5 **(a)** Explain what is meant by *gravitational field strength* at a point.

……

...……[1]

(b) A satellite of mass m orbits a planet of mass M in a circular orbit, with orbital radius r.

Show that its kinetic energy E_K and gravitational potential energy E_P are related by

$$E_K = -\frac{E_P}{2}.$$

[2]

(c) The variation of gravitational potential ϕ with distance r from the centre of Jupiter is shown in Fig. 5.1.

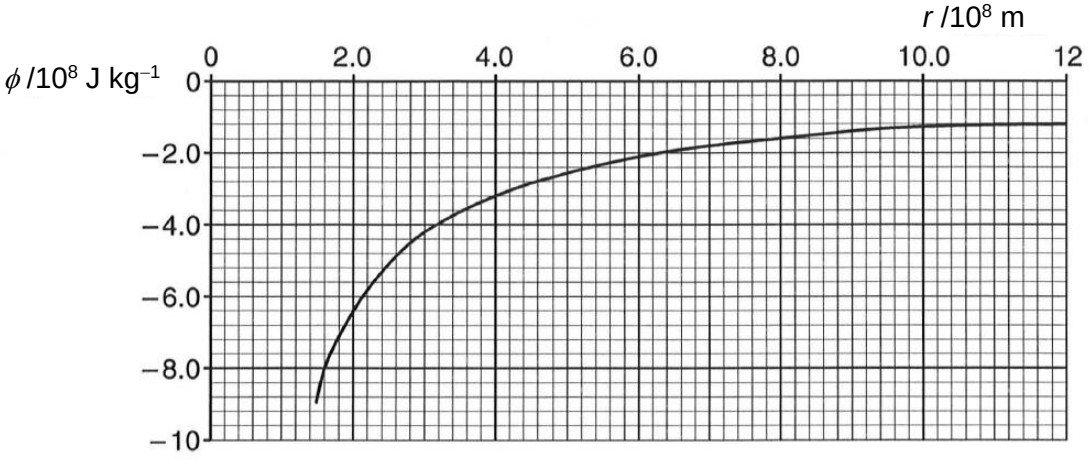

Fig. 5.1

(i) A satellite orbiting Jupiter has a mass of 8.93×10^{22} kg and orbital radius 4.0×10^8 m.

Determine the total energy of the satellite.

total energy = …… J [3]

(ii) The orbital radius of the satellite is reduced. State and explain the effect on

1. the kinetic energy of the satellite,

……

……...[1]

2. the total energy of the satellite.

……

……...[1]

(iii) Use Fig. 5.1 to determine the gravitational field strength due to Jupiter at a distance of 4.0×10^8 m from its centre.

gravitational field strength = ……. m s^{-2} [2]

[Total: 10]