SiQuENC for Impulse and momentum — M SiQuENC

Neatly and graphically represent Situation(s)

1. **Read** a few words.
2. Make sure the meaning of those words is **illustrated** in your sketches/tables.
3. **Underline** the words.
4. **Repeat** with the next few words, if any.

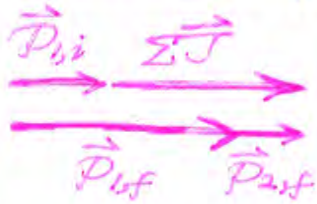
- Draw **bubble** around system.
- Draw **dot** for each "particle."

Label:

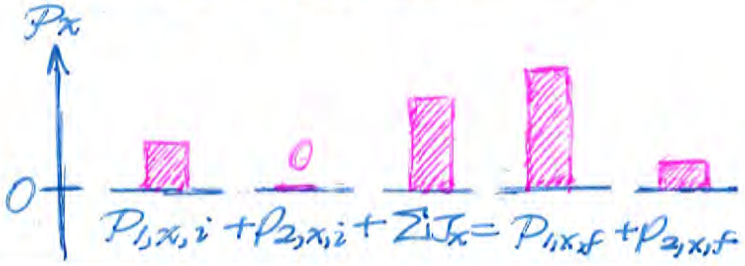
- At/Through: t_i, t_f
- Axes: $+x$, maybe $+y$.

Graphically represent Quantities

Impulse-momentum vector-addition diagram



x-impulse-x-momentum bar chart



Identify allowed Equation(s)

$\Sigma\vec{p}_i + \Sigma\vec{J} = \Sigma\vec{p}_f$

$\Sigma p_{x,i} + \Sigma J_x = \Sigma p_{x,f}$ $\Sigma p_{y,i} + \Sigma J_y = \Sigma p_{y,f}$

ANalyze

Cross out quantities that are obviously 0.

$\Sigma\vec{J} = \vec{0}$? $\Sigma J_x = 0$? $\Sigma J_y = 0$?

Substitute constitutive relationships.

$p_x = mv_x$

Signed area between F_x-t plot and t axis $= J_{F,x}$

Perform algebraic and proportional reasoning.

Communicate

"The system is the …."

Recipe

"By [relationship], the [quantity] [prepositional phrase] … equals [or is proportional to] …"

By the impulse-momentum theorem, the change in the total x-momentum of the carts equals the net…

"The … is 0, so, by [relationship], the [adjective] [quantity] [prepositional phrase] … [verb] …."

The net x-impulse is 0, so by the impulse-momentum theorem, the initial x-momentum of the block fully becomes…

"… the [total quantity] ([quantity 1] [prepositional phrase 1] [plus] …) …"

… the total initial x-momentum (initial x-momentum of the cart plus the initial x-momentum of the block…)…

Equal "The … stays the same."

Altered "The … [increases/decreases] …."

So what? "So the … must …."

Next? (Check whether you've addressed all directives).

Page **M SiQuENC**

SiQuENC for Impulse and momentum

The letters S and i stand for Situations: Neatly and graphically represent **Si**tuation(s)

1. **Read** a few words.
2. Make sure the meaning of those words is **illustrated** in your sketches/tables.
3. **Underline** the words.
4. **Repeat** with the next few words, if any.

- Draw **bubble** around system.
- Draw **dot** for each "particle."

Label:

- At/Through: t-sub-i, t-sub-f
- Axes: +x, maybe +y

The letters Q and u stand for Quantities: Graphically represent **Qu**antities

Title of first section: Impulse-momentum vector-addition diagram
Draw an arrow pointed to the right labeled p-vector-sub-1,i. From the head of this arrow, draw a longer arrow also pointed toward the right labeled Sigma-J-vector. Immediately underneath the two arrows just now drawn, draw another pair of arrows, also touching in a head-to-tail fashion, and also both pointing horizontally to the right. The arrow at the left is longer and labeled p-vector-sub-1,f. The arrow at the right is labeled p-vector-sub-2,f. The two rows of vectors are equally wide and horizontally centered together.

Title of second section: x-impulse-x-momentum bar chart
Plot p-sub-x on the vertical axis. Draw a tickmark labeled 0. At the height of this tickmark, draw five horizontal segments to the right, with one segment each above each of the terms of the labeling equation p-sub-1,x,I + p-sub-2,x,I + Sigma-J-sub-x = p-sub-1,x,f + p-sub-2,x,f. From the segment above the term p-sub-1,x,i, extend upward a short, shaded rectangular bar. Write the number 0 above the segment above the term p-sub-2,x,i. From the segment above the term Sigma-J-sub-x, extend upward a tall, shaded rectangular bar. From the segment above the term p-sub-1,x,f, extend upward an even taller shaded rectangular bar. From the segment above the term p-sub-2,x,f, extend upward a short, shaded rectangular bar. Scale the heights of the bars so that the sum of the heights of the bars for the terms p-sub-1,x,i and Sigma-J-sub-x equals the sum of the heights of the bars for the terms p-sub-1,x,f and p-sub-2,x,f.

E stands for Equation(s): Identify allowed **E**quation(s)
Sigma-p-vector-sub-i + Sigma-J-vector = Sigma-p-vector-sub-f
Sigma-p-sub-x,i + Sigma-J-sub-x = Sigma-p-sub-x,f
Sigma-p-sub-y,i + Sigma-J-sub-y = Sigma-p-sub-y,f

N is the second letter of "A**N**alyze".
Cross out quantities that are obviously 0.
Sigma-J-vector = 0-vector? Sigma-J-sub-x = 0? Sigma-J-sub-y = 0?
Substitute constitutive relationships.
p-sub-x = m-sub-I times v-sub-x
Signed area between F-sub-x-t plot and t axis = J-sub-F,x
Perform algebraic and proportional reasoning.

C stands for **C**ommunicate.
Phrasal template: "The system is the dot-dot-dot"
REASoN is spelled R, E, A, So, and N.
R stands for **R**ecipe.
Phrasal template: "By [relationship], the [quantity] [prepositional phrase] … equals [or is proportional to] …"
Example phrase: By the impulse-momentum theorem, the change in the total x-momentum of the carts equals the net dot-dot-dot.
Phrasal template: "The … is 0, so, by [relationship], the [adjective] [quantity] [prepositional phrase] … [verb] …."
Example phrase: The net x-impulse is 0, so by the impulse-momentum theorem, the initial x-momentum of the block fully becomes dot-dot-dot.
Phrasal template: "… the [total quantity] ([quantity 1] [prepositional phrase 1] [plus] …) …"

Example phrase: dot-dot-dot the total initial x-momentum (initial x-momentum of the cart plus the initial x-momentum of the block dot-dot-dot) dot dot dot

E stands for **E**qual

Phrasal template: The blank stays the same.

A stands for **A**ltered.

Phrasal template: The blank [increases/decreases] dot-dot-dot.

The So stands for **So** what?

Phrasal template: So the blank must blank.

N stands for **N**ext?

(Check whether you've addressed all directives).