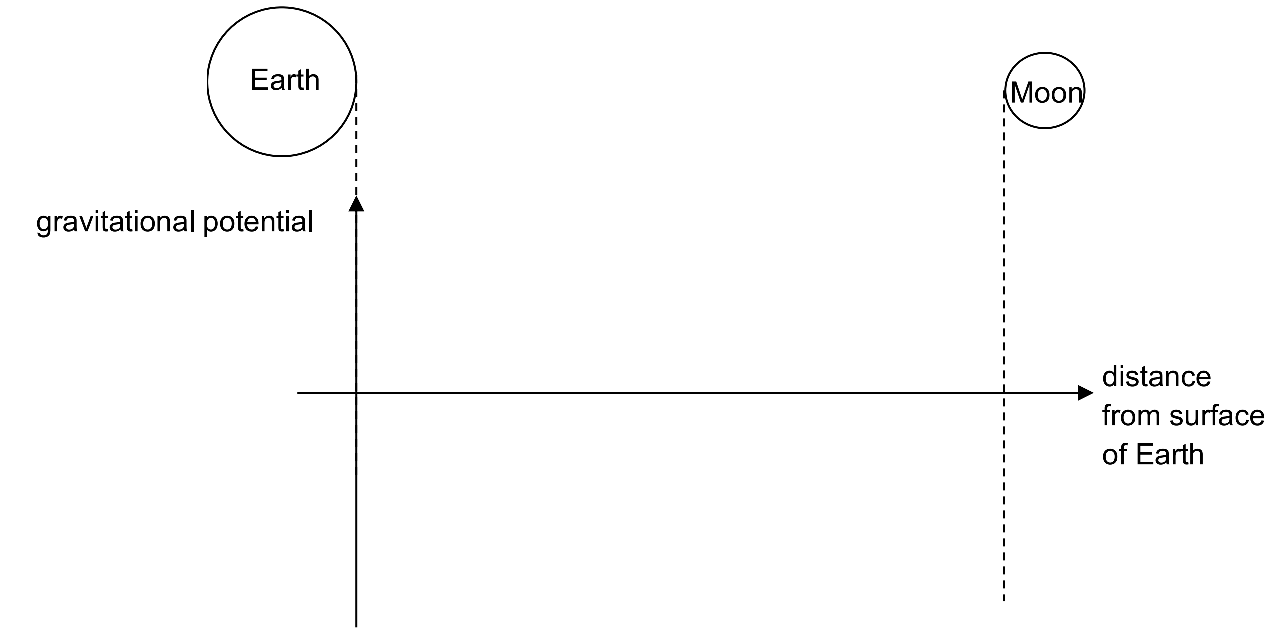

Fig. 1.1

Fig. 1.2

(b) An isolated spherical planet has a diameter of 6.8×10^6 m. Its mass of 6.4×10^{23} kg may be assumed to be a point mass at the centre of the planet

(i) Show that the gravitational field strength at the surface of the planet is 3.7 N kg^{-1}.

[1]

(ii) A stone of mass 2.4 kg is raised from the surface of the planet through a vertical height of 1800 m. Use the value of the field strength from **(i)** to calculate the change in gravitational potential energy of the stone.

change in gravitational potential energy = ... J [2]

(iii) A rock, initially at rest at infinity, moves towards the planet. At point P, its height above the surface of the planet is 3.5 *D*, where *D* is the diameter of the planet, as shown in Fig. 1.3.

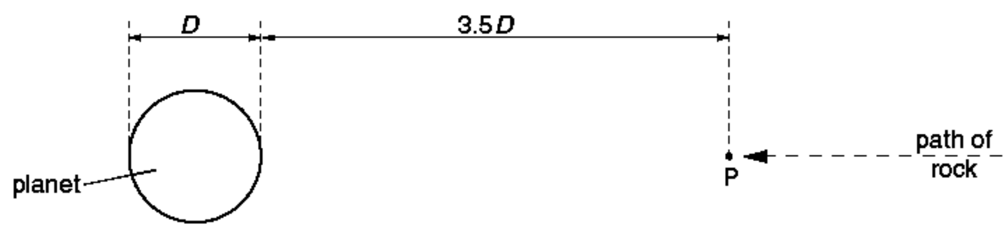

Fig. 1.3

Calculate the speed of the rock at point P.

speed at point P = ... $m\ s^{-1}$ [2]