17 The dwarf planet Ceres is the largest object in the asteroid belt.

Ceres has a mass of 9.38×10^{20} kg. Ceres has a circular orbit of radius 4.14×10^{11} m around the Sun.

(a) (i) Show that the gravitational force exerted on Ceres by the Sun is about 7×10^{17} N.

mass of Sun = 1.99×10^{30} kg

(2)

(ii) Determine the time T, in years, for Ceres to make one complete orbit about the Sun.

1 year = 3.15×10^{7} s

(4)

T = ... years

(b) Mercury is the smallest planet in our solar system. The gravitational field strength g_m at the surface of Mercury is $3.7\,N\,kg^{-1}$.

It is claimed that the gravitational field strength at the surface of Ceres is less than 5% of g_m.

Evaluate whether this claim is accurate.

radius of Ceres = 470 km

(3)

(Total for Question 17 = 9 marks)