Framework for K-12 Science Education

Introduction

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Alignment with Molecules & Minds Simulations

K-12 Science Education Framework

- Previous national framework
  - National Science Education Standards
  - National Research Council, 1996

- Common Core State Standards
  - "establish a shared set of clear educational standards"

    -Common Core State Standards, 2012

  - New York State,
  - July 2010

Focus of K-12 Science Education Framework

- Remain competitive internationally
- Science for informed decisions
  - Health
  - Policy

A Framework for K-12 Science Education

"...broad description of the content and sequence of learning expected of all students by the completion of high school "

-National Research Council, 2012

A guide for:

-curriculum, assessment and standards developers

-teachers, teacher educators

How will K-12 Science Framework Achieve These Goals?

- Developmental progression
  - Curiosity → Knowledge
- Core Ideas
  - Reduce number of topics
  - Depth vs. Breadth
- Knowledge & Practices
  - Combined

K-12 Science Education Framework: Three Dimensions

- Dimension 1
  - Science (& Engineering) Practices
- Dimension 2
  - Crosscutting Concepts
- Dimension 3
  - Core Ideas

K-12 Science Framework: Three Dimensions

"…in order to facilitate students' learning, the dimensions must be woven together in standards, curricula, instruction, and assessments."

-National Research Council, 2012

K-12 Science Framework: Three Dimensions

Explore ideas from

- Dimension 3
  - Core Ideas

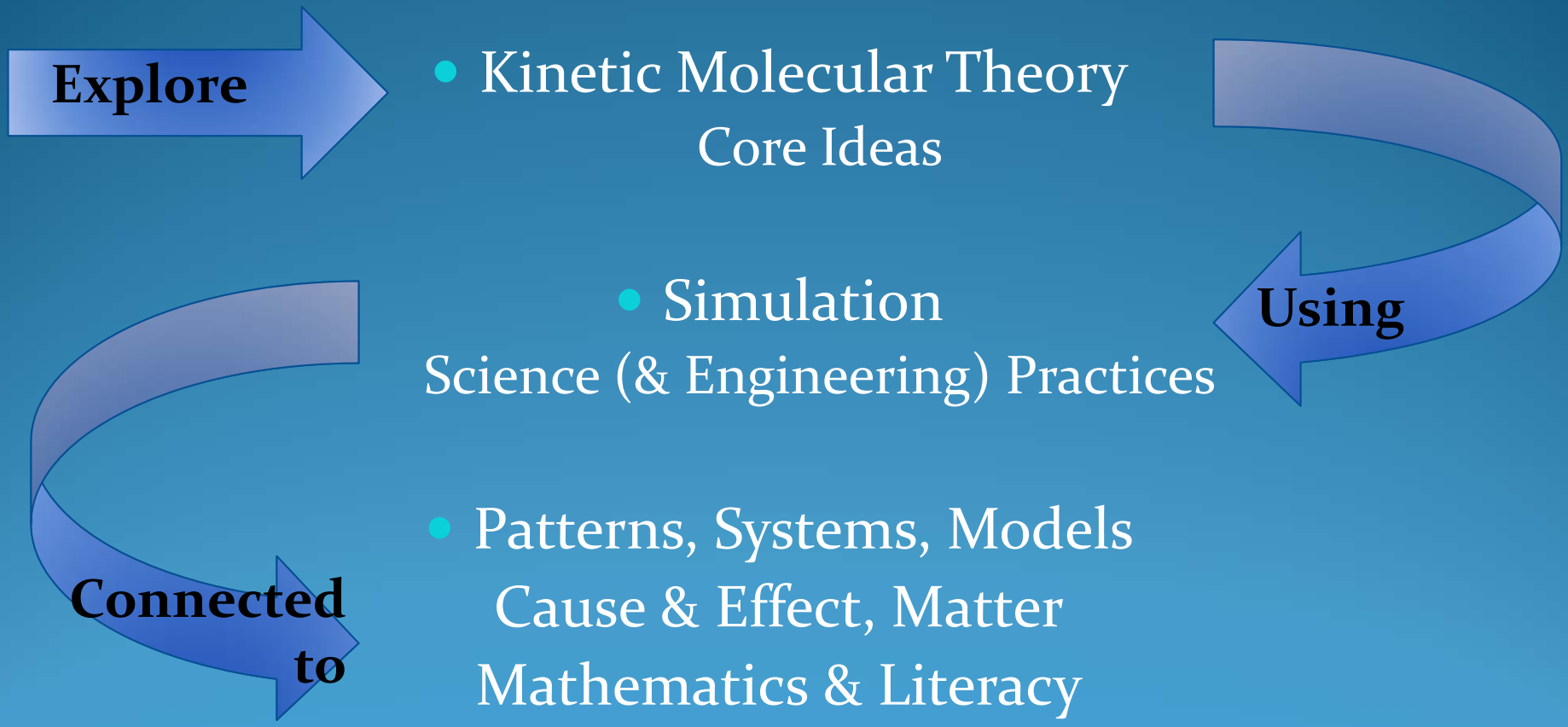
Using Practices from

- Dimension 1
  - Science (& Engineering) Practices

Making Connections to

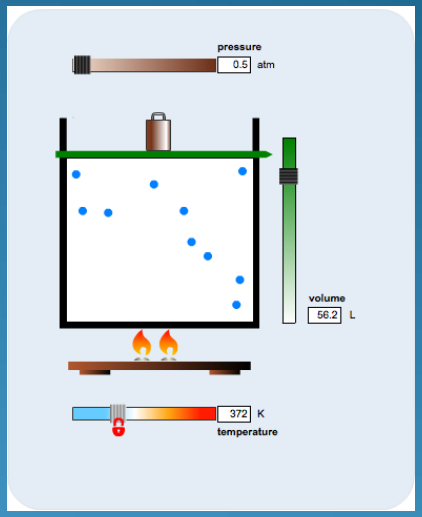
- Dimension 2
  - Crosscutting Concepts

K-12 Science Framework: Three Dimensions



K-12 Science Framework & Molecules & Minds Simulations

- Simulations
  - Diffusion
  - Kinetic Molecular Theory
  - Phase Change
  - Gas Laws



Gas Laws Simulation

- Provide an opportunity for teachers to integrate the K-12 Science Framework recommendations into their teaching

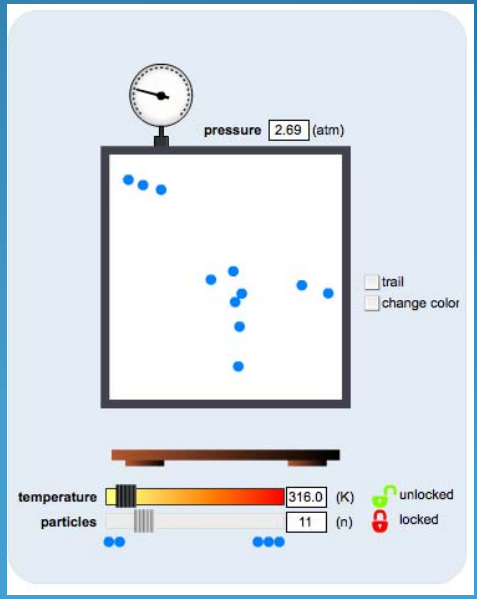
Dimension 1: Molecules & Minds Simulations

Dimension 1:

Science Practices

Molecules & Minds Simulations:

Allow students to engage in scientific practices in the classroom



KMT Simulation

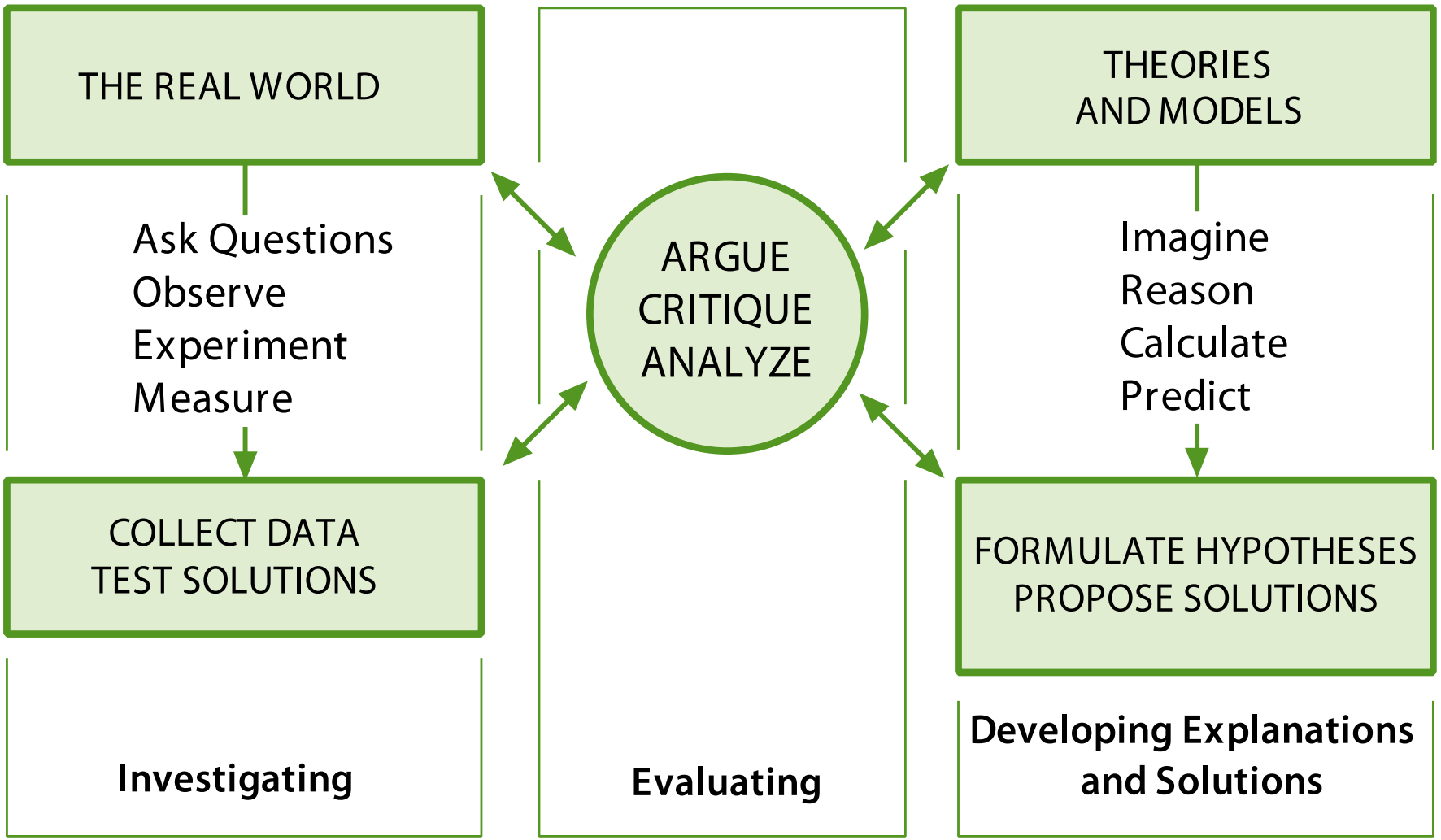


FIGURE 3-1 The three spheres of activity for scientists and engineers.

National Research Council, 2012

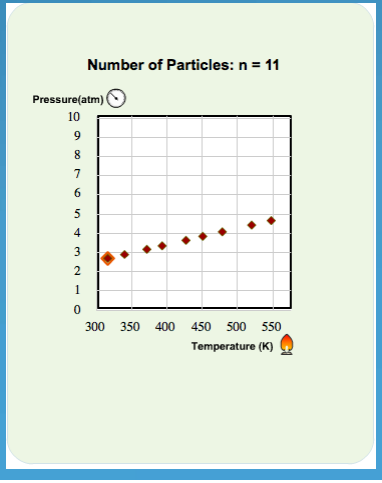
The Real World

Theories and Models

Describe how gas particles behave…

Argue
Critique
Analyze

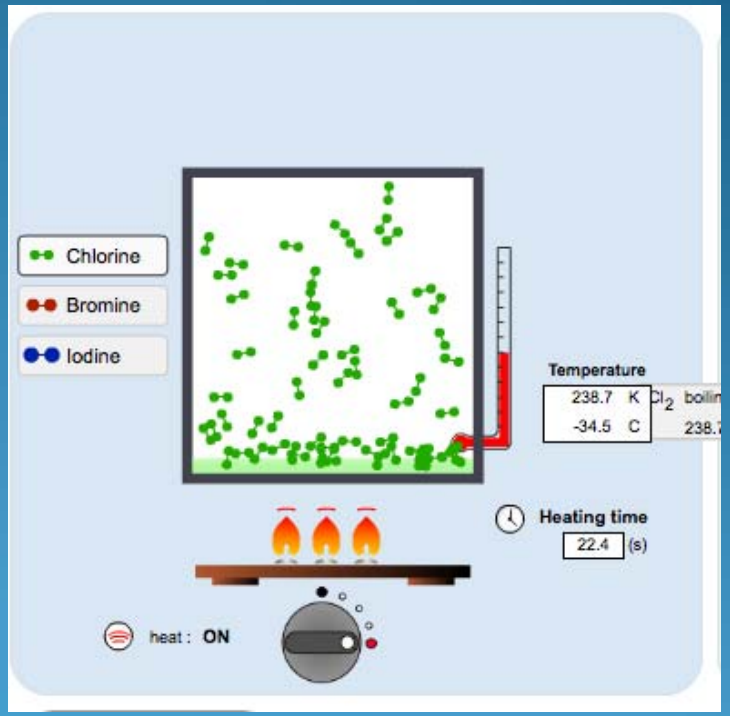
Collect Data
Test Solutions



Formulate Hypotheses
Propose Solutions

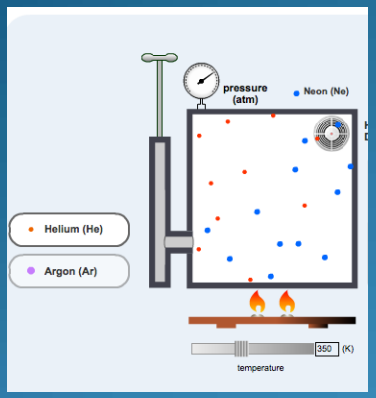
Dimension 2: Crosscutting Concepts

- Patterns
- Systems & Models of Systems
- Cause & Effect
- Stability & Change
- Scale/Proportion/Quantity
- Structure & Function
- Matter & Energy



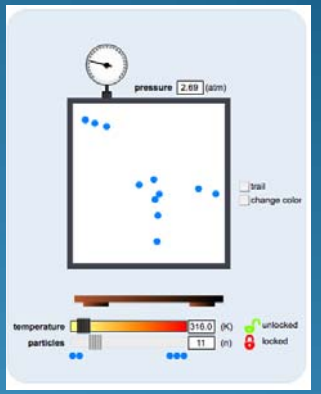
Phase Change Simulation

Dimension 3: Core Ideas



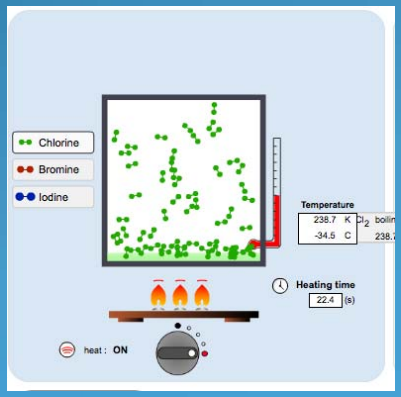
Diffusion Simulation

- Physical Sciences
  - Matter & Interactions
  - Motion & Stability, Forces & Interactions
  - Energy
  - Waves

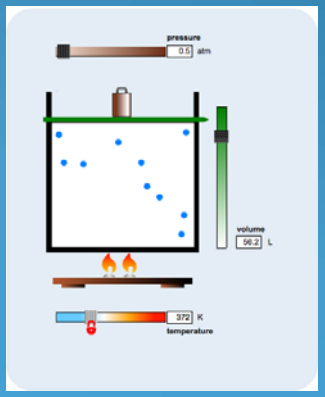


KMT Simulation

- Life Sciences
  - Structures & Processes: Molecules to Organisms
  - Ecosystems: Energy, Interactions, Dynamics
  - Heredity: Variation & Inheritance
  - Biological Evolution: Diversity & Unity



Phase Change Simulation



Gas Laws Simulation

Goal of K-12 Science Education Framework

- Students acquire knowledge of:
  - Science Practices, Crosscutting Concepts, Core Ideas
- Integrate Molecules & Minds Simulations into teaching curriculum

NEXT GENERATION SCIENCE STANDARDS

create
Consortium for Research and Evaluation of Advanced Technologies in Education

MOLECULES & MINDS

References

- Common Core State Standards Initiative (CCSSI). 2010. *Common Core State Standards for Mathematics.* National Governors Association Center for Best Practices and the Council of Chief State School Officers. Washington, DC. http://www.corestandards.org/
- Molecules & Minds Simulations. 2012. http://steinhardtapps.es.its.nyu.edu/create/molecules2/seminar
- National Research Council. (1996). *The National Science Education Standards*. Washington DC: National Academy Press.
- National Research Council. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.