

- 2 (a) On 16 July 1994, a fragment of the comet Shoemaker-Levy 9 entered the gravitational field of the planet Jupiter. The fragment had an estimated mass of 5.5×10^{13} kg.

Fig. 2.1 shows the gravitational field strength around Jupiter as calculated by a keen physics student.

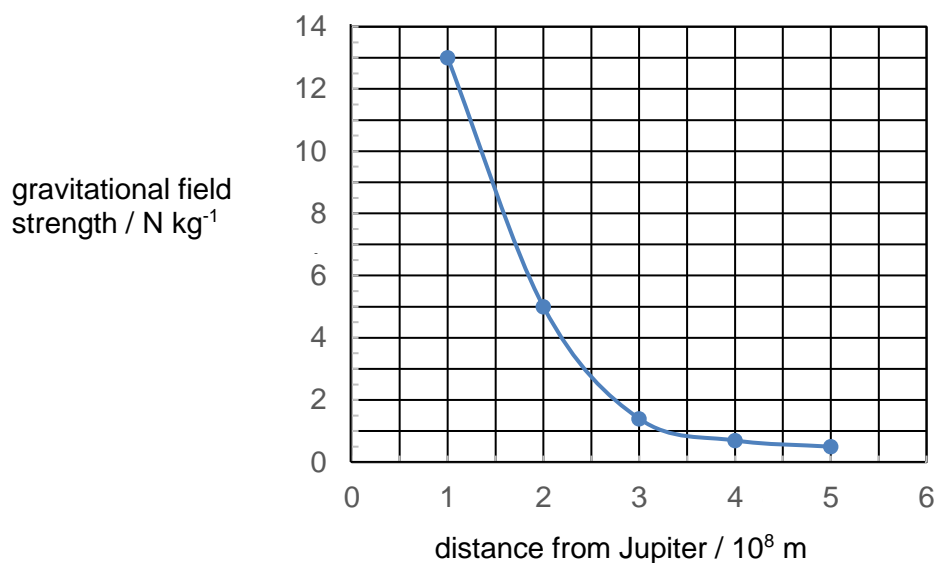


Fig. 2.1

- (i) Calculate the gravitational force acting on the fragment of the comet when it is 4.0×10^8 m from Jupiter.

gravitational force = N [1]

- (ii) Estimate the amount of kinetic energy gained by the comet fragment as it moves from 4.0×10^8 m to 2.0×10^8 m from the Jupiter. Show your working clearly.

kinetic energy gained = J [2]

- (b) (i) A new geostationary satellite called SKY 7 is to be placed in orbit above the Earth's equator. Show that the orbital radius for SKY 7 is 4.23×10^4 km.
Mass of Earth is 6.0×10^{24} kg.

[1]

- (ii) Given that the mass of the satellite is 1000 kg, and Earth's radius is 6.39×10^6 m determine the minimum energy required to put the satellite in geostationary orbit from the surface of the earth when it is launched from the equator.

minimum energy = J [3]

- (iii) As the satellite orbits Earth, it gradually losses energy due to small resistive forces. State and explain the effect of this change on the radius of the orbit and the speed of satellite.

[3]

[Total: 10]