

1. A uniform rod  $AB$ , of mass  $m$  and length  $2a$ , is free to rotate about a fixed smooth axis which passes through  $A$  and is perpendicular to the rod. The rod has angular speed  $\omega$  when it strikes a particle  $P$  of mass  $m$  and adheres to it. Immediately before the rod strikes  $P$ ,  $P$  is at rest and at a distance  $x$  from  $A$ . Immediately after the rod strikes  $P$ , the angular speed of the rod is  $\frac{3}{4}\omega$ .

Find  $x$  in terms of  $a$ .

**(Total 5 marks)**

1. 
$$\frac{4}{3}ma^2\omega = \left(\frac{4}{3}ma^2 + mx^2\right)\frac{3}{4}\omega$$
$$\Rightarrow x = \frac{2}{3}a$$

M1A1A1

DM1A1 5

**[5]**

1. Most candidates realised that angular momentum was conserved. A few, however, tried to conserve energy despite there having been a collision, and they received no credit.