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

……

…… [1]

(b) The Earth may be considered to be an isolated sphere of radius R with its mass M concentrated at its centre.

The variation of gravitational potential φ with distance x from the centre of the Earth is shown in Fig. 1.1.

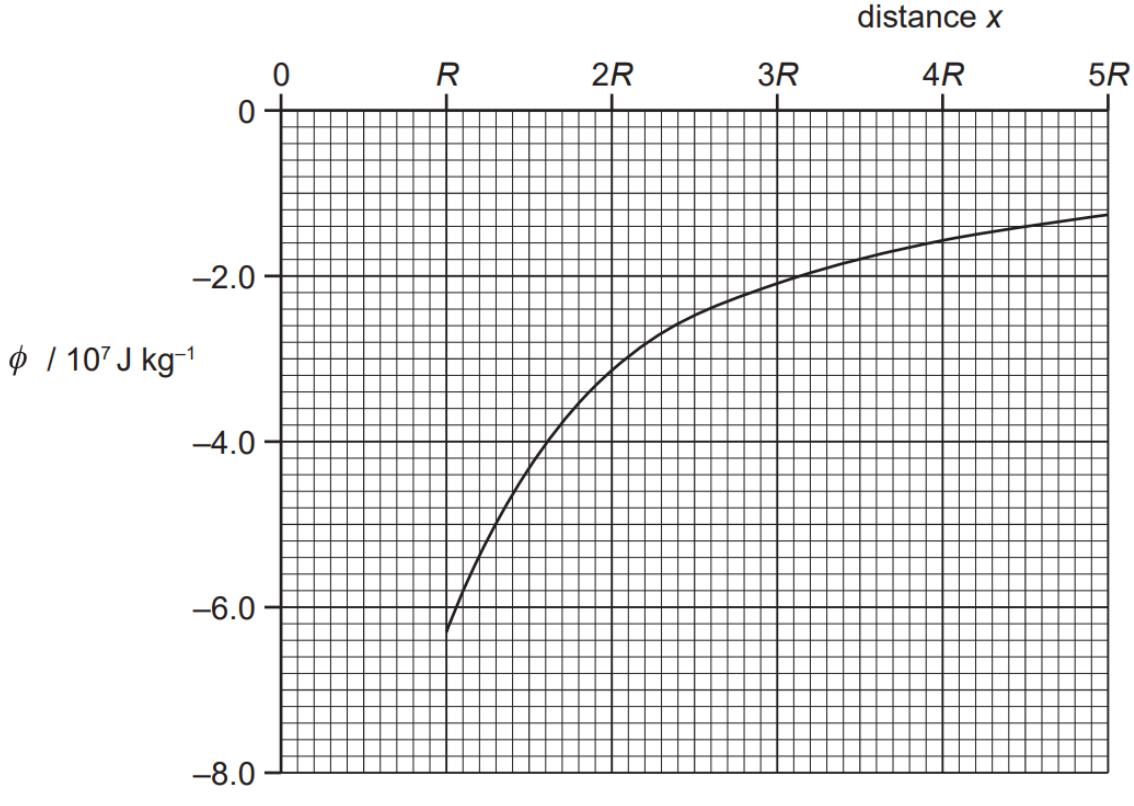

Fig. 1.1

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

(i) Show that the mass M of the Earth is 6.0×10^{24} kg.

[2]

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

When the meteorite at a distance $2R$ above the Earth's surface, calculate

1. the speed of the meteorite,

speed = …… m s^{-1} [3]

2. the acceleration of the meteorite.

acceleration = …… m s^{-2} [2]

(iii) In practice, the Earth is not an isolated sphere because it is orbited by the Moon.

Suggest how the speed calculated in **(ii)1.** will change.

……

……

…… [2]

[Total: 10]