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

.....

.....

..... [2]

(b) The Earth may be considered to be an isolated sphere of radius R with its mass concentrated at its centre.
The variation of the gravitational potential ϕ with distance x from the centre of the Earth is shown in Fig. 1.1.

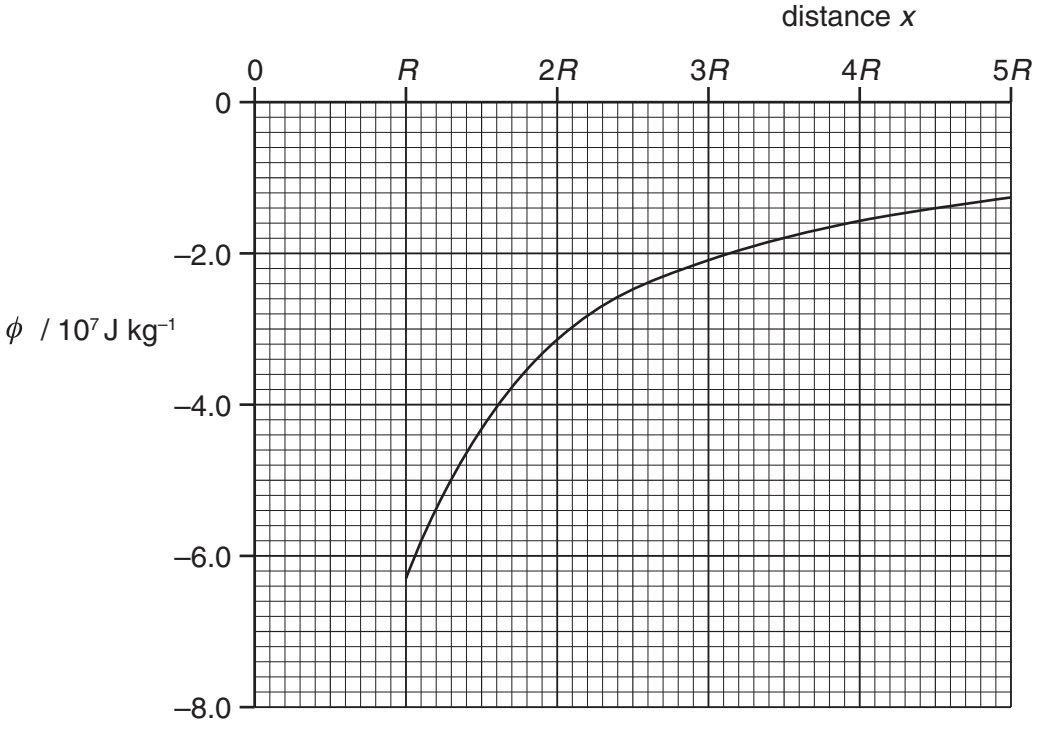

Fig. 1.1

The radius R of the Earth is 6.4×10^6 m.

(i) By considering the gravitational potential at the Earth's surface, determine a value for the mass of the Earth.

mass = ... kg [3]

(ii) A meteorite is at rest at infinity. The meteorite travels from infinity towards the Earth.

Calculate the speed of the meteorite when it is at a distance of $2R$ above the Earth's surface. Explain your working.

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

(iii) In practice, the Earth is not an isolated sphere because it is orbited by the Moon, as illustrated in Fig. 1.2.

Fig. 1.2 (not to scale)

The initial path of the meteorite is also shown.

Suggest two changes to the motion of the meteorite caused by the Moon.

1. .....

.....

2. .....

.....

[2]