

ACID-BASE REACTION SCIENCE EXPERIMENT

Ages 11-14 (Level 3)

Description:	Teach your child how to conduct and report on scientific experiments with this simple acid-base reaction experiment
Leading question:	How would a scientist conduct and report on an experiment?
Age group:	11-13 year old
Subjects:	Science – chemistry
Total time required:	20-40 mins a day for 10 days (total of ~5 hours)
Self-guided / Supervised activity:	Low supervision by parents or guardians/mostly self-guided
Resources required:	Notebook, pen/pencil, glass jar, vinegar, egg, spoon, measuring tape or string, rubber band, or thread

Day	Time	Activity and Description
1	5 minutes (15 minutes)	<p>The learner will be conducting an experiment with the objective of learning about the scientific method and how scientists work. They will accomplish this through an activity where they will observe an acid-base reaction in real life by exploring what happens to eggs that are placed in vinegar, and present their findings</p> <p>Ask the learner what she or he thinks will happen when eggs are submerged in vinegar? What happens when an acid and base mix? If she or he struggles to answer, the learner can review the acids bases and salts unit and solve 5-10 questions around the following:</p> <ul style="list-style-type: none"> • The difference in properties between acids and bases- ex: acids turn blue litmus paper red while bases do not change the color of blue litmus paper; acids do not change the color of red litmus paper while bases turn it blue; acids are sour while bases are bitter and soapy • Examples of each: acids - citrus fruits, vinegar; bases - soap, baking soda etc. • Neutralization: when acids and bases react, they cancel each other's effect and the result is salt, water and energy in the form of heat • Illustrate neutralization as: acids + bases → salt + water. e.g. $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$. <p>P.S.: you can ask the learner true or false questions to check for their understanding after you review the unit. You can refer to appendix 1 for an overview of acids and bases.</p>

	<p>5 minutes</p> <p>10 minutes</p> <p>20-30 minutes</p>	<p>The learner will write down what they think will happen as a result of conducting this experiment. Explain that this is called a hypothesis and that scientists and researchers conduct experiments to test hypotheses, just like she or he will be doing!</p> <p>The learner will elaborate on their hypothesis using scientific concepts from their curriculum (acids, bases, and salts unit – الأحماض والقلويات والأملاح) – what happens when a base and acid react? Once the learner has a good grasp of the concepts, ask them whether they think neutralization is real and if it can be observed in real life. Get them excited about the experiment by saying this will be their chance to test this phenomenon in real life!</p> <p>The learner will have all required materials ready and start the report by entering and filling out the following sections:</p> <ul style="list-style-type: none"> ● Objective of experiment ● Equipment used ● Hypothesis
2	10-20 minutes	<p>The learner will measure the egg's circumference and set up with minimal supervision if safe and possible:</p> <ul style="list-style-type: none"> ● Measure and record the circumference of the middle portion of the egg in cm ● Place the egg in a jar, cover it with vinegar and store in a safe place. You should see bubbles forming at the surface of the shell <p>Note: if you do not have measuring tape, use a piece of string or thread, or a broken rubber band to measure the circumference:</p> <ul style="list-style-type: none"> ● Wrap the thread or string tightly around the egg, but make sure you are gentle enough so as not to break it ● Make sure your finger is placed at the point where the end of the string and the rest of it meet as shown below. <div data-bbox="516 1381 873 1642" data-label="Image"> </div> <p>Source: https://www.gettyimages.ae/photos/turkey-egg?mediatype=photography&phrase=turkey%20egg&sort=mostpopular</p> <ul style="list-style-type: none"> ● Mark the point where the string/thread/rubber band meet with a pen ● Use a ruler to measure the length of the string or thread from the end to the point that is marked

	5-10 minutes	<ul style="list-style-type: none"> Record the circumference <p>The learner will enter and complete the setup/apparatus section of her/his report in the notebook with details of measurement and timing of submersion. Learners can also take a picture to document the setup of the experiment, if a camera or phone camera are available.</p>
	5-10 minutes	The learner will document what he or she saw when the egg was first submerged (bubbles forming) and what he or she expects to see tomorrow
3	5 minutes	The learner will replace the vinegar in the jar after 24 hours have passed and re-submerge the egg in fresh vinegar. Leave it undisturbed in the jar for a week
	10-20 minutes	The learner will record what is happening, the changes being observed and what he or she expects to happen at the end of the experiment
	10-20 minutes	The learner will look around the house for examples of different acids and bases in different household products and items. The learner will reflect on what would happen if some of these were mixed together and write down his or her reflections in the notebook.
4-9	5 minutes	Every morning check on the state of the egg without taking it out of the jar. You only need to replace the vinegar after the first day.
	5 minutes	Ask the learner about what he/she observes. Have a conversation about the changes you are seeing
	10 minutes	The learner should update their report in their notebook with all relevant observations
	30-60 minutes	<p>The learner will spend ~10 minutes daily working on their final presentation on a big chart paper. The presentation should include the following sections:</p> <ul style="list-style-type: none"> Driving question of project as header What is the objective of your experiment? (Write 1 paragraph introducing it) What did the set up consist of? What materials did you use? Can you illustrate the set up? (Draw an illustration of the set up with all the tools used – container, vinegar, egg, spoon, measuring tape etc.) What is your hypothesis? (Write down the hypothesis from day 1 and do some research to find out and write Down the formula for this chemical reaction. The learner can also refer to their textbook for this or other examples of acid-base reactions.) What did you observe each day? What were the results at the end of the experiment? What daily changes were observed? Was our hypothesis supported?

	(10 minutes)	<ul style="list-style-type: none"> • What is your conclusion/main takeaway from the experiment? (Write a paragraph) • What are some real life applications and uses of neutralization (in day to day life, industry etc.)? (The learner can refer to their textbook, find online resources, or ask an adult!) • What did you learn about being a scientist? • Can you explain the scientific method through either a paragraph about how you used it, or an illustration such as the following? <div data-bbox="516 562 1062 1024" style="text-align: center;"> <pre> graph TD A[Research Question] --> B[Hypothesis] B --> C[Experiment] C --> D[Results/ Draw Conclusions] D --> E[Hypothesis Supported] D --> F[Hypothesis Not Supported] E --> G[Report Results] F --> G G --> A </pre> </div> <p>Source: https://courses.lumenlearning.com/suny-nutrition/chapter/1-13-the-scientific-method/</p> <p>Optional and internet access dependent tip: To make these quieter days of the project more fun, the learner can post photo/video/"boomerang" updates of the egg (without taking it out of the jar) starting from day 1 of the experiment.</p> <p>Let her or him have some fun with it by posting it on stories, asking story questions and/or making polls on their social media account. The learner can also create a separate Instagram account for the egg or their projects in general. They can add their friends and post project updates of individual or group projects conducted remotely!</p>
10	<p>5-10 minutes</p> <p>2 minutes</p> <p>15-20 minutes</p>	<p>A week later, the learner will take out the egg from the jar, discard the vinegar, clean the jar and store it away</p> <p>The learner will measure the circumference of the egg again and record it in the notebook</p> <p>The learner will reflect on, discuss the changes he or she observes, and record them in the results and conclusion sections:</p> <ul style="list-style-type: none"> • Why has the acid (vinegar) reacted in this manner with the base (eggshell)?

	20-30 minutes	<ul style="list-style-type: none"> • How do the results compare to the hypothesis from day 1 of the experiment? • Do all acids and bases have the same reaction? • What is another experiment we can try to test this? <p>The learner will make final modifications to their chart and present their findings to the family!</p> <p>Note: you can also shorten the activity by taking out the egg 3-4 days after the initial vinegar replacement on day 3.</p>
Assessment Criteria:	<ul style="list-style-type: none"> - Successful completion of experiment and achievement of dissolved outer shell and translucent egg with inner membrane intact - Complete report with the following sections: objective, hypothesis, observations (day 1-7), results and conclusion - Presentation of findings and experience as scientist 	

Learning outcomes:	<p>Acid-base reactions visualized Setting up a scientific experiment Writing a scientific experiment report Presenting research findings Vocabulary – hypothesis, neutralization</p>
Required previous learning:	Grade 7 Chemistry: acids, bases, and salts knowledge (neutralization effect)
Inspiration:	Naked Eggs: Acid-Base Reaction
Additional enrichment activities:	You can help the learner explore the concept of adding variables to a scientific study by comparing results across different types of eggs (free range vs commercial, quail vs hens, fresh vs old etc.) or type of liquid by testing the reaction of eggshells to water, soda etc.)

Appendix 1

Acids	Bases
taste sour	taste bitter
turn blue litmus paper red	turn red litmus paper blue
corrosive to metals	slippery feel
release H ⁺ ions in water (Arrhenius definition)	release OH ⁻ ions in water (Arrhenius definition)
react with bases in neutralization relations	react with acids in neutralization reactions

Source:

http://hfs.ncvps.org/Curriculum/APChemistry/ModuleFour/ChemicalReactionsLesson/APChem_ChemicalReactions_ToGo7.html
