	1. What's Inside?	2. Atomic configuration: Making a drawing of atom	3. Constructing Atomic Models
Student Experience	1) In groups, students are given covered boxes with different type objects inside. 2) Students are asked to develop a plan to make a hypothesis as to what is inside the box 3) Students carry out their plan and conclude what is inside using recorded evidence to justify their conclusion 4) Students share their method and results	1) Students are presented with multiple diagrams of atoms of the same element and the periodic table. (or diagrams of the evolution of the atom) 2) In groups, students compare and contrast the different versions of the atoms. 3) Students develop a list of the parts of an atom and pick the diagram that shows these the best to present on poster (gallery walk, debate, etc.) 4) Whole class fills out graphic organizer for subatomic particles 5) Students are then given handout showing the atomic configuration of different elements (with P.T.) 6) In groups, students develop a set of criteria for how to draw atoms from the periodic table 7) Criteria is shared between groups and finalized	1) Student are given periodic table and supplies for atom building 2) Students are asked to build atoms from the first 3 periods of the periodic table 3) Student record trends they notice within groups and across periods 4) Students compare notes and evidence 5) Students present models Alternate: students form atomic configuration themselves in groups (boys=protons, etc)
T4T Material	Boxes covered, variety of items to be placed inside boxes with different properties		Small, medium, large petri dishes, 3 different color beads
Big Idea	Atoms are tiny particles that make up everything. Even though we cannot see atoms, we can still find out information about them through experimental tests.	Atoms are made of subatomic particles (P,E,N) that have specific locations. Atoms of same element are identical, while atoms of different elements have different numbers of subatomic particles	Atoms are made of subatomic particles (P,E,N) that have specific locations. Atoms of same element are identical, while atoms of different elements have different numbers of subatomic particles. Atomic number increases by one and atomic mass increases across period, atoms in same group have similar configuration.
Connection to Culminating Activity	Different elements and materials have properties that can be tested for and used to identify them	Different elements and materials have properties that can be tested for and used to identify them. These properties can then be analyzed to choose materials to design and construct devices for specific purposes.	Different elements and materials have properties that can be tested for and used to identify them. These properties can then be analyzed to choose materials to design and construct devices for specific purposes.
CA Standards	Structure of Matter: 3a, 3b, 3c	Structure of Matter: 3a, 3b, 3c Periodic Table: 7	Structure of Matter: 3a, 3b, 3c
Next Gen Sci Standards	PS1-1 Core Ideas: PS1.A	PS1-1 Core Ideas: PS1.A	PS1-1 Core Ideas: PS1.A Sci/Eng: Develop and use models
CCSS	Writing Standards for Literacy: 1.b, 1.e, 2.d, 2.f	Writing Standards for Literacy: 1.b, 2.d, Reading Standards for Literacy: 7	Writing Standards for Literacy: 1.b, 2.d,

	4.Small+Small+Small+etc.= as big as you want Building molecules: simple and extended structures	5. Comparing properties of elements and compounds	6. Physical and Chemical changes
Student Experience	1) Students are given a variety of objects and chemical formulas and asked to build simple structures and extended structures based on the chemical formulas 2) Students combine objects (atoms) to form a new object (molecules) to see how even though atoms are very small they can be connected together to form something much larger. (drawings can be done also, showing how dots can be added together to form larger objects) Teaching points: How many objects could you build with all the different supplies? (connection to periodic table of elements making all substances in universe) Also, some students may use a couple of supplies while others may use many. Students see atoms can form molecules that range is size from a two to thousands of atoms.	1) Students provided with common compounds/molecules (included are the compounds that will be used later in chemical reactions) 2) Students research the individual elements' properties and compare to properties of compounds that these elements make.	1) Students are given the definitions of physical and chemical changes and an example of each 2) Students are then given a handout with examples of both type of changes (written out and pictures) and asked to classify each as either a physical change or chemical change, and give a reason for their choice 3) Teacher demonstrates the burning of a candle and explains the reaction using the terms: reactant, product, chemical reaction 4) Students revisit handout to revise classifications of phys/chem changes 5) In groups students create a list of possible evidence to look for that proves a new substance has formed. 6) Students share the list of criteria to look for to prove a new substance
T4T Material	Various sized/colored circles (represent different atoms), wires/twist ties (bonds)		
Big Idea	Substances are made from different atoms, which combine with one another id various ways. Atoms form molecules that range in size from 2 to thousands.	Elements' properties and the compounds they make up have unique properties.	Chemical changes produce a new substance with different properties. Physical changes don't change identity of substance.
Connection to Culminating Activity	Different elements and compounds have properties that can be tested for and used to identify them. These properties can then be analyzed to choose materials to design and construct devices for specific purposes.	Different elements and compounds have properties that can be tested for and used to identify them. These properties can then be analyzed to choose materials to design and construct devices for specific purposes.	Evidence of chemical changes can be release or absorption of energy.
CA Standards	Structure of Matter 3a, 3b, 3c, 3f	Structure of Matter: 3a, 3b, 3c, 3f Periodic Table: 7c	Structure of Matter: 3b Reactions: 5a, 5c, 5d
Next Gen Sci Standards	PS1-1 Core Ideas: PS1.A Sci/Eng: Develop and use models	PS1-1 Core Ideas: PS1.A PS1-2	PS1-2 Core Idea: PS1.B
CCSS		Reading Standards for Literacy: 4 ,7, 9 Writing Standards for Literacy: 1b, 6,7,8	Writing Standards for Literacy: 8, 9
Time			

	7.Design experiment: Identifying exo/endothermic reactions	8. Chemical equations	9. Modeling compounds with subscripts vs. coefficients
Student Experience	1) Students introduced to final project 2) In groups, students design a procedure to test which substances create a chemical reaction 3) Students identify which are exo/endothermic 4) Students create/revise a list of criteria for identifying chemical reactions based on previous lesson and their tests 5) Students can visually analyze, perform tests, or research properties of product substances 6) Students share results and fill out table that classifies which chemicals produce chem/phys changes and are exo/endo Teaching points: What is a chemical change? How to observe and identify a new substance (properties change)	1) Students analyze a demo/perform experiment (baking soda vinegar,etc) to observe conservation of mass 2) Students share results for reactant/product mass and discuss accuracy/measurement error 3) Students shown chemical equation for demo/experiment to count atoms 4) Students provided with the chemical formulas for the reactants and products made in previous lessons 5) Students match products with correct reactants 6) Teacher goes over steps to balancing chemical equations 7) Students practice balancing chemical equations on handout Teaching: Balancing chemical equations	1) Students provided materials to model molecular compounds with coefficients 2) Students practice constructing correct models from chemical formulas Focus: How to model molecular compounds with coefficients
T4T Material	Thermometers, plastic cups		Various sized circles, wires, pipe cleaners
Big Idea	Chemical changes produce new substances with different properties that can be observed. Measuring heat can be observed as evidence of chemical change.	Atoms in a chemical change are not created or destroyed. Mass is conserved	Subscripts show how many atoms of each element are in a compound. Coefficients show how many of the molecular compound is present in a chemical reaction
Connection to Culminating Activity	Chemical changes release or absorb energy.	Atoms (and thus mass) are rearranged in chemical changes, but not created or destroyed.	Atoms (and thus mass) are rearranged in chemical changes, but not created or destroyed.
CA Standards	Structure of Matter: 3b Reactions: 5a, 5c, 5d	Reactions: 5b	Reactions: 5b
Next Gen Sci Standards	PS1-2 & PS1-6 Disciplinary Core Ideas: PS1-A, PS1.B Sci/Eng: Analyzing and Interpreting Data	PS1-2 & PS1-5 Disciplinary Core Ideas: PS1.B	PS1-2 & PS1-5 Disciplinary Core Ideas: PS1.B Sci/Eng: Developing and Using models
CCSS	Reading Standards for Literacy: 3	Reading Standards for Literacy: 4	Reading Standards for Literacy: 4

	10. Modeling Conservation of mass	11/12. Design experiments to choose substances for self-heating/cooling device	13. Project: Design a self-heating/cooling device
Student Experience	1) Students provided materials to model the balanced chemical equations from the endo/exothermic reactions conducted 2) Students choose materials and construct models to represent a balanced chemical equation (showing conservation of mass). Focus: Conservation of mass	1) Students choose which chemical to use for their final project based on evaluation of class's experiments in Lesson 7. 2) Students prepare procedure for mixing chemicals for their final projects. 3) Students given finite amount of chemicals (about 20 grams) to experiment with best choice of amounts to use. 4) Students create a data table to record and share results with other groups 5) Students carry out experiments and share results with class 6) Students conclude about chemicals and amounts to use for final project.	1) Using results from exo/endothermic reactions groups design a device that will use the chemicals to heat or cool the device. 2) Students construct their device with materials given in class and/or other materials available to them. 3) Students present their device and its use to class 4) Presentations can be done as a gallery walk, or groups individually present to whole class, giving rationale for chemicals used and use for their device.
T4T Material	Various sized/colored circles/objects, white poster boards, wires, pipe clearners	Chemicals, plastic cups, petri dishes	Chemicals, plastic cups, petri dishes
Big Idea	Mass (atoms) are conserved during chemical reactions; atoms rearrange during chemical reactions.	Chemical processes can release or absorb energy and this can be used to heat or cool a device.	Chemical processes can release or absorb energy and this can be used to heat or cool a device
Connection to Culminating Activity	Exo/Endo balanced chemical reactions for final project are modeled.	Chemical processes can release or absorb energy and this can be used to heat or cool a device	Chemical processes can release or absorb energy and this can be used to heat or cool a device
CA Standards	Matter: 3b, 3f Reactions: 5a, 5b	Matter: 3b, 3f Reactions: 5a, 5b, 5c	Matter: 3b, 3f Reactions: 5a, 5b, 5c
Next Gen Sci Standards	PS1-5 Disciplinary Core Ideas: PS1.A, PS1.B Sci/Eng: Developing and using models, constructing explanations and designing solutions	PS1-2, PS1-6 Disciplinary Core Ideas: PS1-B, PS3-A	PS1-2, PS1-6 Disciplinary Core Ideas: PS1-B, PS3-A
CCSS		Reading Standards for Literacy: 3, 9 Writing Standards for Literacy: 1b, 4	Reading Standards for Literacy: 3, 9 Writing Standards for Literacy: 1b, 4

Graphic Organizer to Develop NGSS Aligned Lessons

Selected Performance Expectation:

Students who demonstrate understanding can:

MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.*

Describe what you want to see on the final product.

- Students brainstorm or are presented with scenarios where people may need devices that cool or warm them (Ex. hypothermia, heat stroke, etc.). Students can also brainstorm ideas about products that are meant to be cold or warm, but do not stay cool or warm (Ex. drinks, food, etc.).
- Students will present a device which they constructed (or a prototype designed on a poster) which correctly uses a chemical process to warm or cool itself.

What should an "A" work look like?

1. In groups (2-3 students), students must complete the design process of a device that uses the students' choice of chemicals to heat or cool itself.
2. Students must present the device (actual device or completely labeled poster) to class by explaining:

- What will your device be used for? Why is it needed? What problem does your device solve?
- How did you choose the chemicals to be used? What was your process? (Include data from experiments)
- What materials did you use to build your device and why?
- What problems might still need to be worked out before a device like this might actually be used?
- What type of other invention might your device lead to in the future?
- What was most challenging about the design process?

Which **Common Core State Standard**(s) is (are) addressed in student's final work? Explain.
What would the student response look like to show you that the student met this criteria?

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS1-6)
WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS1-6)

Student response will be the presentation of the device, and the evidence from experiments carried out to justify choices made during the design process.

Which **Crosscutting Concept** is addressed in student's final work? Explain
What would the student response look like to show you that the student understood the underlying crosscutting concept?

Energy and Matter

The transfer of energy can be tracked as energy flows through a designed or natural system.

Students' device shows understanding of exo/endothermic reactions, and uses data as evidence to justify choice.

Which **Scientific Practice(s)** and **Engineering Practice(s)** are addressed in student's final work? Explain.
What would the student response look like to show you that the student thinks like a scientist?

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.

Sequence of lesson to be field tested including estimated instructional time.

1) Intro to Atom
2) Atomic Configuration
3) Modeling atoms
4) Atoms forming compounds
5) Compounds and their properties
6) Physical and Chemical Changes
7) Chemical changes and temperature change
8) Intro to Conservation of mass
9) Modeling compounds (subscripts and coefficients)
10) Modeling Conservation of mass
11) Design procedure for experiments to inform chemical choice for culminating activity
12) Perform/evaluate chemical experiments for final choice (type and amounts) of chemicals
13) Design/Construct a self-warming/cooling device

Artifacts (students' work)

- Each lesson has handouts, and assessment pieces to be reviewed
- Final product: Self-warming/cooling device presented and justified with experimental evidence

Which Performance Expectations fit into and don't fit into our current Chemistry Unit?

What are the Performance Expectation?	**What is the content to be taught?** **What content is current? What content will be new?**

List any current state standards that are not addressed by the NGSS.

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