

Computer simulations, animations, and guided inquiry tutorials for general chemistry: The Next Generation Project

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<http://intro.chem.okstate.edu/Nextgen/NextGen.html>

<http://genchem1.chem.okstate.edu/BDA/Topics.php>

(Teachers only)

Next Generation Project

Overview Learning Outcomes Experiment Experiment Step 4

Record the initial mass for each metal electrode (10 grams) in your notes.

Go to the ammeter to adjust settings for the current and the timer. Turn the ammeter on to run the experiment.

Macroscopic View $\text{Cu}(\text{NO}_3)_2 (\text{aq})$ Standard Reduction Potentials (E°)

Overview Learning Outcomes Experiment Experiment Step 3

Add gases to the reaction chamber by entering values in the boxes above the gas cylinders or in the boxes in the ICF table **Initial** row.

OR enter values in the **Final** row to work in **reverse** mode to determine the initial gas inputs to produce the given final product. When you have filled out the Final row, press on the Final button to check your entries.

If the experiment you are working on requires an **excess** reactant, you can enter the letter "e" in a box for one of the gases only.

Balanced Chemical Equation

Reactants: $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ Products

Initial: 0.0 0.0 moles

Change: moles

Final: moles

React Rerun Reset Moles

Overview Learning Outcomes Experiment Experiment Step 1

Select a substance, mass and temperature (or molarity for acids/bases) for the beaker.

LIQUIDS SOLIDS SOLUTIONS

Choose a liquid

Mass (g) Temp (°C)

Show specific heat ($\text{J/g}^\circ\text{C}$)

LIQUIDS SOLIDS SOLUTIONS

Choose a liquid

Mass (g) Temp (°C)

Show specific heat ($\text{J/g}^\circ\text{C}$)

RUN EXPERIMENT

Show graph view Show microscopic view

Start Reset

Overview Learning Outcomes Experiment Run Experiment Step 1

The main components of the macroscopic view in the simulation:

- Piston, glass container, and hotplate
- Controls to change the conditions of the experiment (pressure, volume, temperature, and number of moles of the gas) and to record each change
- Signify the responding variable by moving the Rspd button beside it. You then manipulate the controlling variables by sliding the slider bars.
- Ability to plot recorded data in graphical representations to view different relationships

Macroscopic Submicroscopic

P V T n

Pressure (atm) Temperature (K)

Export Data Graph Data

Properties

Rspd

P (atm): 0.50 V (L): 2.45 T (K): 298.00

n (mol He): 0.05 n (mol Ne): 0.00 n (mol Ar): 0.00

Record Reset Track Pause

Next Generation Project

Overview Learning Outcomes Experiment Experiment Step 5

In the Microscopic View, you will notice five points where you can see what is happening at the atomic level.

Explore the Microscopic Views by clicking on each point to watch an animation.

Switching between Macroscopic and Microscopic views is only possible when the timer is running and the reaction is going on.

Go back to the Macroscopic View to continue running the experiment.

9.11 g mass 10.33 g mass

Cu(s) Cu²⁺(aq) e⁻

Macroscopic View Cu(NO₃)₂ (aq) Standard Reduction Potentials (E°)

Overview Learning Outcomes Experiment Moles Demonstration Step 5

Click Next

1.00 moles 2.00 moles

Balanced Chemical Equation: $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

Initial: 1.00 2.00 0.0 0.0 moles

Change: [] [] [] [] moles

Final: 0.00 0.00 1.00 2.00 moles

Reactants: CH₄ + 2O₂ Products: CO₂ + 2H₂O

Initial Final

React Run Reset Moles

Next

Overview Learning Outcomes Experiment Experiment Step 4

Running experiment...

This temperature versus time graph represents a short segment of the reaction or process. In order to coordinate the graph with the particulate animation, the time taken to view the animation and graph is at a slower rate. It is not shown in real time.

40.06°C

LIQUIDS SOLIDS SOLUTIONS

Sodium hydroxide - NaOH

Mass (g) 10.0

Temp (°C) 20

Show ΔH solution (kJ/mol)

LIQUIDS SOLIDS SOLUTIONS

Water - H₂O

Mass (g) 100

Temp (°C) 20

Show specific heat (J/g°C)

RUN EXPERIMENT

Show graph view

Show microscopic view

Start Reset

The main components of the macroscopic view in the simulation:

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- Ability to plot recorded data in graphical representations to view

Macroscopic Submicroscopic

Vertical lines are the RMS speeds

Particles (n)

Particle Speed (m/s)

1363.150 m/s

Properties

Rspd

P (atm): 0.50

V (L): 2.45

T (K): 298.00

Record

Reset

Track

Pause

Gases

n (mol He): 0.05

n (mol Ne): 0.00

n (mol Ar): 0.00

The Learning Cycle & Class Instruction

| Learning Cycle | Role | Activity | Class Organization |
|---------------------|--|---------------------------------------|--------------------------------|
| Exploration | Introduction to Concept | Data Collection & Analysis | BCE - Before Class Exploration |
| Concept Invention | Identify Concept | Conclusions and interpretations | DCI - During Class Invention |
| Concept Application | Apply, Extend Reinforce, or Modify Concept | Using the concept in new applications | ACA - After Class Application |

BCE – Before class exploration

- Online activity completed by students prior to class;
- 10 to 15 minutes to complete;
- Can be used to-
 - Pool data to invent concepts,
 - Identify student misconceptions,
 - Review concepts for a new topics
- Instructor can use data to organize content of class

DCI – During Class Invention

- Cooperative group activities;
- Share BCE responses and guided questions;
- Students/instructors invent concept;
- Student respond to clicker questions;
- Apply and extend concept;

ACA – After Class Application

- Online web-based activity;
- Assessing what students take away from BCE and DCI;
- Apply and Extend the concept;
- Technology: simulations, animations;
- Response submitted online;
- Instructor has access to all responses

Review Web site

- <http://intro.chem.okstate.edu/Nextgen/NextGen.html>

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