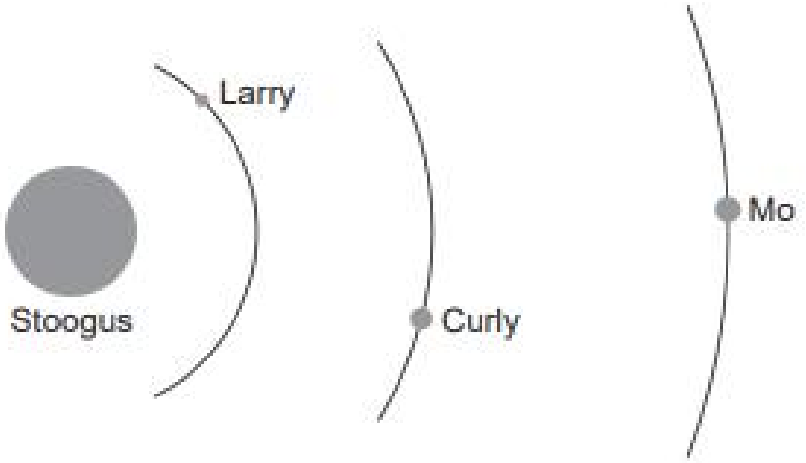
Question 15 **(14 marks)**



A recently discovered planet (Stoogus) in a distant solar system has three moons (Larry, Curly and Mo) orbiting at different distances. Stoogus has a mass of 2.37×10^{24} kg and a day on Stoogus lasts 7.50 Earth hours. Assume all three moons have circular orbits as their masses are insignificant compared to that of Stoogus.

(a) Curly is a geosynchronous satellite that orbits above one specific spot on Stoogus' surface. Calculate the radius of Curly's orbit. (5 marks)

Answer: _____ m

(b) The gravitational field strength that Mo experiences due to Stoogus is 4.50×10^{-3} m s^{-2}. Calculate the distance between the centre of mass of Mo and the centre of mass of Stoogus. (4 marks)

Answer: _____ m

(c) (i) Derive the mathematical relationship between a moon's orbital speed v and its distance r from the planet's centre of mass. (3 marks)

Answer: _____

(ii) Use this relationship from part (c)(i) to identify which moon of Stoogus has the greatest orbiting speed. Justify your answer. (2 marks)

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