Lesson 5 Teacher Reference

Foil/Platform Preparation

SAFETY PRECAUTIONS

Putting any type of metal in a microwave oven can be dangerous if not done carefully and correctly. Make sure to follow the guidelines below before placing any bowl with hole-punched or solid aluminum foil around it in the microwave oven.

Before class, practice creating foil-wrapped bowls following the guidelines below. Run several practice tests using the insulated platform (as seen in the *Microwave Oven Manual*) without students present before conducting any investigations using the microwave oven in front of the class.

If, at any point during any of the investigations, new or unexpected noises start to come from the oven, turn off and unplug the oven immediately. Allow all items to cool before opening the oven door. Such noises may indicate that arcing is occurring, even though it may not be visible.

Examples of the steps below can also be viewed at: https://www.youtube.com/watch?v=9Ldx_Vm5X5c

1. When punching holes in the foil, pay attention to each hole being created. **Make sure the holes are cleanly cut and there are no tears or hanging chads.** To help ensure this, follow directions (a-k) below.

a. Start with the smallest section of unused foil that will wrap around your bowl. The example shown here uses an 8" x 12" piece of foil.

b. Smooth out this foil on both sides.

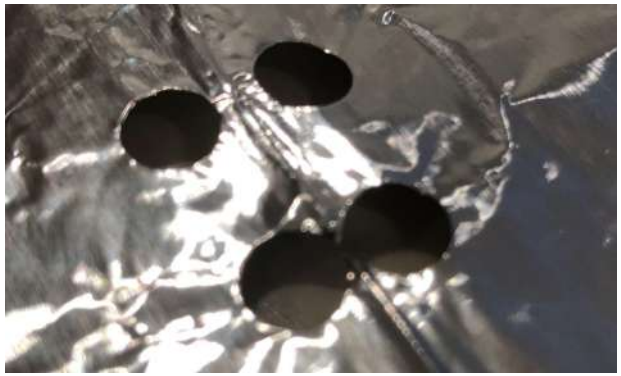
c. Fold the foil in half, using a ruler as a straight edge. Place a piece of paper between the folded

sides. Optional: use grid paper and fold it back over the outside of the foil, to use as a grid for equal spacing of hole punching.	
d. Fold the foil back over itself a second time, again placing a piece of paper between the folded sides.	
e. Trim some of the excess paper around the edges. Leave about ½" to 1" sticking out.	

f. Prepare a sharp (or new) deep-throat ¼" diameter hole-punch by opening the hole-punch catch on the bottom. This will ensure that the discs you punch out will fall through the punch rather than getting bunched up inside the catch.	
g. Punch a line of holes, ~1" apart and at least ½" in from the edge of the foil to the edge of the holes. Double-punching (punching twice) in the same spot can help to ensure clean holes.	
h. Punch three rows (approximately 1" apart) along one side before flipping to the other side. As noted above, double-punching can help to ensure clean holes.	
i. Carefully remove any hanging chads. Gently pull the folded material apart to ensure that the foil does not tear at any locations where a hole-punch caused the foil to bunch up. j. If you get a tear between one hole and another, start over.	

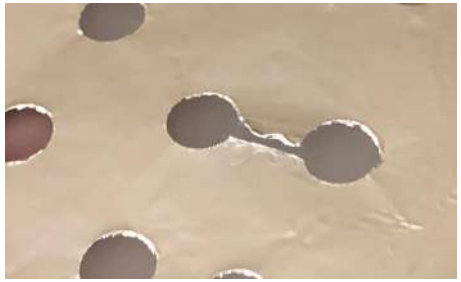
k. Make at least two of these sheets for each class of students.	

Here are two examples of what to avoid and one example of what you are trying to make:

		
No--Be mindful of any defects in the holes. Holes must be cleanly cut. If there are any hanging chads or small sections where foil is not cleanly cut, discard the foil and create a new hole-punched piece.	No--Two hole-punched sections that overlap or are very close to each other can create antennas. If two hole-punched sections overlap or are very close, discard the foil and create a new hole-punched piece.	Yes--The holes are clean, free of defects, and appropriately spaced so as not to create any small sections that can serve as antennas.

2. Foil must always be wrapped tightly around the bowl. **No gaps, even as small as a millimeter, should exist between the pieces of foil wrapped around the bowl.** Any gaps between the foil can cause arcing.
3. **Foil must never protrude away from the bowl.** Any foil protruding in any direction can act as an antenna and cause arcing.
4. Always use a new piece of foil when running a test. **Never reuse a piece of foil.** Once foil has been bent or molded, it does not mold as tightly around objects when used a second time. All foil should be molded tightly around the bowl.
5. It is dangerous to run the microwave oven empty, so be sure to **never** use it without an uncovered absorber such as an open bowl of water inside. Covering a bowl of water with foil essentially creates an "empty" oven by shielding the absorber, so you need to add an additional, uncovered bowl of water before running the oven. **All investigations must be conducted with an uncovered bowl of water in the oven to absorb the microwave radiation.**

Here are four examples of what to avoid:

			
No--A piece sticking out in any direction can act as an antenna.	No--The foil has the appearance of being wrapped very nicely, with neat folds and clean lines. These lines, however, create small gaps in the foil sections. This can cause arcing. Though it may seem counterintuitive, crunching and squeezing the layers together can create a more gapless fit than folding nicely.	No--Foil is coming away from the bowl. This can cause arcing. All foil must be flush to the bowl or to other pieces of foil.	No--Even small pieces, such as a tear or rip from a hole, can cause arcing. After wrapping the bowl, inspect your hole-punched areas for defects in the foil around a hole that may not be flush with the rest of the foil.

Here are two examples of what you are trying to make:

	
Yes--The foil is wrapped tightly around the bowl and no gaps exist. The foil is wrapped so that the edges meet on the bottom of the bowl and all layers have been tightly compressed, with no gaps between them.	Yes--All foil is securely wrapped around the bowl, with no gaps or protruding sections.

6. Make sure to use an insulated platform to keep the foil off of the oven floor. The insulated platform is a microwave-safe plastic cutting board with four microwave-safe plastic bowls as spacers under its corners. These should keep the platform and the bowls on it at least 1" from the oven floor. This will help to prevent arcing from the floor to the foil. The image to the right shows an example of this setup. This matches the safety guidelines that students read about in Lesson 1 in the *Microwave Oven Manual*.