

Index no. _____

SPhO 2022 Theory Paper 2

1. (a) A compound pendulum consists of a uniform thin rod AB of length 50 cm and mass 1.5 kg and a thin disc with diameter 15 cm and mass 3.0 kg attached to the end B of the rod. The system can oscillate about a horizontal axis through the end A of the rod perpendicular to the plane of the disc. Initially, the system hangs in equilibrium with the rod vertical. A small object of mass 0.1 kg travelling horizontally with a speed of 30 ms^{-1} strikes the system at B and sticks to it. What is the greatest angle which the rod makes with the downward vertical in the subsequent motion?

[8 marks]

[17.5°]

[Moment of inertia of a disc, with mass M and radius R , about an axis through its centre is $\frac{1}{2}MR^2$;

Moment of inertia of a thin rod, with mass M and length ℓ , about an axis through its end is $\frac{1}{3}M\ell^2$]