Section A

Answer **all** the questions in the spaces provided.

1 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.

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

[2]

(b) 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 field strength given in **(a)** to determine the change in gravitational potential energy of the stone.
Explain your working.

change in energy = ... J [3]

(c) 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. 1.1.

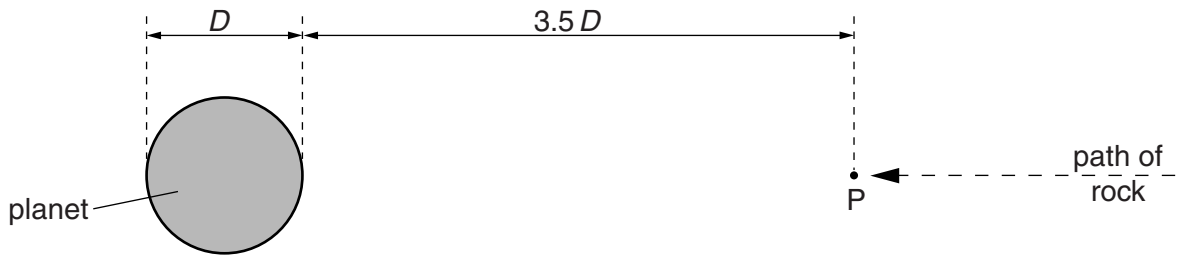

Fig. 1.1

Calculate the speed of the rock at point P, assuming that the change in gravitational potential energy is all transferred to kinetic energy.

speed = ... $m\,s^{-1}$ [4]