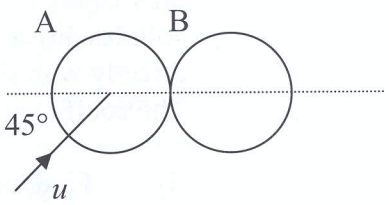
5 **(*b*)** A smooth sphere A moving with speed u, collides with an identical smooth sphere B which is at rest.



The direction of motion of A, before impact, makes an angle of 45° with the line of centres at the instant of impact.

The coefficient of restitution between the spheres is e.

Show that the direction of motion of A is deflected through an angle α where

$$\tan\alpha = \frac{1+e}{3-e}.$$

PCM	$m(u\cos 45) + m(0) = mv_1 + mv_2$	5
NEL	$v_1 - v_2 = -e(u\cos 45 - 0)$	5
	$\Rightarrow \quad v_1 = \frac{u}{2\sqrt{2}}(1-e)$	5
	$\tan(\alpha+45) = \frac{u\sin 45}{v_1}$	
	$= \frac{\frac{u}{\sqrt{2}}}{\frac{u}{2\sqrt{2}}(1-e)}$	
	$\frac{\tan\alpha+1}{1-\tan\alpha} = \frac{2}{1-e}$	5
	$\tan\alpha + 1 - e\tan\alpha - e = 2 - 2\tan\alpha$	
	$(3-e)\tan\alpha = 1+e$	
	$\tan\alpha = \frac{1+e}{3-e}$	5

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