

# Problem solving SiQuENC (adapted from Etkina)

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## Neatly and graphically represent situation(s)

1. Read the problem with careful attention.
2. Represent the problem statement in a visually navigable format.

Organize items like these	Using tools like these
a. Described situation(s)	a. Sketch(es)
b. Given information/quantities	b. Table(s)
c. Requested unknowns	c. List(s)

Make sure that your representation is complete so that you do not need to refer back to the original problem statement.

3. Use dashed bubble(s) to identify system(s) (set(s) of focal point(s) of analysis).
4. Label situations (e.g. initial and final, A and B, etc.).
5. Identify requested unknowns.

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## Graphically represent quantities and their relationships

Ways to represent quantities	Specific examples of types of diagrams
a. Lengths	a. Motion diagrams and graphs of kinematics quantities
b. Directions	b. Vector component decomposition diagrams
c. Countable copies of icons	c. Free body diagrams
	d. Bar charts
	e. Standing wave diagrams

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## Identify relevant allowed starting point (in) equation(s)

1. Look at cribsheets in which allowed knowledge has been organized into categories.
2. Try to identify (a) relevant categor(y)ies.
3. Look again at your representations of the problem statement and of quantities.
4. Write down relevant (in)equation(s).

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## Analyze

Deductively reason	Check whether result is reasonable
a. Manipulate algebraic equations.	a. “[X] has dimensions/units of _____, which is (not) expected.”
b. “According to the law of _____, [X] is (proportional to   inversely proportional to   etc.) [Y]. Because [X] _____, [Y] _____.”	b. Check order of magnitude.
c. Recognize an equation of a line $y = mx + b$ and interpret its slope and $y$ -intercept.	c. Functional dependence: “According to this result, as [X] increases (by _____), [Y] _____. This is (not) reasonable because _____.”
d. Recognize what is being held constant and what is being changed.	d. Limiting cases: “According to this result, as [X] gets very _____, [Y] _____. This is (not) reasonable because _____.”
e. Design an experiment with correctly identified independent, dependent, and control variables.	

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## Communicate

1. Label each key logical point in your work with a number.
2. Following the order of your labels, translate each numbered key point into a sentence.

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## Acknowledgments

This step sheet is based on Etkina's presentation of problem-solving as a four-step process. I am grateful to Katerina Visnjic for valuable discussions introducing me to this method for describing problem solving.

## Textbook correlation

Below is a chart illustrating correlations between the SiQuENC steps and problem-solving steps from Etkina (978-0-321-87972-1) and Knight (978-0-321-87972-1).

SiQuENC	Knight	Etkina
Neatly and graphically represent <u>s</u> ituation(s)	Prepare	Sketch and translate
Graphically represent <u>q</u> uantities and their relationships		Simplify and diagram
Identify relevant allowed starting point <u>e</u> quations	Solve	Represent mathematically
<u>A</u> nalyze		Solve and evaluate
<u>C</u> ommunicate	Assess	