5 (b)

(iii) Take loss of kinetic energy in the $\vec{i}$ direction

$$\text{KE before} = \frac{1}{2}(4)u^2\cos^2\alpha = 2u^2\cos^2\alpha$$

$$\text{KE after} = \frac{1}{2}(4)\{0\}^2 + \frac{1}{2}(8)\left\{\frac{1}{2}u\cos\alpha\right\}^2$$

$$= u^2\cos^2\alpha$$

$$\text{Loss in KE} = 2u^2\cos^2\alpha - u^2\cos^2\alpha$$

$$= u^2\cos^2\alpha$$

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6 (b)

Let v be the speed of c : when it reaches d

Total energy at c = Total energy at d

$$\frac{1}{2}m(10gr) + mg(2r) = \frac{1}{2}mv^2 + mg(0)$$

$$v^2 = 14gr$$

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Let v_1 be the speed of : the combined mass at d

$$mv + m(0) = 2mv_1$$

$$v_1 = \frac{1}{2}v$$

5

At maximum height :

Gain in PE = Loss in KE

$$(2m)g(h) = \frac{1}{2}(2m)(v_1)^2$$

$$2gh = \frac{14gr}{4}$$

$$h = \frac{7r}{4}$$

5

5

As $h < 2r \Rightarrow$ the combined mass will not reach c.

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