KINETIC ENERGY :

You must be very careful if asked about the kinetic energy lost or gained in a ~~problem~~ collision as to what exactly you are being asked!

→ (i) The kinetic energy of a body mass 5kg moving with velocity $3\vec{i} - 14\vec{j}$ is

$$= \tfrac{1}{2} m v^2 = \tfrac{1}{2} 5\left(\sqrt{3^2 + (-14)^2}\right)^2$$
$$= \tfrac{5}{2}(3^2 + 14^2)$$
$$= \tfrac{5}{2}(203) = 507.5 \text{ Joules.}$$

→ The kinetic energy lost by the left body in the "Impulse Eg"

if we take $m_1 = 10$. ie

$$\tfrac{1}{2} m_1 v_1^2 - \tfrac{1}{2} m_1 u_1^2 = \tfrac{1}{2} 10(3^2 + 7^2) - \tfrac{1}{2} 10((-6)^2 + 7^2)$$
$$= 5(9 + 49) - 5(36 + 49)$$
$$= 45 + 5 \cdot 49 - 180 - 5(49)$$
$$= -135 \text{ Joules.}$$

{What do you notice about the KE change in the '$\vec{j}$ parts'?}

→ The total kinetic energy lost by the system in the "Impulse Eg" (Take $m_2 = 12$)

is Total KE After − Total KE before

$$= \left[\tfrac{1}{2} 10(3^2 + 7^2) + \tfrac{1}{2} 12((-2)^2 + 3^2)\right] - \left[\tfrac{1}{2} 10((-6)^2 + 7^2) + \tfrac{1}{2} 12(1^2 + 3^2)\right]$$
$$= [5(9 + 49) + 6(4 + 9)] - [5(36 + 49) + 6(1 + 9)]$$
$$= 5(9) + 5(49) + 6(4) + 6(9) - 5(36) - 5(49) - 6(1) - 6(9)$$
$$= 5(9) - 5(36) + 6(4) - 6(1)$$
$$= 45 - 180 + 24 - 6.$$
$$= -135 + 18$$
$$= -117 \text{ Joules.}$$

[Again what do you notice about the $\vec{j}$ part contribution to the energies change]

→ The fractional change of kinetic energy of [one / BOTH] of the spheres

$$\text{FRACTIONAL CHANGE} = \frac{\Delta KE}{\text{old KE}} = \frac{\text{Change in KE}}{\text{original KE}}$$

NB : As we have seen so far we can 'forget' the $\vec{j}$ cpts contribution to the KE when calculating the top line ΔKE as they cancel each other out in the subtraction [redacted] BUT on the bottom line there is no subtraction to cancel anything out