Appendix E

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| **Teacher Candidate Name: Name removed** | **Lesson Title: Temperature and Reaction Rate** |
| **(K-12) Course name: Chemistry** | **Grade Level: 11th grade** |
| **Topic: Factors that affect the Reaction Rate** | **Day in Lesson Sequence: 5-6** |
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| **Lesson Rationale:** What is the central focus of the lesson? What is the purpose for the content you will teach? How are you helping students build conceptual understandings, procedural fluency (if relevant), and critical thinking skills in this lesson? How will students make connections to other course content and to their experiences? What requisite skills do students need in order to access the lesson and participate fully? Where does this lesson fall within a learning sequence (What would come before? What will happen after?)? |
|  Adjusting temperature to either slow down or speed up a chemical reaction is something that all students have experienced in their personal lives, either deliberately or out of habit. For example: refrigeration or freezing is a well-known method to slow down food decomposition, cooking or baking food at higher temperatures means that it is done faster, bread dough rises more quickly in a warm place than in a cool one. Also, warm-blooded animals regulate body temperature so that their biochemical reactions run at the correct rate. We have all experienced an illness where fever allows the body’s immune system to speed up. Temperature is therefore a great introduction to this unit “Factors that affect the rate of chemical reactions”, as students will be able to draw on their own experiences to make a prediction on the effect of temperature on the rate of a chemical reaction. The warm-up exercises allow students to relate the topic of this lesson to their own experience, making the lesson more relevant and interesting. Also, in order for students to understand the effect of temperature, pressure, mixing, concentration, particle size, surface area, and catalyst on the rate of a chemical reaction, it is helpful to isolate the reaction as a single system and develop a model to describe it.   Students learned about the collision theory on day 2 of this unit, which will allow them to give more scientific explanations for the effect of temperature on the rate of reaction. On day 3, students learned how to calculate rates of reaction from data, which prepared them for this discovery lab in which they design a procedure to check the effect of temperature on the rate of reaction, and collect data. Students learned to draw models for complex chemical reactions to apply their knowledge of collision theory on day 4, and were also asked to indicate rate-determining steps in a process using energy diagrams for certain chemical reactions. The 3 previous days combined set students up for a successful discovery lab and application of learned skills. The online simulation allows students to see part of the effect of temperature change on molecules: they move faster, collide and react more often. It does not show correct orientation or sufficient energy though. That is addressed in the clarification part of this lesson. In the simulation, students predict, investigate and explain cause and effect, which is an important skill for everyday life. They also experience working with a system model, which is an important tool to explain and understand systems and ideas. Students make a prediction, explain their prediction, and design a procedure to test their prediction. These are important skills for anyone pursuing science, and prepare all students to think critically and be informed citizens. Students collect, organize, and analyze data, and draw a justified conclusion, which increases their critical thinking skills. Students are given time to formulate their own thoughts, but are also given several opportunities to discuss and compare their thoughts with their peers. This helps less secure students to gain confidence, allows students who need more time to fully participate, allows ELL students to think (and possibly discuss) in their first language, and also gives gifted students an opportunity to share their knowledge. Vocabulary from the previous days is listed on the board throughout the lesson, as well as the new vocabulary. This reminds students and the teacher to use these terms, which will improve fluency. This lesson is followed by a lesson focusing on the other factors that affect the rate of chemical reactions: concentration, surface area, particle size, mixing, pressure, and catalysts. |
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| **Content Standards:** (Minnesota State, Common Core, and/or National Standards): Cite constellation of standards, using the numeric code reference as well as the text, that are the focus of this lesson. If addressing only a part of a standard, italicize that part.  |
| MN State Standards and Benchmarks:9C.2.1.3.6 Describe the factors that affect the rate of a chemical reaction, including temperature, pressure, mixing, concentration, particle size, surface area and catalyst.Nature of Science and Engineering Benchmarks:4. Science Models, Laws, Mechanisms, and Theories Explain Natural PhenomenaDisciplinary Core IdeasPS1.B *Chemical Reactions*: how do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?ETS2 *Links Among Engineering, Technology, Science, and Society*: How are engineering, technology, science, and society interconnected?Crosscutting Concepts2. *Cause and effect*: investigating and explaining causal relationships and the mechanisms by which they are mediated.4*. Systems and system models*: defining a system and making a system model provides tools for understanding and testing ideas.Science Practices2. *Developing and using models*3. *Planning and carrying out investigations*4. *Analyzing and interpreting data*5. *Using mathematics and computational thinking* |
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| **Content Objectives:**  What do you want students to be able to *do* as a result of this lesson. *Use the following sentence frame:* Students will be able to (assessable action).  |
| SWBAT compare and contrast systems at different temperaturesSWBAT match energy diagrams to change in temperatureSWBAT explain how temperature affects chemical reaction rates using collision theorySWBAT write a procedure to test a predictionSWBAT make observations and collect dataSWBAT organize and process dataSWBAT draw a justified conclusion from data |
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| **Academic Language Objectives:** What language do you want students to be able to produce to demonstrate what they have learned in this lesson? |
| •*Technical Vocabulary:* What key vocabulary (“the bricks”) do you need to introduce/review with students and how will you engage students with that vocabulary in the lesson? Is this vocabulary being introduced, developed, or reviewed in this lesson? New Vocabulary:* Temperature: property which reflects the average kinetic energy of the particles in a system

Review Vocabulary:* Evaporation
* Chemical Kinetics: the branch of chemistry that is concerned with the rate of chemical reactions
* Rate of reaction: the speed at which a reaction happens = concentration of product formed over time
* Kinetic energy: energy of motion of particles (atoms or molecules) in a system
* Activation energy: minimum quantity of energy required to activate reactants to a state in which they can react

• *Academic language functions:* What function is essential for students to engage in learning within your instructional purpose? (eg. analyze, compare/contrast, explain, interpret, argue, persuade, categorize, describe, predict, question, retell, summarize, justify with evidence )Justify with evidence• *Language forms:* What phrases and words (“the mortar,” language and phrases typically invisible to native speakers) do students need in order to engage with the content concepts?* I think that the effect of \_\_\_\_\_\_ on \_\_\_\_\_\_\_\_\_ is \_\_\_\_\_\_\_\_\_\_ , because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* We observed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The effect of \_\_\_\_\_\_\_\_\_\_\_ on \_\_\_\_\_\_\_\_\_\_\_\_\_ is\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* According to the data, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Based on the data, we conclude that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

• *Interaction:* What opportunities will you provide for students to interact with the new technical vocabulary, academic language function and language forms to develop fluency (written and/or oral)?* Vocabulary from the previous days is listed on the board throughout the lesson, as well as the new vocabulary. This reminds students and the teacher to use these terms, which will improve fluency.
* Definitions for the vocabulary terms are referred to throughout the lesson
* Students are encouraged to use the new vocabulary terms and definitions in their explanations and conclusions
* Examples of the various language forms are written on the board and are also included on the discovery lab hand-out
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| **Assessment & Feedback** |
| **• Prior Knowledge Assessment:** How have/will you formally and/or informally assess what students already know, think, or can do relative to each objective? What misconceptions, alternative conceptions, or common errors does research show you could expect students to demonstrate related to the objectives? How will you plan to reveal and address misconceptions and common errors during the learning sequence? |
| **Prior Knowledge Assessment*** Day 5: Students write about food decomposition and consider how to influence the rate of decomposition
* Day 6: Write-share-SHARE: evaporation & particle characteristics at certain temperatures

**Misconception*** Many students believe that every collision of reactants leads to a reaction
* It is a common misconception that all particles in a system have the same amount of energy, depending on their temperature, rather than an average energy
* It is often thought that the activation energy changes with a change of temperature
* Many students struggle to read energy diagrams accurately
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| **• Formative Assessment:** In what ways will you informally and formally monitor student progress towards the objectives during the lesson? How will those assessments inform your teaching decisions during the lesson and in planning subsequent instruction? How will your students be able to use self-assessment and teacher feedback to deepen their understanding, refine their skills, and demonstrate subsequent growth?  |
| **Informal formative assessment**:* Teacher observes as students make and explain a prediction on their lab activity worksheet, and compare and discuss their prediction and explanation with their lab partner. Teacher observes as students work together to write a procedure to test their prediction, make observations and collect date, organize and process their data and draw a justified conclusion. Teacher listens to students’ discussions.
* Sticky Bars are used to check students’ ability to match energy diagrams to compare particles at different temperatures

**Formal formative assessment**:* Day 5: Prior Knowledge: Students write about food decomposition and consider how to influence the rate
* Day 5: 2-minute paper. Students explain the effect of temperature on the rate of reaction using collision energy and the effect of change in temperature on the kinetic energy of molecules
* Day 6: Prior Knowledge: Write-share-Share: evaporation & particle characteristics at certain temperatures
* Day 6: Exit card. Students list 5 situations from their daily lives in which a deliberate or accidental increase or decrease in temperature affects a reaction rate
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| **• Summative Assessment:** What culminating assessment(s) will students complete in the future that will allow you to evaluate their final mastery of the objective(s)?  |
| There is an authentic assessment as well as a summative assessment for this unit. **Authentic assessment**: Problem-solving Lab, in which students are expected to make and explain a prediction concerning the factors that affect the rate of chemical reactions, plan and carry out an investigation testing their explanation, observe and process data and draw a justified conclusion. Students present their prediction, investigation, data and conclusion in the form of an individual lab report. **Summative assessment**: unit test containing a combination of multiple choice questions, matching energy diagrams to given chemical reactions, calculating reaction rates from data, and a choice of 2 open-ended, critical thinking questions. This allows students to show their knowledge and skills in different ways, and sets them up for success. |
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| **Provisions for Learning Differences:** How does the design of instruction meet the needs of individual students and groups of students with particular learning needs (English Language Learners, students with IEPs, students with 504 plans, underperforming students, students with gaps in academic knowledge, struggling readers, and gifted students in need of greater support or challenge)? What adaptations and modifications will you make for specific individuals or small groups of learners? |
| **Students with Learning Disabilities**:* This students receives referential seating near the front of the class and grouping with a student that avoids frustration and promotes productivity
* New and review vocabulary is presented in oral and written form on the white board
* The lesson agenda is presented orally and also listed on the white board
* This lesson includes both verbal and visual directions for assignments, presented step-by-step if needed
* Students work together on the lab and on practice problems, which will help this student to keep up with the class pace, structure his/her time and organize and process data
* Notes will be provided for this student
* This lesson does not require a lot of reading
* Where writing is assigned, prompts will be given and typing is allowed
* Language forms will be given and modeled

**Students with ADHD**:* This students receives referential seating near the front of the class and grouping with a student that avoids frustration and promotes productivity
* This lesson contains hands-on learning opportunities
* Write-share-SHARE activities allow for discussions with peers and keep students on task

**ELL students**:* New and review vocabulary is presented in oral and written form on the white board
* This lesson includes both verbal and visual directions for assignments
* Notes will be provided for this student, if necessary
* Students work together on the lab and on practice problems, with opportunities for discussions with peers
* Language forms will be given and modeled

**Students who are struggling readers**:* New and review vocabulary is presented in oral and written form on the white board
* This lesson includes both verbal and visual directions for assignments

**Students with EBD**:* The lesson contains assignments that are routinely used, such as warm-up exercises, write-share-SHARE, and student collaboration for the discovery lab and problem sets
* This student will be carefully matched with a partner such that he/she can feel confident and participate equally in the group activity

**Gifted Students**: * Students will be grouped carefully
* Students have several opportunities to discuss their thought with peers
* Students design their own procedure to test their prediction
* Students choose how to present their processed data
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| **Materials:** What materials will you need in order to teach this lesson? What materials will students need?\*\*ATTACH ANY HANDOUTS, SLIDES, READINGS, ETC. NECESSARY TO COMPLETE THE LESSON.\*\* |
| **For the teacher:**Picture of a rotten food to be projected on the white boardPicture of an evaporating puddle on a sidewalk to be projected on the white boardNotebook to take notes as students are working on their discovery labEnergy diagrams for particles at different temperatures**For each student:**Half sheet of white printer paper for the warm-up exercisesDiscovery lab hand-out5 post-it notes**For each Lab team of 2 students:**Computer with internet connection<https://lab.concord.org/embeddable.html#interactives/sam/chemical-reactions/3-temperature-and-reaction-rate.json>**Students will need:**Pencil or penLab NotebookLesson Notebook |
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| **Learning Activities** |
| **Time** | **Learning Activities***For each section, clearly articulate:** *What the teacher will be doing;*
* *What students will be doing;*
* *Directions that will be given (including time cues, getting materials, forming groups, determining roles, tasks to be completed, etc.)*
* *Examples and/or information the teacher will provide;*
* *Questions and prompts the teacher will pose before, during, and following completion of an activity to elicit student articulation of their learning;*
* *Expected on and off-target student responses; planned teacher interventions;*
* *Any additional information that a principal, mentor teacher, or substitute teacher would need to observe or to carry out the lesson flawlessly*
 | **Rationale***For each learning experience (there may be multiple learning experiences within each section), clearly articulate:**• why you selected this instructional strategy;**• how individual and group learning needs are met,* *•  what learning you want to result from the experience.* |
| **-2-0****min****0-4****min** | **Lesson Launch** How will you motivate your students? How will you connect to your students’ previous experiences/background knowledge? How will you help students transition from the previous lesson to this one? |  |
| **Day 5****Preparation**Teacher:* Write new and review vocabulary on the board
* List the agenda on the board

**Warm-up exercise**Teacher: * Project a picture of a rotten food on the white board along with the question “Briefly describe how this happened and what could have prevented it” for a short write-share-SHARE (see attached file).
* Greet students at the door during passing time.
* Take attendance during warm-up exercise.

Students: * Write in their notebook a short description of what might have happened to this food that caused it to rot and how they could have influenced the rate of decomposition.

Teacher: * Get students’ attention.
* Ask students to share their story with their table partner.
* Walk around to find out who wrote the funniest story and the most chemically correct description.
* Ask those students to share their story.
 | It is important to all students, but especially those who struggle with organizational, behavioral, and language skills to have a visual on the board for both the agenda and the new and review vocabularyWarm-up exercises are great to get students to settle down to learn as soon as they enter the classroom, while the teacher first greets students at the door during passing time, and then takes attendance.Throughout this Chemistry course, we have focused on food chemistry to help students understand that chemistry is part of their everyday lives. This warm-up exercise will not only get their attention, it will also guide them to use their knowledge about the effect of temperature on the rate of chemical reactions (refrigeration slows down food decay). Writing a short description allows students to draw on their own experiences.  |
| **5-10****min****10-12****min****13-17****min****18-21****min****22-45****min****46-51****min****52-55****min****0-4****min****5-12****min****13-15****min****16-18****min****19-22****min****23-30****min** | **Instructional Task(s) Sequence** What learning experiences will you engage students in that will help them build the understandings and skills needed to meet the content and language objectives?  |  |
| **Discovery**Teacher:* Get students’ attention to start the lesson.
* Tell students and write on the board today’s question: “How does temperature affect the reaction rate?”
* Tell students that they will find out for themselves using a computer simulation
* Give students both verbal and written directions and expectations for the discovery lab, including language forms
* Hand out the discovery lab hand-outs to each student
* Remind students to write their name, block, and date
* Give students time to think about and write their prediction and explanation for the effect of temperature on reaction rates based on their existing knowledge

Students:* Write their prediction and explanation

Teacher:* Stay at the front of the room quietly to indicate that students should be working or use proximity as needed
* Pair up students with their table partner
* Ask students to discuss their prediction and explanation and prepare to share out
* Walk around the classroom to listen to conversations
* Ask 2 students to share their prediction with the class
* Encourage questions, comments and discussion, but don’t correct or give explanations
* Tell students to get a computer from the cart, check their email and click on the link for the simulation
* Give students a few minutes to get to know the simulation
* Direct students to write a procedure to test their prediction, record and process their data, and write a conclusion
* Tell students they will share their work visually with the class at the end of the lesson

Students:* Work together on the discovery lab

Teacher:* Walk around the classroom to observe, prompt where necessary, and check appropriate computer use
* Use proximity when students are off-task
* Give students a 5 minute notice to the end of the activity
* Instruct students to display their work on their table and walk around the classroom to look at each others work

Students:* Walk around the classroom to look at each others work

Teacher:* Ask students to return to their seats
* Lead a brief class discussion, encouraging questions
* Collect lab hand-outs

**Day 6****Warm-up exercise**Teacher:* Project a picture of a drying sidewalk along with the question “How does the water in a puddle evaporate on a 60˚ day in April?” for a short write-share-SHARE (see attached file)

Students:* Write a short description of the evaporation process
* Share their description with their table partner

Teacher:* Walk around the classroom and find out which students know that the water molecules in a puddle have different energy, which allow some water molecules to evaporate even though the water is not boiling
* Ask 2 students to share their description

**Clarification:**Teacher:* Build off students explanation for water evaporation at temperatures lower than boiling point
* Clarify, if necessary, that evaporation is the process of a liquid becoming a gas
* Show an image for evaporation on the white board:

:d0d92755-edbd-48e8-aef5-5bf06d550a00.gif* Clarify that evaporation is about the energy in individual molecules, not about the average energy of a system: not all molecules in a liquid have the same energy. Atoms with enough energy can escape from the liquid and turn into a vapor
* Check for understanding with showing 1-5 fingers
* If necessary, describe a class of students in the gym: not everyone moves at the same speed, but we could calculate an average speed
* Tell students, and write on the board that the energy that is measured with a thermometer, the temperature, is the average energy of all molecules in the system.
* Tell students to explain to their table partner how a puddle of water evaporates

Students:* Explain to their table partner how a puddle of water can evaporate

Teacher:* Bring the class back
* Tell students that there is a way to represent the range of energy of molecules in a system at a certain temperatures and show them the following diagram

**:temperature .png*** Give students a minute to study the diagram
* Ask students to discuss the diagram with their table partner
* Ask students to name the x- and y-axis and explain
* Point out the Ea in the diagram and ask students to discuss with their table partners what the shaded area means
* Walk around to listen to students’ discussions
* Ask 2 students to share their thoughts, who understand the concept
* Check for understanding using Sticky Bars assessment: students match energy diagrams to compare particles at different temperatures
* Lead a discussion and invite student explanations and questions
 | All students benefit from clear directions and expectations. Writing them on the board will help visual students.Students are given time to formulate their own thoughts, but are also given several opportunities to discuss and compare their thoughts with their peers. This helps less secure students to gain confidence, allows students who need more time to fully participate, allows ELL students to think (and possibly discuss) in their first language, and also gives gifted students an opportunity to share their knowledge.It is important to assign students to a group. Allowing them to choose their own groups will take up valuable class time, will lead to off-task behavior as friends partner up, and will leave out certain students who might not be as popular. Assigning groups allows a teacher to optimize learning, by sometimes pairing students of similar ability and other times planning for a supportive partner for a struggling student.It is considerate to warn students that they are expected to share their work with the rest of the class at the end of the lesson.Allowing students to work together increases their social skills, lowers their anxiety, promotes discussion and critical thinking.In order for students to understand the effect of temperature, pressure, mixing, concentration, particle size, surface area, and catalyst on the rate of a chemical reaction, it is helpful to isolate the reaction as a single system and develop a model to describe it. Students will look for patterns in lab observations and use their knowledge about collision theory and activation energy to answer the “How did the increase in temperature cause the reaction to speed up?” Students learn that causation is not always guaranteed. The reaction rates of many common reactions double with each 10˚C rise in temperature, but not always. The actual rate increase must be determined experimentally. It is considerate to give students a 5 minute notice to the end of the activity to allow them to wrap up before sharing their work.Evaporation is a topic that was taught in Middle school. Allowing students time to recall their knowledge and then share with a peer increases the chance that students remember.It is better to call on students to share their ideas, after they had an opportunity to share with a peer, than to ask for volunteers: students are more motivated to participate if they know they might get called on, students who are too shy to raise their hand are given a chance to share their thoughts, and students don’t need to wonder if their thoughts are worthwhile enough to be heard.Images help all students visualize the concept at hand, and especially ELL students, and students with ADHD (who may get off-task if the instruction is completely verbal).In my experience, students are more likely to raise only 2 fingers when they don’t understand the concept, than raise their hand to ask for clarification.Asking students to repeat the information that was shared to their table partner increases the likelihood that all students fully understand. It is also an opportunity for the teacher to hear misconceptions, or misunderstanding.Many students struggle to read graphs and diagrams. It is important to give them time to consider the diagram before discussing or explaining it, especially for students who need more time to process. Asking students to discuss the diagram with their table partner is another way to increase their level of understanding, and an opportunity for the teacher to check the level of understanding in the class. Math plays a very important part in chemistry. Pointing to and explaining all parts of a graph helps students see the relationship that is portrayed.The Sticky Bars Assessment allows students to get out of their seat and walk over to the board, which provided a break for all students, but especially students with ADHD. It resets the brain, allowing for renewed energy to continue the lesson. |
| **31-48****min****50-52****min****53-55****min** | **Lesson Summary** **and Closure** How will key points of the lesson be articulated and summarized? By whom? How will you help students transition to the upcoming lessons on this topic?  |  |
| * Bring the class back to attention
* Briefly review and write on the board the definition for collision theory: “reactants that collide with the correct orientation and sufficient energy *may* react to form product(s)” (day 2)
* Ask students if they observed this in the simulation: they should have seen that some collisions did not result in a product, especially at lower temperatures
* Briefly review and write on the board the definition for the rate of reaction: “the speed at which a chemical reaction happens” (day 3)
* Ask students how they measured the rate of reaction in the discovery lab: hopefully they will come up with something like: Rate of reaction = ∆ [product]/∆ time
* State that it has been observed experimentally that a rise of 10 °C in temperature usually doubles or triples the speed of a reaction between molecules.
* Ask students to briefly discuss with their lab partner if they came to the same conclusion in yesterday’s simulation
* Ask several students to share and invite students comments
* Remind students that the activation energy for a chemical reaction does not change with temperature.
* Explain that the average increase in particle [kinetic](https://www.boundless.com/chemistry/definition/kinetics)[energy](https://www.boundless.com/chemistry/definition/kinetic-energy) at higher temperatures means that a greater proportion of the reactant molecules now have the minimum energy necessary to collide and react, so the rate of the reaction increases. Similarly, the rate of reaction will decrease with a decrease in temperature.
* Ask students to write a 2-minute paper on the effect of temperature on the rate of reaction using collision energy and the change of particle kinetic energy

Students:* Write a 2 minute paper
* Turn in the paper

**Transition to upcoming lesson:**We looked at the effect of temperature on the rate of reaction in this lesson. Tomorrow we will explore other factors that affect the rate of chemical reactions.**Application:**Exit card. Students list 5 situations from their daily lives in which a deliberate or accidental increase or decrease in temperature affects a reaction rate. | Drawing connections among the ideas/knowledge from the last 3 lessons shows students the interconnectivity of scientific knowledge, and models a higher level of cognitive thinking.Comparing and contrasting, valuing, and defending conclusions with a peer allows students to practice an important life skill.By asking students to write a 2-minute paper, they have the opportunity to put new ideas into their own words, which will greatly increase retention of new knowledge, show misconceptions and level of understanding. Students started this unit relating the effect of temperature to their own experiences, and ending the lesson with listing applications allows them to recognize the role of chemistry in their everyday lives. |
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| **Management and Safety Issues:** Are there management and safety issues that need to be considered when teaching this lesson? If so, list them. What will you do to prepare students for these issues?  |
| Management Issues: any time students are asked to work on computers, there is the potential for them to use the computer in inappropriate was. Students will be monitored throughout the activity.Safety Issues: There are no safety issues with this lesson |
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**Day 5: Warm-up Exercise**

Write-share-SHARE

Projected on the white board:

“Briefly describe what happened and how you could have prevented it.”



11th grade Chemistry

Lab Activity

Temperature & Rate of Reaction

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block:\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_

Group members:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Procedure:

Go to “Rate of Reaction Simulation” in Safari:

[https://lab.concord.org/embeddable.html#interactives/sam/chemical-reactions/3-temperature-and-reaction-rate.json](https://lab.concord.org/embeddable.html%22%20%5Cl%20%22interactives/sam/chemical-reactions/3-temperature-and-reaction-rate.json%22%20%5Ct%20%22_blank)

How does temperature affect the rate of reaction?

1. Based on what you already know from your own experiences, what do you predict is the effect of temperature on the rate of reaction?

*I predict that*

1. Why do you think that?
2. Using the “Rate of Reaction Simulation” provided, describe how you will test your prediction.
3. What were your results?

Record and process your data here in a clear, easy-to-read format.

1. What do you conclude about the affect of temperature on the rate of reaction?

*Based on our data, I conclude that*

1. If you had more time and access to any materials, how could you improve this experiment?

**Day 6: Warm-up Exercise**

Write-share-SHARE

Projected on the White Board:

“How does the water in a puddle evaporate on a 60˚ day in April?”

