

Situation 1

FILL OUT THIS TABLE

<u>frame</u>	<u>total momentum</u>
lab frame before	$3(10) + 2(5) = 40 \text{ kg m/s}$
cm frame before	$3(2) + 2(-3) = 0$
cm frame after	$3(-2) + 2(+3) = 0$
lab frame after	$3(6) + 2(11) = 40$
"momentum of CM"	$m_{\text{Tot}} v_{\text{cm}} = 5(8) = 40$

Q: WHAT IS THE VELOCITY OF THE 3 kg BLOCK AFTER THE COLLISION(lab)?

$$+6 \text{ m/s}$$

Q: WHAT IS THE VELOCITY OF THE 2 kg BLOCK AFTER THE COLLISION(lab)?

$$+11 \text{ m/s}$$

Q: WHAT IS THE TOTAL MOMENTUM IN THE CM FRAME BEFORE THE COLLISION?

$$0$$

Q: WHAT IS THE TOTAL MOMENTUM IN THE CM FRAME AFTER THE COLLISION?

$$0$$

Q: WHAT IS THE TOTAL KINETIC ENERGY BEFORE THE COLLISION (lab frame)?

$$\frac{1}{2} 3(10)^2 + \frac{1}{2} 2(5)^2 = 150 + 25 = 175 \text{ Joules}$$

Q: WHAT IS THE TOTAL KINETIC ENERGY AFTER THE COLLISION (lab frame)?

$$\frac{1}{2} 3(6)^2 + \frac{1}{2} 2(11)^2 = 54 + 121 = 175 \text{ Joules}$$

Q: IS MECHANICAL ENERGY CONSERVED?

Yes

Situation 2

FILL OUT THIS TABLE

<u>frame</u>	<u>total momentum</u>
lab frame before	$3(10) + 2(-5) = 20 \text{ kg m/s}$
cm frame before	$3(6) + 2(-9) = 0$
cm frame after	$3(-6) + 2(9) = 0$
lab frame after	$3(-2) + 2(13) = 20$
"momentum of CM"	20 kg m/s

Q: WHAT IS THE VELOCITY OF THE 3 kg BLOCK AFTER THE COLLISION(lab)?

$$-2 \text{ m/s}$$

Q: WHAT IS THE VELOCITY OF THE 2 kg BLOCK AFTER THE COLLISION(lab)?

$$+13 \text{ m/s}$$

Q: WHAT IS THE TOTAL MOMENTUM IN THE CM FRAME BEFORE THE COLLISION?

$$0$$

Q: WHAT IS THE TOTAL MOMENTUM IN THE CM FRAME AFTER THE COLLISION?

$$0$$

Q: WHAT IS THE TOTAL KINETIC ENERGY BEFORE THE COLLISION (lab frame)?

$$\frac{1}{2} 3(10)^2 + \frac{1}{2} 2(5)^2 = 175 \text{ Joules}$$

Q: WHAT IS THE TOTAL KINETIC ENERGY AFTER THE COLLISION (lab frame)?

$$\frac{1}{2} 3(2)^2 + \frac{1}{2} 2(+13)^2 = 175 \text{ Joules}$$

Q: IS MECHANICAL ENERGY CONSERVED?

Yes

Situation 3

FILL OUT THIS TABLE

<u>frame</u>	<u>total momentum</u>
lab frame before	$3(10) + 2(5) = 40 \text{ kg m/s}$
cm frame before	0
cm frame after	$5(0) = 0$
lab frame after	$5(8) = 40$
"momentum of CM"	40 kg m/s

Q: WHAT IS THE VELOCITY OF THE COMBINED BLOCK AFTER THE COLLISION?

$$+ 8 \text{ m/s}$$

Q: WHAT IS THE CM VELOCITY OF THE SYSTEM?

$$+ 8 \text{ m/s}$$

Q: WHAT IS THE TOTAL MOMENTUM IN THE CM FRAME BEFORE THE COLLISION?

$$0$$

Q: WHAT IS THE TOTAL MOMENTUM IN THE CM FRAME AFTER THE COLLISION?

$$0$$

Q: WHAT IS THE TOTAL KINETIC ENERGY BEFORE THE COLLISION (lab frame)?

$$\frac{1}{2} 3(10)^2 + \frac{1}{2} 2(5)^2 = 175 \text{ Joules}$$

Q: WHAT IS THE TOTAL KINETIC ENERGY AFTER THE COLLISION (lab frame)?

$$\frac{1}{2} 5(8)^2 = 160 \text{ Joules}$$

Q: IS MECHANICAL ENERGY CONSERVED?

NO, it's an inelastic collision

situation 4

FILL OUT THIS TABLE

<u>frame</u>	<u>total momentum</u>
lab frame before	$3(10) + 2(-5) = 20 \text{ kg m/s}$
cm frame before	0
cm frame after	0
lab frame after	$5(4) = 20 \text{ kg m/s}$
"momentum of CM"	20 kg m/s

Q: WHAT IS THE VELOCITY OF THE COMBINED BLOCK AFTER THE COLLISION?

$$+ 4 \text{ m/s}$$

Q: WHAT IS THE CM VELOCITY OF THE SYSTEM?

$$+ 4 \text{ m/s}$$

Q: WHAT IS THE TOTAL MOMENTUM IN THE CM FRAME BEFORE THE COLLISION?

$$0$$

Q: WHAT IS THE TOTAL MOMENTUM IN THE CM FRAME AFTER THE COLLISION?

$$0$$

Q: WHAT IS THE TOTAL KINETIC ENERGY BEFORE THE COLLISION (lab frame)?

$$\frac{1}{2} 3(10)^2 + \frac{1}{2} 2(-5)^2 = 175 \text{ Joules}$$

Q: WHAT IS THE TOTAL KINETIC ENERGY AFTER THE COLLISION (lab frame)?

$$\frac{1}{2} 5(4)^2 = 40 \text{ Joules}$$

Q: IS MECHANICAL ENERGY CONSERVED?

NO, it's an inelastic collision