

2 (a) Define gravitational potential at a point.

[1]

(b) A planet may be assumed to be a uniform sphere. It has gravitational potential ϕ at distance r from the centre of the planet.

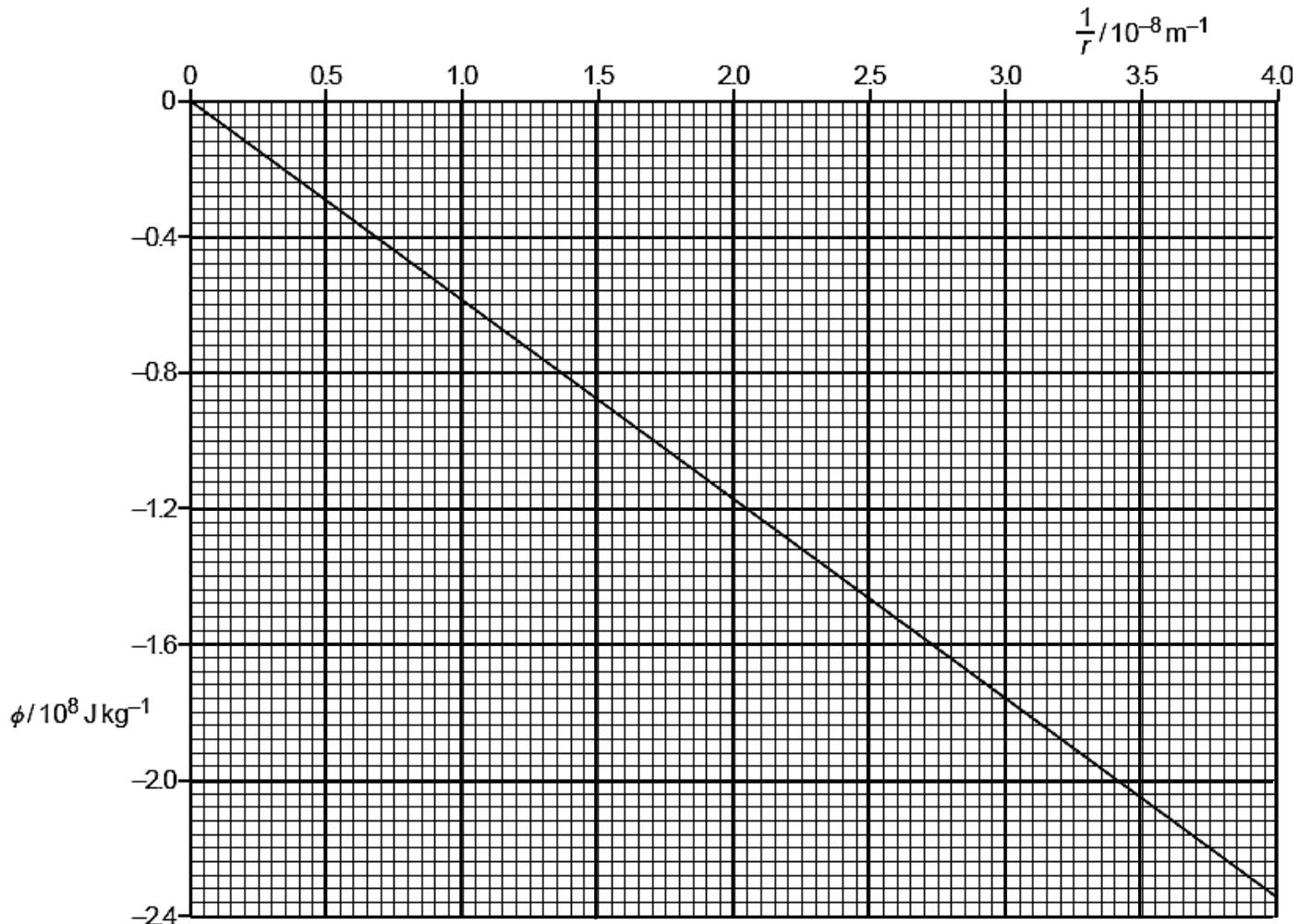


Fig. 2.1

- (i) Explain why the gravitational potential at any distance from the planet is always negative.

[2]

(ii) Using information from Fig. 2.1, calculate the mass of the planet.

$$\text{mass} = \dots \text{kg} \quad [2]$$

(iii) The period of rotation of the planet is 0.72 Earth days.

A satellite in orbit around the planet remains above the same point on the surface of the planet.

Determine the radius R of the orbit of the satellite.

$$R = \dots \text{m} \quad [3]$$

(iv) The speed of the satellite in (b)(iii) is 8400 m s^{-1} . The mass of the satellite is 1200 kg.

Determine the additional energy required to move the satellite from its orbit to infinity.

energy required = J [3]