

A hollow hemispherical bowl of radius  $a$  has a smooth inner surface and is fixed with its axis vertical. A particle  $P$  of mass  $m$  moves in horizontal circles on the inner surface of the bowl, at a height  $x$  above the lowest point of the bowl. The speed of  $P$  is  $\sqrt{\frac{8}{3}ga}$ .

Find  $x$  in terms of  $a$ .

[6]