



ADAPTING PERIMETER'S RESOURCES FOR ONLINE CLASSROOMS

All teachers have slightly different styles, but when constrained to an online or virtual classroom, available teaching tools need to be modified.

Adapt Perimeter Resources (and your own lessons) for the virtual classroom with these suggested strategies:

SHARING INFORMATION

- Connect with live, direct instruction using an online tool designed for meetings (ie. Zoom, Google Hangouts, Ring Central etc).
- Screencast (record your computer/tablet screen) with voiceover using free screencasting applications
- Provide digital slide presentations with complete note sections to students

DISTRIBUTING WORKSHEETS

- Use email, an online file-sharing program (ie. Dropbox, Google Docs etc) , or a virtual classroom environment to share tasks, instructions, or activities with students
- Use your own established teacher website to provide an organized and familiar method of distribution

COMPLETING AND COLLECTING WORK

- Depending on your school jurisdiction, you may already have directions for collecting and/or assessing work during closures
- The form of student work (paper/digital) will depend on your situation - be sure that students know what is required
- Students could complete paper worksheets and then scan/photograph and send them to their teacher
- Students could complete assignments digitally and submit them to an online drop box

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It Does Matter	Activity 2 - What's the Matter with Change?	Elementary	Changes of state, physical changes, heat	Instead of performing a live demo, suggest students watch a YouTube video (created by you or something like https://www.youtube.com/watch?v=3v98madaW1M). When you activate their learning, you will need to give specific instructions and prompts because you won't actually be there to help them. Transform the Powerful Ideas part of the lesson into a reading assignment about the states of matter and encourage them to perform their own research (books and technology) about changes of state.
It Does Matter	Activity 3 - About the Cost of Production	Elementary	Environmental impact of changes of state in manufacturing	Change the hook into a do-at-home experiment as these materials are easy to obtain. Instead of asking the questions in person, consider adapting and using questions in the lesson as written prompts for students to consider after the experiment. Have students perform the research project about the manufacturing of a consumer product individually. The "How It's Made" channel on YouTube is a fantastic resource. The blackline masters for this lesson fit an online version very well.
It Does Matter	Activity 4 - 3D Printing: Matter of the Future	Elementary	Volume of a rectangular prism, solving problems using a formula	Adapt this lesson by having the students watch a video on 3D printing (there are lots online, but try these ones to get started: https://www.youtube.com/watch?v=QDXBHGE07MI and https://www.youtube.com/watch?v=Vx0Z6LplaMU). Have the students use sugar cubes to follow written instructions about layering and calculating volume in the Activate Learning section. Then move on to the design and modelling of their 3D objects. Have them estimate the volume of their object in the same way as described in the resource. As closure, have them post pictures of their object and its estimated and actual volume and complete the exit slip.
It Does Matter	Activity 5 - Math, Matter and Mini-Ice Rinks	Elementary	Solving volume problems in real life; collect, organize and display data from an experiment	This lesson can be used with minor modifications. Students will work individually using products around their home. Substitute measuring cups for graduated cylinders, etc. You can omit the hook for this activity and provide an inquiry worksheet to guide their thinking through the activity.
It Does Matter	Activity 6 - The Amount of Waste	Elementary	Environmental impact of waste; applying knowledge of volume to a new situation	This lesson can be used with minor modifications. Shift the set of prompts to a home situation. Ask students to use their knowledge of volume to estimate the volume of garbage in one can for the family. Then continue with the activity but modified for their family. Pick and choose appropriate extensions for your students to complete. There are many important questions posed that can be done individually.
It Does Matter	Activity 7 - Trash Compactor Challenge	Elementary	Design/Build/Test a device	This design challenge is perfect for students to do from home. You may need to provide some video resources about simple machines as this is learning from grades 2 and 4. Have students work through the blackline masters and then post images of their devices to your online classroom!
Mission Possible	Activity 1 - Making Models: Philae Comet Lander	Elementary	Making Models: engineering cycle, design/build/test/improve a device	This lesson is well suited for virtual classrooms and can be completed individually at home. This is a version of a classic design challenge where students build and test a device. Some collaboration can be completed online with friends from class but for the most part students work individually.

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Mission Possible	Activity 2 - Representing Mathematical Thinking	Elementary	Displaying data, connections between percent and decimal numbers; all in relation to space science	Use this lesson as printed in the resource. Replace the in-class hook for a similar youtube video showing an easy percentage or fraction that could be counted and expressed. The Activate Learning section can be adapted to an individual activity in a journal. Use images of data to give students prompts. The blackline masters in this activity can be used individually. The group work at the end of the activity can be adapted to fit with an online discourse or omitted.
Mission Possible	Activity 3 - Comparing Parts of the Whole	Elementary	Work with fractions, decimals and percents; communicate how to use data as proof.	With a few adaptations, this lesson and its blackline masters can be used in an online learning environment. Change the Activate Learning section from a class discussion or a think-pair-share into a series of written prompts that students could respond to in a journal. If your students have access to online video conferencing, have them perform the group discussions virtually. Consider providing a sample solution set so that students (or parents) can check their answers.
Mission Possible	Activity 4 - Making Connections: Fractions, Decimals and Percents	Elementary	Relationships between fractions, decimals and percents; explain how data can be used to make convincing arguments	Suggest that students watch a selection of videos on their own and encourage them with the prompt provided in the resource. Have students complete the blackline masters on their own.
Temperature Rising	Activity 1 - The Mini-Research Station	Elementary	Volume of triangular prism and rectangular prism	This lesson can be broken into two separate activities. Students can do the “hook” portion with a parent or sibling at home. In the second part, students utilize materials from their home (straws, popsicle sticks, paper clips, etc.) and then calculate volume using the worksheet provided. Finally, students can use the exit slip to reflect on what they’ve learned.
Temperature Rising	Activity 3 - Heat Transfer Investigations	Elementary	Conduction and convection methods of heat transfer	Students can do the Teacher Demonstration at home with a parent’s help. If students have made their Research Stations, this activity is quite easy for them to do with minimal modifications.
Temperature Rising	Activity 5 - The Future of our Hot Earth	Elementary	Literacy skills; thinking critically about scientific information	This activity is designed for students to read a passage and to summarize it in their own words. If it is not possible to facilitate small groups and give oral presentations, students can write a summary and share their ideas via email with a small group from their class. Students can use “exit slips” as starter questions.
Temperature Rising	Activity 6 - Parts Per Million	Elementary	Solve problems using the calculation of unit rates	To set the stage for what PPM means, have your students watch a YouTube video such as https://www.youtube.com/watch?v=aa-m8a-jZ0k . This will help them visualize the concept of PPM before working on this activity. Have students analyze the graph and hypothesize the meaning of the spike in Carbon Dioxide. Finally, have them work on the “exit slip” questions as a worksheet.
Temperature Rising	Activity 7 - Climate Data	Elementary	Read, interpret and draw conclusions from primary and secondary data; make connections to climate change	Have your students skip the hook and go directly to the Activate Learning activity. They can collect heart rate data from anyone in their family instead of a partner. They can graph their data and compare with peers using photos or Google sheets. Next, have each student evaluate all graphs and compare them. Encourage students to look at the axis and focus on units. Students can independently fill out the “exit slip” questions and submit them as worksheets.

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Temperature Rising	Activity 8 - That Data is not Fair	Elementary	Collect and organize primary data and display the data in charts or graphs	This activity must be adapted. In order to collect primary data, students can call 20 friends or family members and ask them a question about their favourite _____. They'll work out percentages and create a graph with their data on worksheet 8.1.
Automated for the Future	Activity 3: Building Systems - Design and Technology Challenge	Elementary	Simple machines (eg. pulley, lever, wheel and axle) and their applications	Send students BLM 3.2. Working alone or in virtual groups, have students design their vehicles and send their designs to you for approval to build them. Once approved, students can build their vehicles. Note: Suitable for students capable of handling open-ended activities. If you're able to share the video with your students, they may benefit from watching it before doing this activity.
Automated for the Future	Activity 4: Cool Coding Systems	Elementary	Automated systems, simple machines	Send students the activity "Instructions for Drawing a Simple Picture" and have them complete the activity.
Automated for the Future	BLM A.7 Show What You Know - Math	Elementary	MATH: circles, circumference, radius, diameter, $C = 2\pi r$	Send students BLM A.7 and have them complete it. Encourage your students to present their completed worksheet to a sibling or parent.
Automated for the Future	BLM A.8 Show What You Know - Math	Elementary	MATH: circles, circumference, radius, diameter, $C = 2\pi r$	Send students BLM A.8 and have them complete it. Encourage your students to present their completed worksheet to a family member or a friend via video chat.
Automated for the Future	BLM A.9 Show What You Know - Science	Elementary	Simple machines, automated systems	Send students BLM A.9 and have them complete it. Encourage your students to present their completed worksheet to a family member or a friend via video chat.
Automated for the Future	BLM A.10 Show What You Know - Science	Elementary	Simple machines and their applications, automated systems	Send students BLM A.10 and have them complete it. Encourage your students to present their completed worksheet to a family member or a friend via video chat.
Process of Science	Activity 2 - Why Is It Like That?	Elementary/Junior	Process of Science/ Modelling; Observation/ Inference; Skill-building and scientific literacy	Instead of physical objects or images at stations, send photographs to students and ask them to complete graphic organizers individually first. Then have them connect online with a few friends to add to each other's graphic organizers. They can use a different colour pen or font colour when they add the products of their collaboration.
Process of Science	Activity 3 - What Do You See?	Elementary/Junior	Process of Science/ Modelling; Observation/ Inference; Skill-building and scientific literacy	Send the footprints picture to students and ask them to share their stories verbally in an online classroom or submit their written stories to you. Have them connect with a friend to discuss their ideas. Discuss the ideas of inference vs observation and how we use these to build models or stories to describe what we see.
Process of Science	Activity 6 - Thinking Deeper	Junior/Senior	Process of Science/ Modelling; Asking deeper questions	This lesson can be completed online/at home easily with few modifications. Provide links to the Alice and Bob videos and Minutephysics videos. Have students complete the questions and the storyboard. To share their final storyboard, have them post it to a social media platform if they are comfortable.
Figuring Outer Space	Activity 1 - The Evolution of Stars	Junior	Life cycle of stars and fate of stars	This is a good activity for several days. It can be run individually or collaboratively. Provide your students with all the images from Appendix A. Have them complete Part 1 and submit the summary to you. Then, provide them with the four pages of Appendix B. Have them complete Part 2. When they are ready, provide Appendix C: Tester Cards and have them submit their summary.

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Figuring Outer Space	Activity 2 - How to Find an Exoplanet	Junior	Transit method of identifying exoplanets	This activity will require students to find some supplies in their homes. They will need a light source (like a desk lamp or a large flashlight), several spheres or cardboard discs that are smaller than the diameter of the light source, and a cell phone with a light meter app (e.g., for Android use phyphox). This activity is best done through interaction where students make predictions and justify their predictions, perform the activity, share their results, and modify their thinking, if necessary. Send the students the Activity sheet and have students work collaboratively or independently, checking in regularly.
Figuring Outer Space	Activity 3 - Take a Tour of the Milky Way	Elementary/Junior	Exploration of the Milky Way Galaxy and location of our Sun	This activity will require miscellaneous materials from the house: cotton balls, small balls, pipe cleaners, cereal bowls, etc. Send the students the Activity sheets. Have them complete Part 1 and share photos of their model. Have them compare their model to those of classmates. They can then complete the rest of the Activity.
Figuring Outer Space	Activity 4 - The History of the Universe	Junior	The history of the Universe and how the Universe has changed over time	Over several days share the images and information from Appendix E. Have students put the cards in order. Have them submit an image and then have the classmates compare the various images.
Figuring Outer Space	Activity 5 - Crab Nebula Expansion	Junior	Use ratios and make measurements to analyze motion	This is an excellent independent work activity. There are two versions of the worksheets: 1 is for an applied-level class while 2 is for an academic-level class. Send out the student sheet you have chosen and both images in Appendix F. Have students watch the video <i>Crab Nebula: 50 Years of Expansion</i> (https://www.youtube.com/watch?v=S5GEQt-ypOI) then complete and submit their work.
Figuring Outer Space	Activity 6 - The Search for Exoplanets	Junior	Use geometry, area formulas and mathematics to model the transit of an exoplanet	This is an excellent independent work activity. There are two versions of the worksheets: 1 is for an applied-level class while 2 is for an academic-level class. Send out the student sheet you have chosen. Have students complete and submit their work.
Evidence for Climate Change	Activity 1 - Carbon Dioxide	Junior	Causes and effects of greenhouses gases; analysis of scientific data	Part 1 of this activity can be done online easily. Post or send a single graph daily and have students submit their responses each day. If possible, have students interact in online groups to discuss. The short clip of the video that comes with the resource can also be used as a PEOE (it is labelled SHORT) and can be chunked. Show the first part and have students submit their predictions. Then show the rest and have students record and submit their observations. Part 2 of this activity will be difficult to have students do at home. It could be skipped or it could be done as a video demonstration by the teacher.
Evidence for Climate Change	Activity 2 - Climate Modelling	Junior	Analyze the causes and effects of climate change	This jigsaw activity can be modified to be done online if your students have a way to collaborate online. Divide your class into 6 groups and provide each group with a forcing factor and graph. Students work together and become "experts" on their forcing factor. You then form new groups with an expert for each factor in each group. At this point you will need to give all group members all the graphs for ease of comparison.

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Evidence for Climate Change	Activity 3 - Warming World	Junior	Conduct inquiries and gather data; demonstrate how climate change is affecting our planet	In Part 1 of this activity, students are meant to do a PEOE for three demonstrations. Two of these demonstrations (balloon demo and ice melt) are very easy for students to do themselves and involve only balloons, a candle, ice, rocks, and water. The other demonstration which shows thermal expansion could be done at home, but might be more challenging. An alternative would be to use a video like this (or a clip of it) - https://www.youtube.com/watch?v=Wx9lpHnmYY so students can make observations. In Part 2 students analyze data cards. If possible, have them collaborate virtually.
Evidence for Climate Change	Activity 4 - Impact of Transportation	Junior	Evaluate choices on transportation; propose ways to reduce carbon dioxide emissions	Parts 1 and 3 of this activity can be done easily by students at home. Part 2 of this activity can be modified to be done online provided your students have a way to collaborate online. Part 2 uses a jigsaw. Form groups and give each group a transportation scenario. These groups become experts on that scenario. Create new groups with one person from each scenario.
Evidence for Climate Change	Activity 5 - How much carbon is in that tree?	Junior	Calculate the amount of carbon dioxide stored in a tree; calculate the height of an object using angles and right-angle trigonometry	This activity can be done online easily. Students are given instructions on how to build a clinometer with either a smartphone app and a straw or a protractor and a straw. Students use the clinometer to measure the height of a tree close to their home. If students do not have a tree nearby, they can still do the activity using the supplied data sheet.
Evidence for Climate Change	Activity 6 - When does it make sense to switch?	Junior	Solve algebraic equations; solve word problems related to realistic scenarios	This activity can be done easily as a math worksheet at home. Students make calculations and solve equations to evaluate choices related to purchasing household items.
Evidence for Climate Change	Design Challenge	Junior	Model anthropogenic factors that lead to climate change	This activity can be done by students at home if they have a thermometer. There are smartphone apps that can measure temperature, but students should be cautious with their phone if they use water in their challenge. The other required item is a clear plastic container like a pop bottle. Students are free to use other items like baking soda, vinegar, fruit cores or peels, and stones. In the challenge, students place the bottle near an incandescent light source. Students will not have access to the same setups, so rather than a competitive challenge have students try to get the largest increase in temperature possible. Instead of a lamp, students can use direct sunlight.
Wave Model Applications	Activity 3: Investigating Earthquakes - Part 2 and CYL	Junior/Senior	Comparing wave types to wave speed, triangulation	Provide students the Activity pages from Activity 3, Appendix D and Appendix E. Use Earthquake A from Appendix D to help students bring meaning to the information: two types of signals, time delay between signal types. Establish with students that P-waves (pressure) travel faster than S-waves (shear). Show students how to determine the distance from Kipapa, Hawaii. Have them work to finish Earthquake A. Assign groups and have the groups determine the epicentre for Earthquakes B through D. Then have students finish with Consolidate Your Learning.
Wave Model Applications	Activity 4: How Do We Hear? - Parts 2 and 3	Junior/Senior	Resonance and how the ear's shape affects hearing	Provide students with Activity 4, Parts 2 and 3. Have students use common materials in their homes to complete. Collect their responses. For Part 3, have students use the sound from a single speaker rather than headphones. Have students complete the Indigenous Connection by viewing the video of a water drum at https://www.youtube.com/watch?v=mhe1VmsniSE .

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Wave Model Applications	Design Challenge	Junior/Senior	Analyzing how mechanical waves affect structures, make a physical structure and apply different wave-types until the structure fails. Modify and improve the structure	Provide students with the Design Challenge sheets including the rubric. Have students collect building materials such as small boxes or wooden blocks from their homes. If they want to use interlocking blocks, then have them stack the blocks on their sides, so that they do not interlock. Have students share with each other how they will create a shaking table. Have students complete the activity and share videos of their results.
A Deeper Understanding of Energy	Activity 1: The Conservation and Transformation of Energy - Parts 1 and 2	Senior	Energy, energy transformations, gravitational energy	If necessary, introduce the concepts of work-energy bar charts and energy flow diagrams to students. Send students the Student Activity sheet and have them do Parts 1 and 2. They can either work alone or collaborate electronically with friends. Discuss the concepts of energy flow diagrams and work-energy bar charts with them.
A Deeper Understanding of Energy	Activity 2: Innovative Technologies	Senior	Energy, energy transformations, gravitational energy, electrical energy	Change the first sentence in Part 1, question 1 to "Find five devices in your house that use electricity. Choose a variety of objects, such as plug-in and battery powered objects." Send students the Student Activity Sheet and Appendix A: Light Bulb Comparison Cards. Have them do the activity. They can either work alone or collaborate electronically with friends.
A Deeper Understanding of Energy	Activity 3: Nuclear Transformations	Senior	Radioactive decay, alpha decay, beta decay, nuclear reactions, energy transformation in nuclear reactions	Send students the Student Activity sheet and Appendix B: Table of Isotopes. Have them do the activity and submit their answers electronically. They can either work alone or collaborate electronically with friends. Review the concepts of alpha and beta decay. One option for this is for students to watch <i>Stable and Unstable Nuclei</i> https://www.youtube.com/watch?v=UtZw9jflxXM (4 minutes).
A Deeper Understanding of Energy	Activity 4: Ionizing Radiation	Senior	Radioactive decay, alpha decay, beta decay, gamma decay, nuclear reactions, medical applications of radioactivity	Send students the Student Activity sheet, Appendix C: Ionizing Radiation Cards, and Appendix D: Equivalent Dose Table. Have them watch <i>GSCE Physics - Alpha, Beta, and Gamma Radiation #33</i> https://www.youtube.com/watch?v=VeXpMijpazE (4 minutes) and have them do the activity.
A Deeper Understanding of Energy	Activity 5: Mass-energy Equivalence	Senior	Mass-energy equivalence ($E = mc^2$), mass energy, radioactive decay	Send students the Student Activity Sheet and have them first watch <i>Energy-mass Equivalence</i> https://www.youtube.com/watch?v=hWcACTswM9A (5 minutes). Have them do the activity.
The Mystery of Dark Matter	Activity 6: Dark Matter Lab	Senior	Uniform circular motion	Send students the Student Activity sheet and have them complete it. Have each student make their own circular motion apparatus using the tube of a pen, string or fishing line, and small masses (eg. washers, nuts, or bolts). Students can also choose to measure mass in numbers of washers, nuts, etc. After the activity, students can watch <i>The Mystery of Dark Matter (Part 1)</i> : https://www.youtube.com/watch?v=Dx1Wf84bC2M (7 minutes) and <i>The Mystery of Dark Matter (Part 2)</i> : https://youtu.be/OzrxXxkdN1w (7 minutes) and summarize their main points.
Contemporary Physics	Activity 2: Detector Physics	Senior	Momentum, energy, magnetic fields and force, particle physics	Send students the Student Activity sheet, Appendix C: ATLAS Component Cards, and Appendix D: CMS Component Cards. Have them watch <i>Inside CERN's ATLAS Particle Detector</i> https://www.youtube.com/watch?v=6G0jh0F7OZM (2 minutes). Have them complete Parts 1, 3, and 4.

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Contemporary Physics	Activity 7: The Hydrogen Atom	Senior	Bohr model of atom, emission spectra, wave nature of matter	Send students the Student Activity sheet and have them watch <i>The Bohr Model</i> https://www.youtube.com/watch?v=GhAn8xZQ-d8 (6 minutes). Have students complete the activity except for Part 3, question 1 which requires a specialized item.
Fields	Activity 1 - What is a Field?	Senior	Fields store and transfer energy and momentum	Share with students the Student Activity pages and the video <i>The Reality of Fields</i> (https://youtu.be/cTWwFX5hwfo?list=PL1608DAAD37A04B35). Have students collect household items that hold static charge (balloon and wool sweater) and dipole magnets (connectors for toy vehicles or door closures). Students can work independently or in groups through Part 1, then watch the video, and complete the rest of the activity.
Fields	Activity 3 - Maxwell's Equations	Senior	Use the familiar ideas of electric and magnetic fields to make predictions about the variables in Maxwell's Equations	Edit the Student Activity pages such that students are doing thought experiments rather than actual investigations. Share the revised pages with students. Have them work in groups to complete each part. Encourage students to determine the nature of the relationships between the variables in Maxwell's equations rather than the actual equations.
Fields	Activity 5 - Explaining Mercury's Orbit	Senior	Communicate how the geometry of general relativity can be used to explain Mercury's Orbit	Share Appendices C, D, and E and the Student Activity pages with your students. Have students work independently or collaboratively via email (or an online platform) to complete the Student Activity pages.