

pH Scale Sim

design version 4

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June 2, 2007

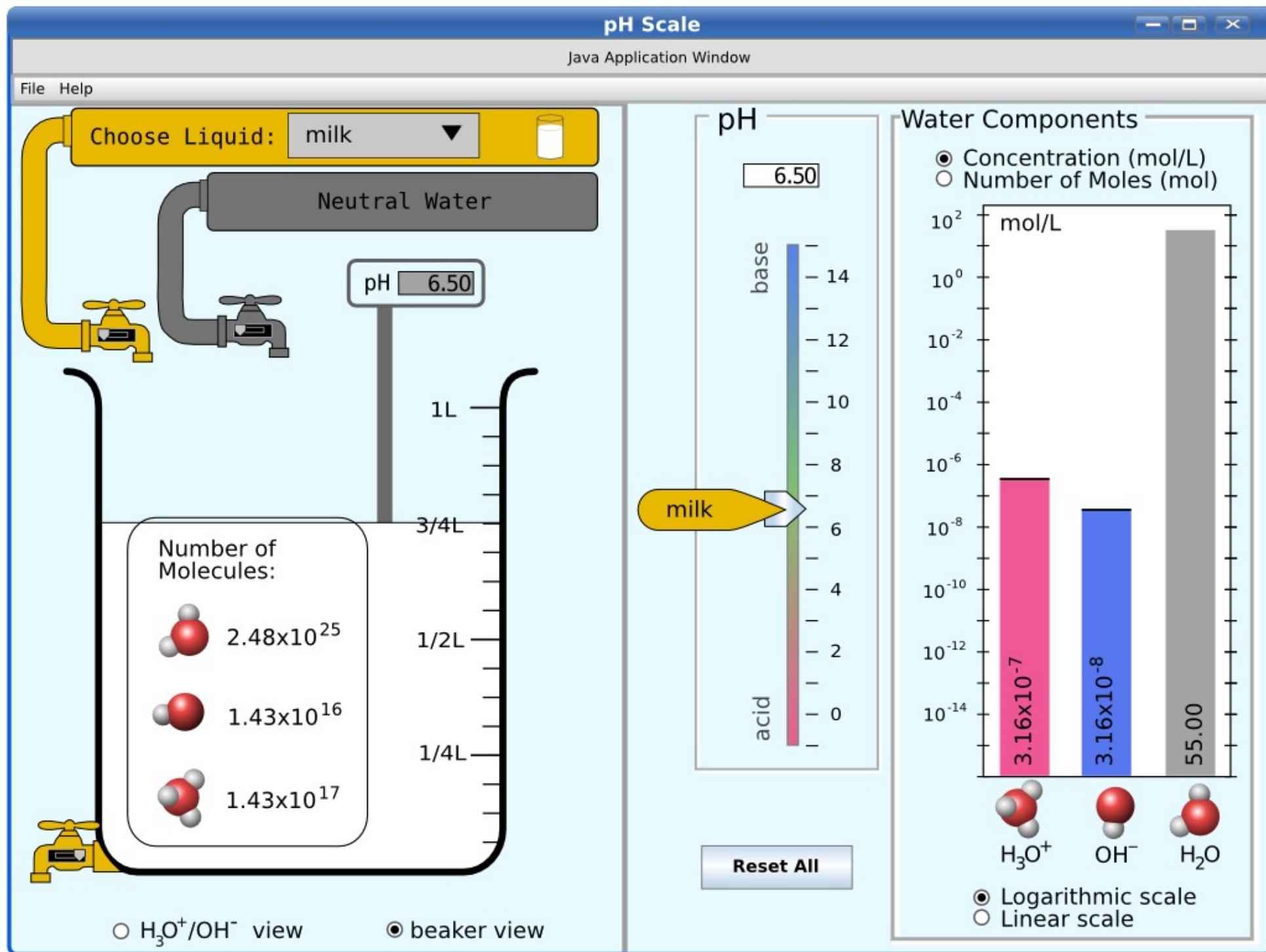
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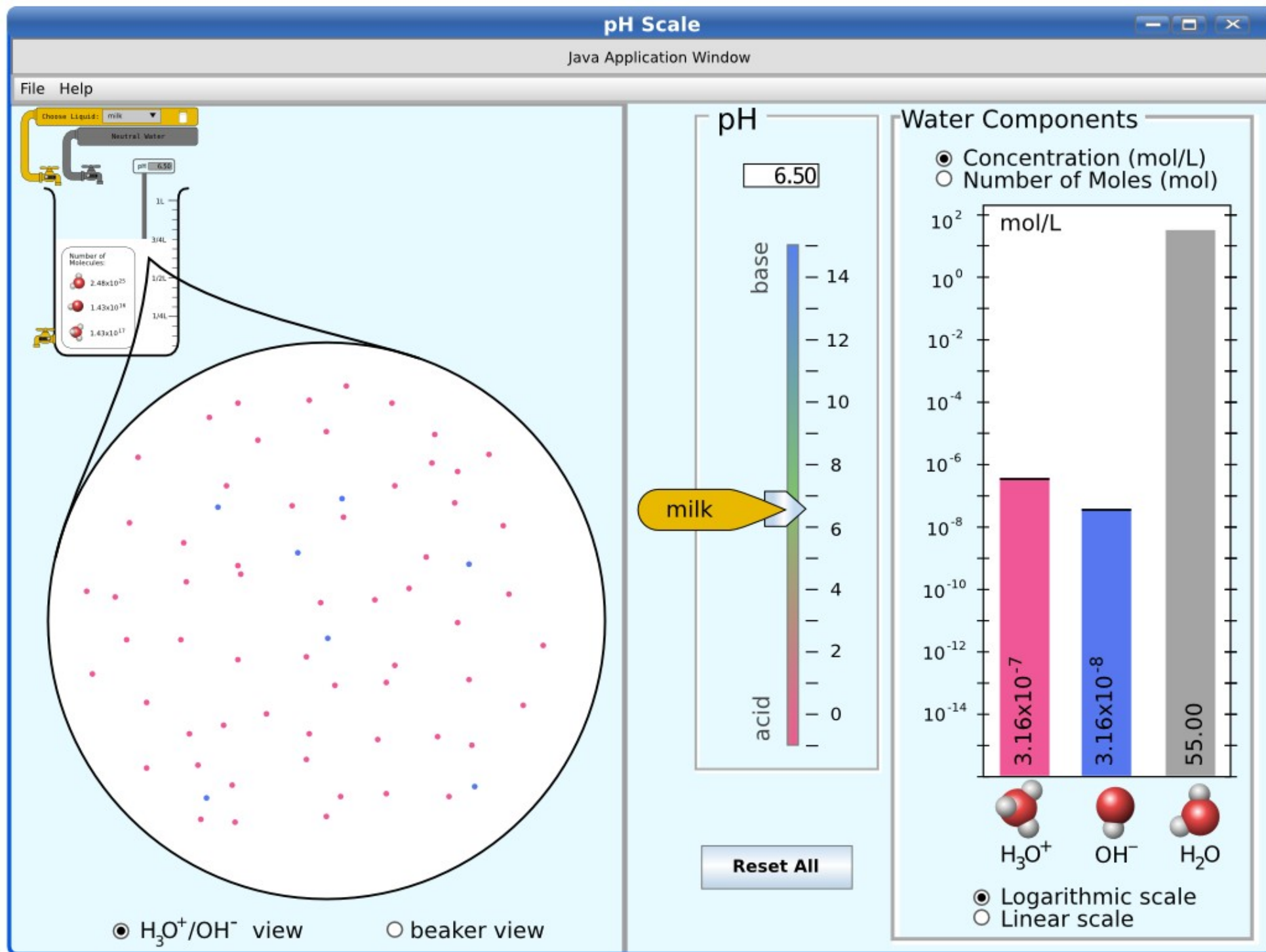
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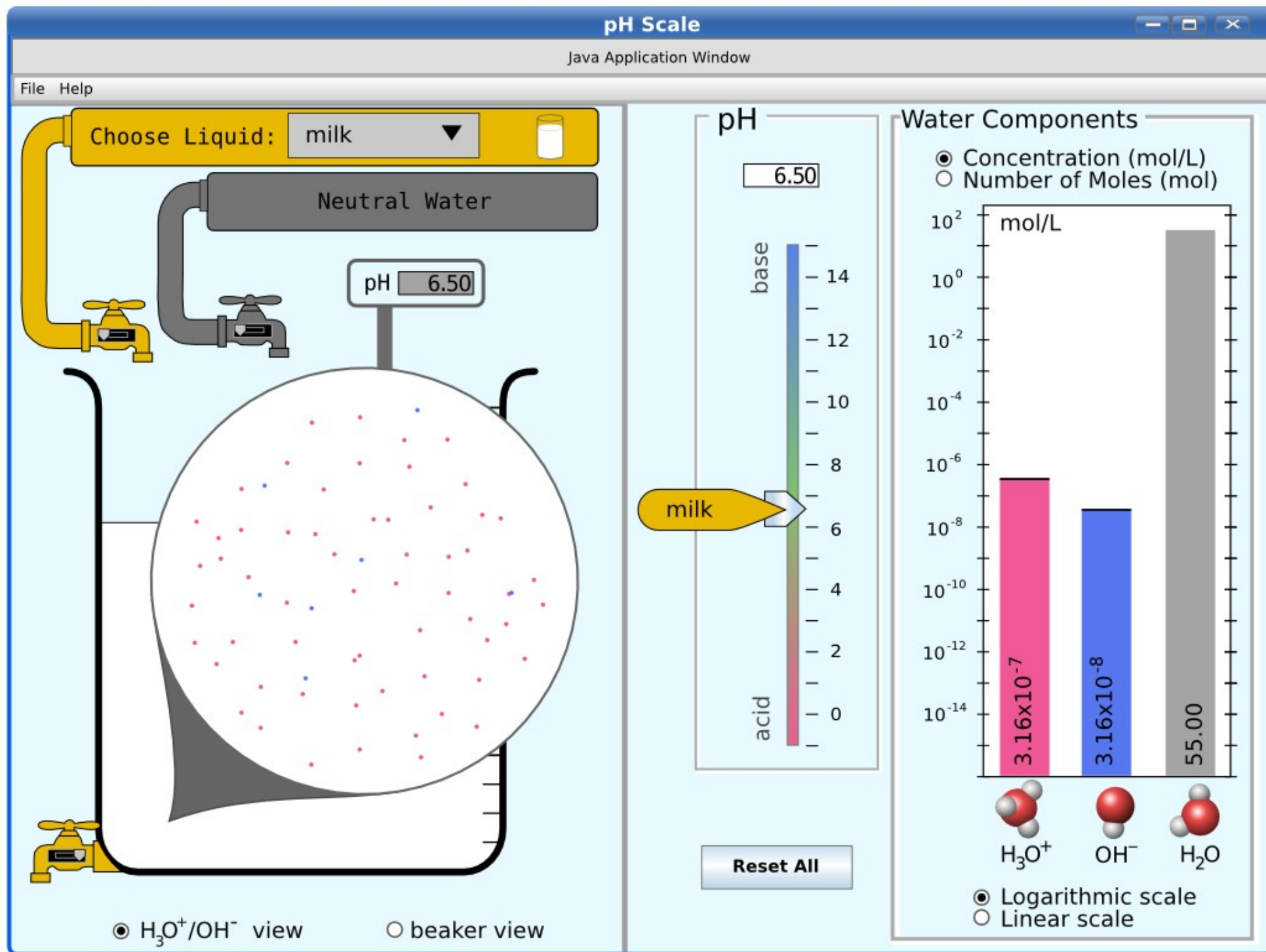
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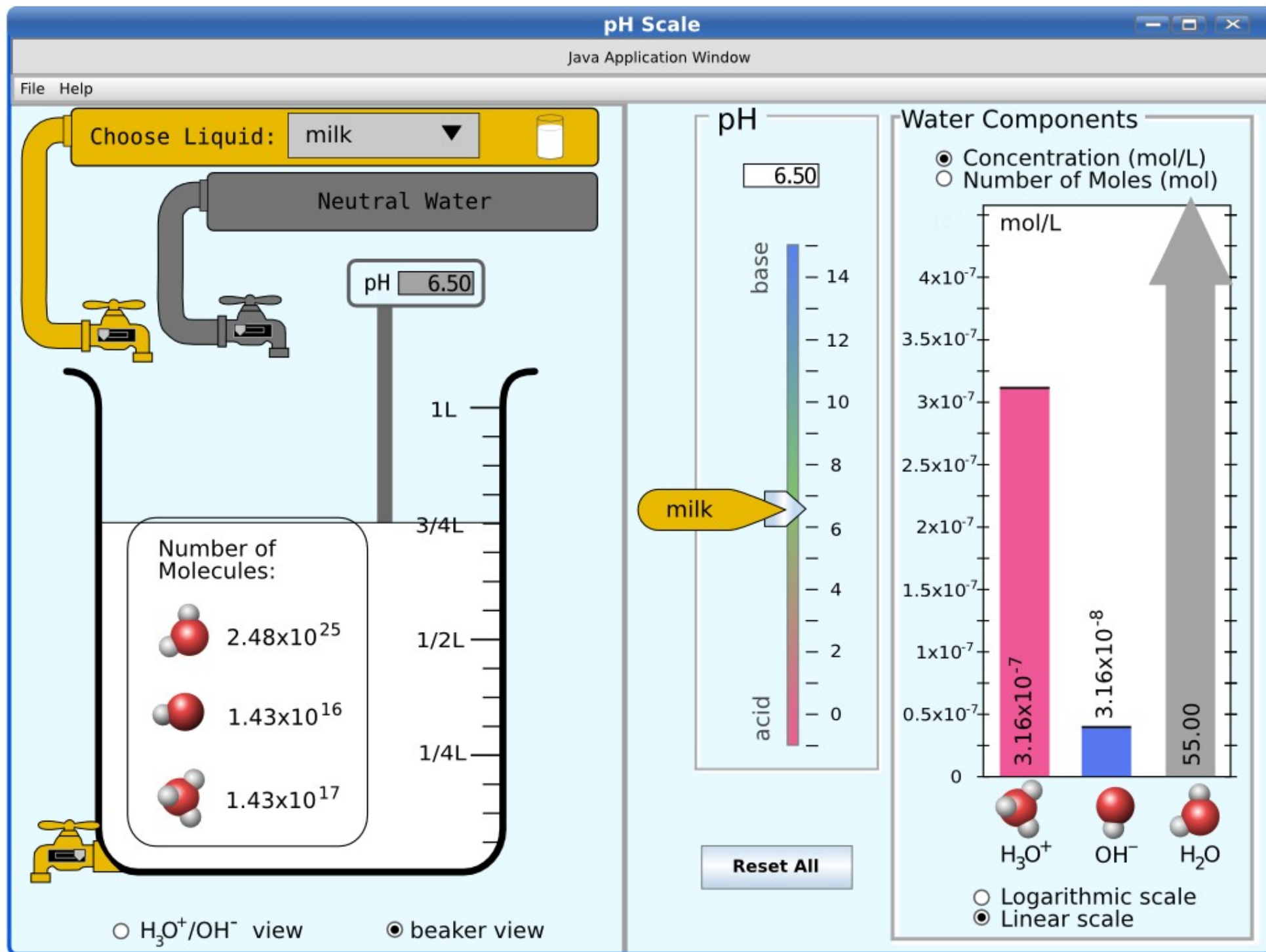
Basic Sim Operation

- pH slider
 - affects the number of speck-molecules shown in the beaker and the bars in the bar chart
 - does not affect the label tag (see "choose a liquid")
- bar charts
 - radio buttons for "concentration" and "number of moles"
 - concentration
 - mol/L bars of both OH and H₃O are drag-able, and tied to the pH slider
 - number of moles
 - all three bars are drag-able
 - changing the OH and H₃O bars moves the pH slider
 - changing the H₂O slider turns on the faucet/drain (for increasing/decreasing the bar height) to change volume in beaker
 - radio buttons for "logarithmic scale" and "linear scale"
 - here's an idea for showing the linear scale: automatically set the scale to include both values H₃O⁺ and OH⁻, water will always be off-scale, so it is represented by bar that turns into an arrow pointing upwards off the chart (see mockup)
- faucet and drain
 - cannot fill above 1 liter
 - neutral water can be added to any liquid (it then becomes "custom")
- Choose a liquid
 - when a new liquid is chosen, the beaker liquid disappears and the faucet turns on to fill with the new liquid
 - a label tag appears on the pH slider to indicate the pH of the current and previous liquids chosen
- H₃O⁺ OH⁻ view / beaker view
 - beaker view includes "Number of Molecules", which is a continuous display of the number of the three molecules in the beaker
 - H₃O⁺ OH⁻ view shows particles as dots, also called the "microscope view"









Learning Goals

Students will be able to use pH scale to write descriptions that demonstrate how to:

- A. Determine if a solution is acidic or basic
- B. Determine if a solution weak or strong by looking at the pH
- C. Place acids or bases in relative order
- D. Describe on a molecular scale, with illustrations, how the water equilibrium varies with pH
- E. Determine concentration of hydroxide, hydronium and water at a given pH

New learning goals (rough):

1. pH does not change with volume
2. diluting with water moves pH closer to 7

Outstanding Issues

1. When diluting with water, how does the color of liquid in the vessel change? Can we simply make the color more transparent, or do we need to make the color approach whatever color we use for water?
2. Do the faucets work in microscope mode?
3. When the height of the bars in the graph isn't tall enough to fit the text (eg, 1×10^{-14}), where is the text placed?
4. How do we show the bar chart on a linear scale? Auto-scaling? Buttons to change scale?

pH of Common Liquids

The following were taken from the web (<http://www.healthnews-nz.com/table5.html>).

Acid Mine Runoff	-3.6 – 1.0
Battery Acid	< 1.0
Gastric Acid	2.0
Lemon Juice	2.4
Cola	2.5
Vinegar	2.9
Orange or Apple Juice	3.5
Beer	4.5
Coffee	5.0
Tea	5.5
Acid Rain	< 5.6
Milk	6.5
Pure Water	7.0
Human Saliva	6.5 – 7.4
Blood	7.34 – 7.45
Sea Water	8.0
Hand Soap	9.0 – 10.0
Household Ammonia	11.5
Bleach	12.5
Household Lye	13.5