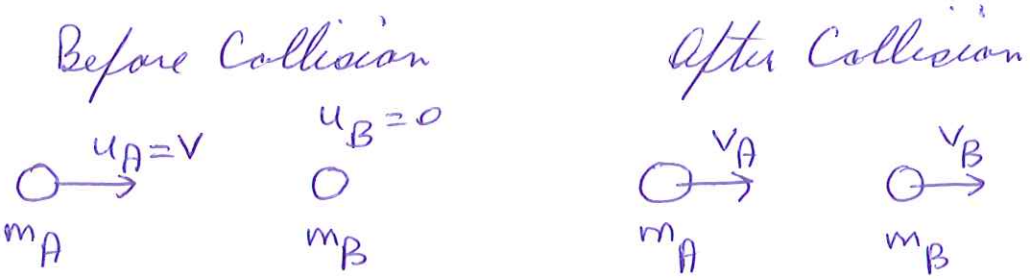
Quiz 6

Name: _____ Student Number: _____

1. A player shoots stone A with a velocity v head on against stone B initially at rest.

a) (2 marks) Draw a diagram illustrating the motion of the two stones before and after the collision. Label all velocities and masses.



b) (2 marks) Write down an expression using Conservation of Momentum relating the initial and final velocities.

Initial Mom = Final Mom.

$$m_A u_A = m_A v_A + m_B v_B \quad (1)$$

c) (2 marks) Assuming the collision is elastic, write down an additional equation relating the variables.

Elastic $\Rightarrow$ K.E. is conserved

$$\frac{m_A}{2} u_A^2 = \frac{m_A}{2} v_A^2 + \frac{m_B}{2} v_B^2 \quad (2)$$

d) (4 marks) Find the final velocities of the two stones if stone B is half the mass of stone A. in terms of v.

$$m_B = \frac{m_A}{2}$$

$$(1) \Rightarrow \quad m_A u_A = m_A v_A + \frac{m_A}{2} v_B .$$

$$u_A = v_A + \frac{v_B}{2}$$

$$v_A = u_A - \frac{v_B}{2} \qquad (3)$$

$$(2) \Rightarrow \quad \frac{m_A}{2} u_A^2 = \frac{m_A}{2} v_A^2 + \frac{m_B}{4} v_B^2$$

$$u_A^2 = v_A^2 + \frac{v_B^2}{2}$$

Subst. in for v_A from (3).

$$u_A^2 = \left(u_A - \frac{v_B}{2}\right)^2 + \frac{v_B^2}{2}$$

$$= u_A^2 - u_A v_B + \frac{v_B^2}{4} + \frac{v_B^2}{2}$$

$$0 = -u_A v_B + \frac{3}{4} v_B^2$$

$$= v_B\left(-u_A + \frac{3}{4} v_B\right)$$

$$\therefore v_B = 0, \quad \frac{4u_A}{3}$$

↑ silly

Total = 10 marks

For $v_B = \frac{4u_A}{3}$, $(3) \Rightarrow v_A = u_A - \frac{2u_A}{3} = +\frac{u_A}{3}$