

HL 195

5(a) (i) PCM

momentum before = momentum after

$$2m(4u) + 3m(-u) = 2m(v_1) + 3m(v_2)$$

$$\Rightarrow 2v_1 + 3v_2 = 5u \quad \dots\dots\dots \text{eq1}$$

NEL

$$v_1 - v_2 = -e(4u + u)$$

$$\Rightarrow v_1 - v_2 = -5eu \quad \dots\dots\dots \text{eq2}$$

Solve equations 1 and 2

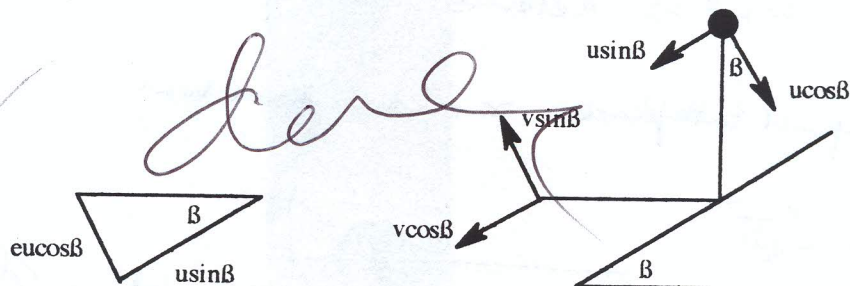
$$v_1 = u(1 - 3e)$$

$$v_2 = u(1 + 2e)$$

(ii) If $e > 1/3$ then $v_1 < 0$ and $v_2 > 0$

i.e. the particles move in opposite directions after the collision.

(b) (i)



along the plane

$$v \cos \beta = u \sin \beta$$

$$\Rightarrow v = u \tan \beta$$

perpendicular to the plane

$$v \sin \beta = e u \cos \beta$$

 \Rightarrow

$$u \tan \beta \sin \beta = e u \cos \beta$$

 \Rightarrow

$$\tan \beta = \sqrt{e}$$

(ii) Kinetic Energy before = $0.5mu^2$

$$\text{Loss in kinetic energy} = 0.5m(u^2 - v^2)$$

$$= 0.5m(u^2 - u^2 \tan^2 \beta)$$

$$= 0.5mu^2(1 - e)$$

$$\text{Fraction of KE lost} = \frac{0.5mu^2(1 - e)}{0.5mu^2}$$

$$= 1 - e$$