2 This question is about the gravitational field around Mars.

Fig. 2.1 shows some equipotential lines around Mars. The mass of Mars is 6.4×10^{23} kg and the radius of Mars is 3.4×10^{6} m.

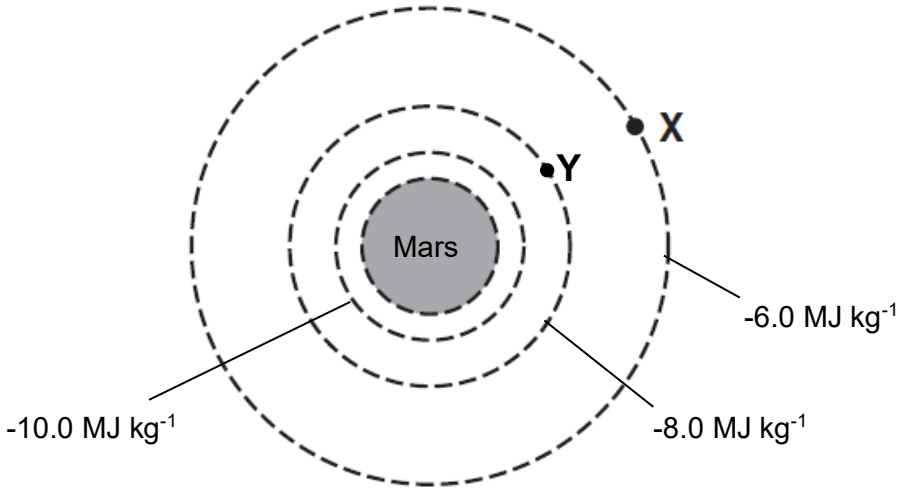

Fig. 2.1

(a) Define *gravitational field strength* at a point.

.....

..... [1]

(b) State how Fig. 2.1 shows that the gravitational field strength decreases as the distance from the surface of the Mars increases.

.....

..... [1]

(c) A spacecraft at point X drops a satellite, of mass 90 kg, from rest onto the surface of Mars.

Calculate the velocity of the satellite when it reaches point Y.

velocity = ... m s^{-1} [2]

(d) The satellite reaches the geostationary orbit of Mars. Fig. 2.2 shows this satellite orbiting at a height of 1.7 x 10^7 m above the surface of Mars.

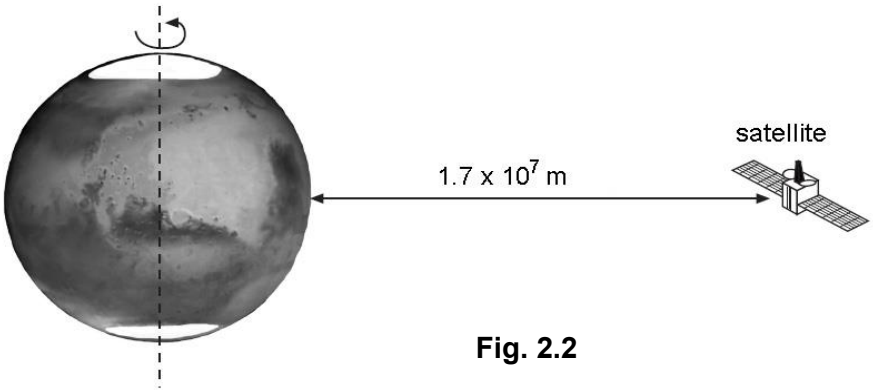

Fig. 2.2

(i) Calculate the period of the satellite in the geostationary orbit.

period = ... h [3]

(ii) Calculate the kinetic energy of the satellite in this orbit.

kinetic energy = ... J [2]

(iii) Assuming that the satellite experiences friction as it orbits around Mars, explain in terms of conservation of energy, what happens to the kinetic energy of the satellite.

.....

.....

.....[2]

[Total: 11]