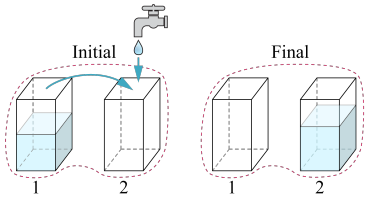
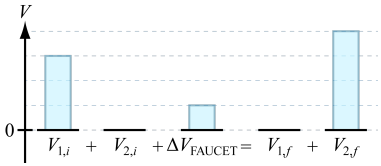
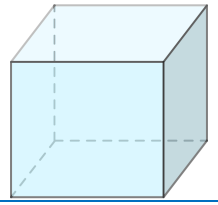
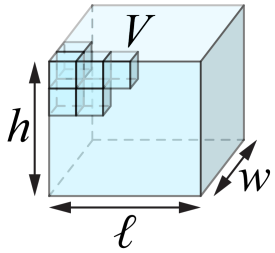
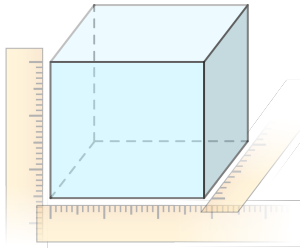
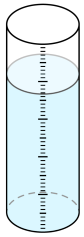
Skills for accelerated middle-school math: Use **POSTER** to take notes using multiple representations. Use **RAM** to categorize knowledge as **rules**, formulas for **abstracted quantities**, and **measurable quantities**. Use **REASoN** to draw conclusions and write explanations.

	Phrases	**O**ntology	**S**ketch	**T**ickmarks	**E**xpressions		**R**elationships
#	Verbally state	Categorize knowledge	Draw concrete cartoons	Plot and graph using axes	Assign quantities variables		State patterns using equations/inequalities
1.	Incompressible fluids obey **conservation of volume:** change in system's total volume is accounted for by exchange with surroundings.	**R**ule (governing law or pattern)	Water volume in final container exceeds water volume in initial container by amount from faucet. Outline two-containers system. 	Volume bar chart 	$V_{\text{TOT},i}$	Total initial volume	$V_{\text{TOT},i} + \Delta V = V_{\text{TOT},f}$
					ΔV	Total volume delivered from surroundings	
					$V_{\text{TOT},f}$	Total final volume	
2.	A **rectangular prism's volume** equals the product of the prism's length, width, and height.	Formula for **abstracted quantity** (constitutive relationship)	Cabinet projection of prism 	Highlight some unit cubes (an object's volume is the number of unit cubes that fit in the object).  Double-headed arrows label prism's length, width, and height (double-headed arrows indicate endpoint tickmarks of implied coordinate axes).	ℓ	Prism's length	$V_{\text{RP}} = \ell w h$
					w	Prism's width	
					h	Prism's height	
					V_{RP}	Prism's volume	
3.	Linear dimensions **length**, **width**, and **height** can be measured using a ruler.	**Measurable** and almost measurable **quantity**	Length, width, and height directly measured using rulers 		ℓ	Prism's length	
					w	Prism's width	
					h	Prism's height	
4.	Fluid **volume** is directly measured in a graduated cylinder and indirectly measured by pouring into a graduated cylinder.		Graduated cylinder 		V	Volume	

Use **POSTER** to read: A rectangular lunchbox full of water is emptied completely into an initially empty rectangular aquarium that's longer, wider, and taller than the lunchbox. Is the height of the water in the aquarium greater than, less than, or the same as the height of the water in the lunchbox?

#	**P**hrases Verbally state	**O**ntology Categorize knowledge‡	**S**ketch Draw concrete cartoons	**T**ickmarks Plot and graph using axes	**E**xpressions Assign quantities variables Letter | Meaning and value	**R**elationships State patterns using equations/inequalities

‡ Categories: rule (pattern), abstracted quantity, measurable quantity, scene, object, person, event

Make sure the applicable steps of **REASoN**ing are represented in your **POSTER** work. Use task verbs to determine the amount of **REASoN**ing to include in written explanations

Toulmin	McNeill's CER	Frensley's ABCDs	REASoN	#	Cite and represent	**"Paragraph-length response"** (in disuse)	**"Justify"**	**"Briefly explain"**
Warrants	**Reasoning**	**Basic principles**	**Rules** and relationships	1.	**Rules** that were used	✓	✓	🚫
				2.	**Formulas** for **abstracted quantities** that were used	✓ When possible, use parentheses to sneak formulas for abstracted quantities into sentences.	☝ Only state formulas for abstracted quantities if no rules are used.	🚫
	Reasoning	**Connect** to situations	**Equal**	3.	**Abstracted quantities** immediately determined from a rule to stay the **same** or to **equal** given values	✓	🚫	🚫
				4.	**Measurable quantities** immediately determined from a rule to stay the **same** or to **equal** given values	✓	🚫	🚫
Evidence	**Evidence**			5.	**Abstracted quantities** given to stay the **same** or to **equal** given values	✓	🚫	🚫
				6.	**Measurable quantities** given to stay the **same** or to **equal** given values	✓	🚫	🚫
	Reasoning		**Altered**	7.	**Abstracted quantities** immediately determined from a rule to be **different** (and how)	✓	✓	✓
				8.	**Measurable quantities** immediately determined from a rule to be **different** (and how)	✓	✓	✓
Evidence	**Evidence**			9.	**Abstracted quantities** given to be **different** (and how)	✓	✓	✓
				10.	**Measurable quantities** given to be **different** (and how)	✓	✓	✓
	Reasoning	**Draw** ideas together into assertion	**So what?**	11.	**Chain of deduced consequences** from quantities mentioned in evidence and continuing	✓	✓	✓
Claim	**Claim**	**Answer** / Assertion		12.	until conclusion is drawn for a requested quantity or suitable proxy			
		Answer / Assertion	**Next?**	13.	Did you answer all questions? (Don't need to represent this yes-no question thoroughly using POSTER).	🚫	🚫	🚫