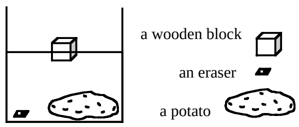
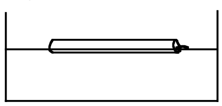
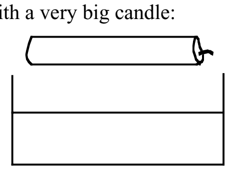
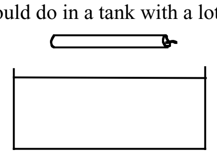
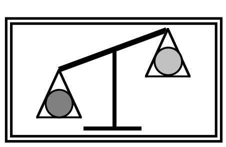
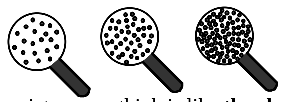
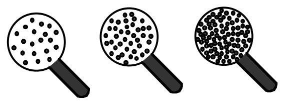
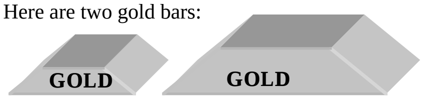
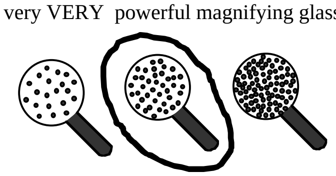
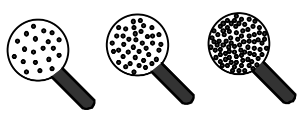
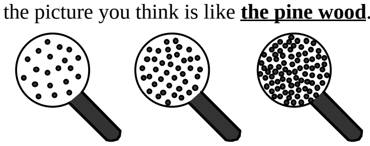
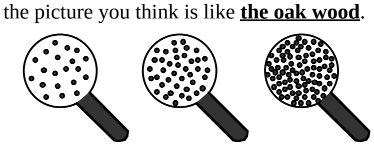
Sinking & Floating Assessment References:

1998-1999

Assessment Question	Basis
1. Three objects, a rubber eraser, a wooden block and a potato, were put into a tank of water. Here is a side view of the tank of water:  (a) Why do you think the wooden block floats in the water? (b) Why do you think the eraser and the potato sink in the water?	Loosely based on Carol Smith's tasks (1992) which were in turn loosely based on Piagetian tasks about floating and sinking objects. Carol Smith, Joseph Snir and Lorraine Grosslight (1992), Using conceptual models to facilitate conceptual change: the case of weight-density differentiation, Cognition and Instruction, 9(3), 221-283 Also similar to a pretest question in Rowell & Dawson's work which asked children to consider why certain items (provided in lists) float and others sink. J.A. Rowell and C. J. Dawson, (1977), Teaching about floating and sinking: An attempt to link cognitive psychology with classroom practice, Science Education, 61(2), 245-253
2. Candles float in water. Here is a picture of a candle floating in water  (a) Please draw a picture of what you think would happen with a very big candle:  Explain why you think this would happen:__________ (b) Please draw a picture of what you think the candle would do in a tank with a lot of water:  Explain why you think this would happen:	Based on Biddulph & Osborne's candle task which asked children how a longer piece of a candle would float in comparison to a shorter piece Biddulph, F. & Osborne, R. (1984) 'Pupils ideas about floating and sinking', Paper presented to Australian Science Education Research Association Conference, May, Melbourne, Australia. Biddulph, F. (1983) Students' views of floating & sinking. Learning in Science Project (Primary). Working Paper No. 116., Waikato University, Hamilton, New Zealand.
3. Clay is two times heavier than wax. If you put **the same size balls** of clay and wax on a balance scale it would look like this:  (a) If you could look at balls of wax and clay with a very very VERY powerful magnifying glass, what do you think the wax and clay balls would look like?	Based on Piaget & Inhelder's 1974 task in which children were asked to make clay and wax balls that would weigh the same amount. Also inspired by Novick & Nussbaum's (1981) paper-and-pencil assessment called "Test About Particles in a Gas". Shimshon Novick and Joseph Nussbaum, (1981), Pupils' understanding of the particulate nature of matter: A cross-age study, Science Education, 65(2), 187-196 Also used Hibbard & Novak's (1975) idea of having chldren think about a VERY powerful magnifying glass.

Circle the picture you think is like **<u>the wax ball</u>**.  Circle the picture you think is like **<u>the clay ball</u>**.  (b)Please explain how you decided on your answers:	K. Michael Hibbard and Joseph D. Novak, (1975), Audio-tutorial elementary school science instruction as a method for study of children's concept learning: Particulate nature of matter, Science Education, 59(4), 559-570
4. Here are two gold bars:  This is what the **<u>smaller gold bar</u>** looks like using a very very VERY powerful magnifying glass:  (a) Circle the picture you think is like **<u>the large gold bar</u>**.  (b) Please explain how you decided on your answer:	Loosely based on Smith & Unger's (1997) "dots-per-box" work. Carol Smith and Chris Unger, (1997), What's in dots-per-box? Conceptual bootsrapping with stripped-down visual analogs, <u>The Journal of the Learning Sciences, 6</u>(2), 143-181
5a. A log of <u>oak wood</u> burns much longer than **<u>the same size</u>** log of <u>pine wood</u>. Explain how this can happen. 5b. If you could look at a slice of oak wood and a slice of pine wood with a very very VERY powerful magnifying glass, what do you think the oak and pine wood would look like? Circle the picture you think is like **<u>the pine wood</u>**.  Circle the picture you think is like **<u>the oak wood</u>**. 	Far transfer item. Also loosely based on Smith & Unger (1997). (see question 4)
6a. Here is a chart that shows several characteristics of a set of blocks. Fill in the chart to show what you think Block C would do in water.	Loosely based on Gennaro's work (1981) with 9th grade students on density. Eugene D. Gennaro (1981), Assessing junior high students' understanding of density and solubility, <u>School Science and</u>

Block	Weight	Size	In water this block…
A.	4 g	2 cm^3	sinks
B.	6 g	12 cm^3	floats
C.	4 g	16 cm^3	? __________

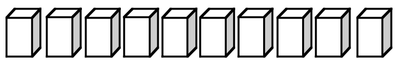
6b. How did you decide on your answer?

6c.Please explain what you think is the main reason an object will sink or float in water.

Mathematics, 81, 399-404

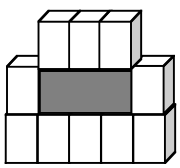
7. This brick is 100cm^3 and weighs 200 grams. It sinks in water.

Here are 10 styrofoam blocks:



Each of the blocks is 15 cm^3 and weighs 2 grams.

If all of these styrofoam blocks are attached to the brick, the whole thing is bigger and heavier. It now weighs 220 grams and is 250 cm^3.



If this whole thing is put into a tank of water, it floats! It floats even though it is bigger and heavier. How can this be?

Inspired by Schauble et al.'s "spring task" (1991, 1996).

Schauble, L., Kopfer, L.E., & Raghavan, K. (1991), Students' transition from an engineering model to a science model of experimentation, Journal of Reseach in Science Teaching, 28, 859-882

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Gennaro, E.D. (1981), Assessing junior high students' understanding of density and solubility, School Science and Mathematics, 81, 399-404

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Lichtfeldt, M. (1996), Development of pupils' ideas of the particulate nature of matter: In Long-term research project, in Research in Science Education in Europe: Current Issues and Themes, G. Welford, J. Osborne & P. Scott, eds., The Falmer Press, London, 1996, pp. 212-228

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Rowell. J.A. and Dawson, C. J. (1977), Teaching about floating and sinking: An attempt to link cognitive psychology with classroom practice, Science Education, 61(2), 245-253

Schauble, L., Kopfer, L.E., & Raghavan, K. (1991), Students' transition from an engineering model to a science model of experimentation, Journal of Reseach in Science Teaching, 28, 859-882

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Smith, C., Snir, J., and Grosslight , L. (1992), Using conceptual models to facilitate conceptual change: the case of weight-density differentiation, Cognition and Instruction, 9(3), 221-283

Smith, C. and Unger, C. (1997), What's in dots-per-box? Conceptual bootsrapping with stripped-down visual analogs, The Journal of the Learning Sciences, 6(2), 143-181

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