1 The point O is on the fixed horizontal line l. Points A and B on l are such that $OA = 0.1$ m and $OB = 0.5$ m, with A between O and B. A particle P oscillates on l in simple harmonic motion with centre O. The kinetic energy of P when it is at A is twice its kinetic energy when it is at B. Find the amplitude of the motion. [3]

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2 Two uniform small smooth spheres A and B have equal radii and masses $2m$ and m respectively. Sphere A is moving with speed u on a smooth horizontal surface when it collides directly with sphere B which is at rest. The coefficient of restitution between the spheres is $\frac{2}{3}$.

(i) Find, in terms of u, the speeds of A and B after this collision. [4]

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Sphere B is initially at a distance d from a fixed smooth vertical wall which is perpendicular to the direction of motion of A. The coefficient of restitution between B and the wall is $\frac{1}{2}$.

(ii) Find, in terms of d and u, the time that elapses between the first and second collisions between A and B. [5]