

STEM Week	I'd Like to Be an Oncological Research Scientist	Biomedical Engineering
Topic	Curing Cancer	
Learning Outcomes	Through completing the Curing Cancer activity, students will design, build, and test a filter to separate cancer cells from healthy blood cells.	
ISTE Student Standards	<p><b>1.4 Innovative Designer</b> - Students use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions</p> <p><b>1.4a</b> Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.</p> <p><b>1.4b</b> Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.</p> <p><b>1.4c</b> Students develop, test and refine prototypes as part of a cyclical design process.</p> <p><b>1.4d</b> Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.</p>	
MA STE Frameworks	<p><b>The Science and Engineering Practices</b></p> <ol style="list-style-type: none"> <li>1. Asking questions and defining problems</li> <li>2. Developing and using models</li> <li>3. Planning and carrying out investigations</li> <li>4. Analyzing and interpreting data</li> <li>5. Using mathematical and computational thinking</li> <li>6. Constructing explanation and designing solutions</li> <li>7. Engaging in argument from evidence</li> <li>8. Obtaining, evaluating, and communicating information</li> </ol> <p><b>ETS1. Engineering Design</b></p> <p><b>4.3-5-ETS1-3.</b> Plan and carry out tests of one or more design features of a given model or prototype in which variables are controlled and failure points are considered to identify which features need to be improved. Apply the results of the tests to redesign a model or prototype.</p> <p><b>4.3-5-ETS1-5(MA)</b> Evaluate relevant design features that must be considered in building a model or prototype of a solution to a given design problem.</p> <p><b>6.MS-ETS1-1.</b> Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution. Include potential impacts on people and the natural environment that may limit possible solutions.</p> <p><b>6.MS-ETS1-5(MA)</b> Create visual representations of solutions to a design problem. Accurately interpret and apply scale and proportion to visual representations.</p> <p><b>6.MS-ETS1-6(MA).</b> Communicate a design solution to an intended user, including design features and limitations of the solution.</p> <p><b>7.MS-ETS1-7(MA)</b> Construct a prototype of a solution to a given design problem.</p>	

	<p><b>ETS2. Materials, Tools, and Manufacturing</b>  <b>6.MS-ETS2-2(MA).</b> Given a design task, select appropriate materials based on specific properties needed in the construction of a solution.</p>
Targeted Academic Language (vocabulary)	<p><i>benign tumor:</i> A non-cancerous growth that cannot invade other parts of the body.</p> <p><i>cancer:</i> A disease in which abnormal cells divide uncontrollably and destroy body tissue.</p> <p><i>chemotherapy:</i> the treatment of diseases, such as cancer, with chemical substances that are toxic to fast-growing cells.</p> <p><i>deoxyribonucleic acid:</i> abbreviated DNA, a self-replicating material present in nearly all living organisms as the main constituent of chromosomes. It is the carrier of genetic information.</p> <p><i>malignant tumor:</i> A tumor capable of spreading to other parts of the body.</p> <p><i>oncologist:</i> A doctor who specializes in treating people with cancer.</p> <p><i>radiation therapy:</i> The treatment of disease, especially cancer, using high-energy radiation, such as x-rays or gamma rays.</p> <p><i>tissue:</i> A group of similar cells that work together to carry out a specific function (such as skin, bone, muscle).</p> <p><i>tumor:</i> A swelling of a part of the body caused by an abnormal growth of tissue, whether benign or malignant.</p>
Materials	<ul style="list-style-type: none"> <li>● Straws</li> <li>● String</li> <li>● Paper clips</li> <li>● Tooth picks</li> <li>● Popsicle Sticks</li> <li>● Plastic spoons</li> <li>● Paper</li> <li>● Tin foil</li> <li>● Tape</li> <li>● glue</li> <li>● Scissors</li> <li>● Rulers</li> <li>● 2 different size candies to represent Cancer cells (ex. Skittles and gummy bears)</li> </ul>
Resources	<p><a href="#">What is Cancer? Design Sheet</a></p>
Essential Question	How do we develop methods to treat or cure cancer?
Pre Guiding Questions	<p>What is cancer?</p> <p>How does it affect the body?</p>

	<p>What do medical research scientists do? How do we develop targeted treatments for cancer or any other disease?</p>
<p>Instructional Procedure</p>	<p><b>Introduction (30 minutes)</b></p> <ul style="list-style-type: none"> <li>● Begin the lesson by having a class discussion using the Pre-Guiding questions. No correct answers are needed at this time - students should simply be sharing their current knowledge. Questions will be answered throughout the lesson.</li> <li>● Use the <a href="#">What is Cancer?</a> Deck to introduce students to how cancer affects the body</li> </ul> <p><b>Lesson Development (60 minutes)</b></p> <ul style="list-style-type: none"> <li>● Divide the class into groups of three students each.</li> <li>● Instruct students to adopt a role for this activity. Potential roles within the group include surgeon, cell counter, materials manager, timer, note-taker, etc.</li> <li>● Have each group brainstorm designs for its cancer removal tool, select the most promising design, and make an engineering drawing on the back of the worksheet that includes labels of all materials they plan to use.</li> <li>● When the drawings are finished, groups show them to the teacher. Upon teacher approval, groups each team receive a bag of lentils, bag of lima beans, paper cup (the biomedical "trash can"), a stopwatch/timer and the requested materials, as specified in their approved designs.</li> <li>● Give groups time to build their designs.</li> <li>● When a tool is built, a group may immediately start testing. After beating or losing the battle with cancer, students improve their designs when possible and then start the battle again at Trial 1 (with an appropriately challenging number of cancer cells).</li> </ul> <p><b>Wrap Up/Closing (20 minutes)</b></p> <ul style="list-style-type: none"> <li>● Start by having the students clean up their stations. Dispose of materials that are single use and save materials that can be reused for other activities.</li> <li>● What worked well when you tested your filter? What didn't work?</li> <li>● How would you improve your filter?</li> <li>● Do you think filters are the best way to treat/cure cancer? Why or why not?</li> </ul>
<p>Assessment</p>	<p>Filters Filter test results</p>
<p>Accommodations/ Differentiation</p>	<ul style="list-style-type: none"> <li>● Read-aloud</li> <li>● Scribing</li> <li>● Peer support</li> <li>● Google Translate</li> </ul>

Reflection/Next Steps	How will you know if the students retained any of the information presented today? Were the students engaged? If not, what could you do differently next session? If they were engaged, what specific parts of today's lesson worked well? Did you provide enough differentiation so that all students were able to work at their l
Instructional Tips/ Strategies/	Do the activity yourself, before trying it with students. Keep the supplies organized throughout the activity Provide students with time checks throughout the activity
Notes	