

STEP III, 2007, Q9

- 9 Two small beads, A and B , each of mass m , are threaded on a smooth horizontal circular hoop of radius a and centre O . The angle θ is the acute angle determined by $2\theta = \angle AOB$.

The beads are connected by a light straight spring. The energy stored in the spring is

$$mk^2a^2(\theta - \alpha)^2,$$

where k and α are constants satisfying $k > 0$ and $\frac{\pi}{4} < \alpha < \frac{\pi}{2}$.

The spring is held in compression with $\theta = \beta$ and then released. Find the period of oscillations in the two cases that arise according to the value of β and state the value of β for which oscillations do not occur.



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