

# Box Model Assembly Instructions

## Materials

### Materials needed for each box model (multiply by 6 for a class set)

- 2 bankers boxes with lids
- 2 8"-x-10" picture frame mats
- 2 small binder clips
- 2 toys or objects that are at least 5" tall
- 1 cylindrical flashlight (zooming and dimming capabilities)
- removable mounting putty

### Materials needed to make a class set of box models

- 1 box cutter
- 1 roll of duct tape
- one-way mirror film, cut into 8"-x-10" pieces for each model
- pencil or pen
- black marker
- ruler (optional)
- spare cardboard (optional)

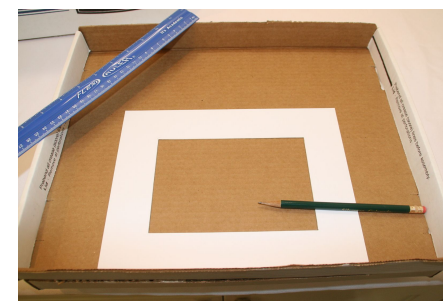
Additional modifications to the box model are shown in *Box Model Modification Instructions*.

## Instructions

1. Assemble the boxes for Rooms A and B. The boxes will arrive flattened. Assemble them following the instructions on the box. If the box has openings for handles, do not punch those out. It is important to prevent any unwanted light from getting into the closed box. If needed, use duct tape to cover the handles to ensure they remain intact and closed.



2. Measure where to cut the holes. Remove the box lids from the boxes and place the lids on a countertop with the inside facing up. Place a picture frame mat on the first box lid, flush against one of the long sides, but centered in the middle (see photo). On each end of the mat, there should be approximately 2.5" from the outside edge of the mat and a little over 4.25-4.5" from the inside edge of the mat. Once centered, use the inside of the mat as a stencil to outline the opening on the lid in pencil or pen. Repeat for the second lid. Be sure to place the mat at the same exact location on both lids so the holes will line up when the lids are taped together.



3. Cut a hole in each box lid. Use a box cutter to cut out the stenciled rectangle on each lid. Save the cut-out cardboard for use in step 6. Note: It is helpful when using the box cutter to place a spare piece of cardboard underneath so you don't damage your floor or countertop.



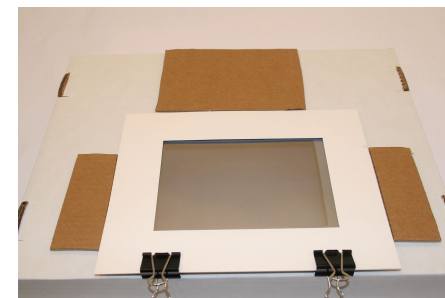
4. Assemble the mirror frame. Tape the two mats together along a long edge using duct tape. This creates a frame to make a one-way mirror with the one-way mirror film.



5. Prepare the one-way mirror. Cut out an 8"-x-10" (or slightly smaller) piece of one-way mirror film. The film has a layer of plastic on it. Keep that layer on. It will keep the one-way mirror stiff for better reflections. Insert the film between the two mats. Use the two binder clips to hold the mats together on the long side that is not taped.



6. Create the "window" frame for the one-way mirror to slide in and out. Place one lid topside up on the countertop. Set the second lid aside. Take the two small pieces of cardboard cut from the lids in step 3. Cut one in half lengthwise. Place the one-way mirror, which is inside the mats, on the top of the lid. Line up the one-way mirror with the rectangular hole. Then place the three pieces of cardboard around the edges of the one-way mirror mat, creating a "frame" around the mats on three sides. Tape the cardboard pieces solidly in place. These cardboard pieces create a space to guide (and hold in place) the one-way mirror when it slides in and out of the box model. Take the one-way mirror out of the frame and set aside.



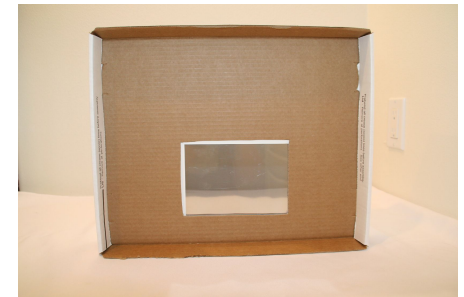
7. Tape both box lids together. Place the second lid upside down (i.e., inside of the box facing up) directly on top of the first lid. Line up the cut-out holes. Tape the two lids together along three sides. Do not tape along the long side that is closest to the holes. This is where you'll slide the one-way mirror in and out of the box model.



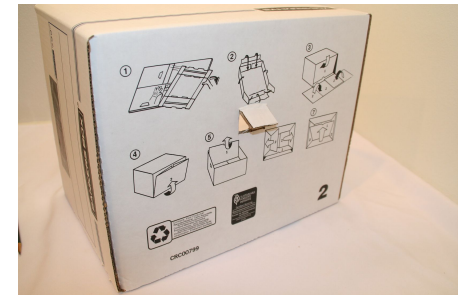
8. Slide the one-way mirror in the frame between the box lids to test it. Depending on the height of the toys or objects you will use, you need to decide if students will insert the one-way mirror from the bottom (with short objects) or from the top (with taller objects). This decision determines placement of the flashlight holes and viewing holes.



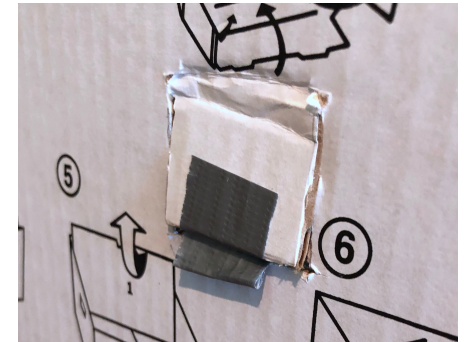
Example of flipping the lids to get the mirror to a lower height for shorter toys or objects.




9. Cut a viewing hole in each box. Position the first box with the bottom down on a cutting surface (on the floor or table with scrap cardboard underneath). In the middle of the box panel, cut a three-sided rectangle along the sides and bottom (approximately 1-1.5"). This should be cut in the center of the box, approximately 7.5" from the edge of one of the short sides and 6" from the edge of one of the long sides. Repeat for the second box. Note: If the boxes have a double bottom, you will need to cut through both layers.



Fold the flaps (made by the three sides that are cut) outward. Add duct tape to the flaps to allow students to close and open them easily.



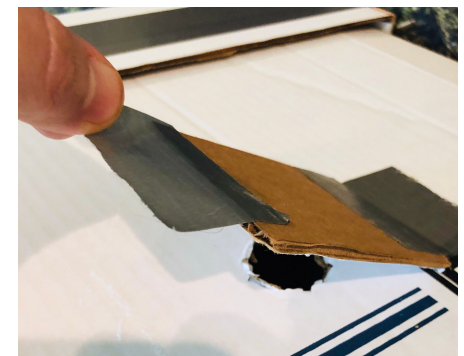
10. Measure where to place the flashlight holes. Label one box Room A and the other Room B. For Room A, measure approximately 5" in from the long sides of the box. Use the flashlight to trace a circle slightly smaller than the flashlight's diameter. This will help to ensure the flashlight does not slip through the hole.

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11. Cut the flashlight hole in Room A and add the flashlight. Use the box cutter to cut the hole. Flip the box over so the hole is now at the top, like the room's ceiling. Put the flashlight through the hole. The end with the on-off control should stick out the top of Room A and the light should shine down into the room.



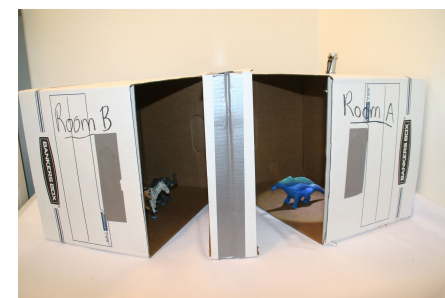
12. (optional) Cut the flashlight hole in Room B and then cover the hole. Option: Do this now or just prior to Lesson 2 (see [material: LT.L2.TREF1]). Students will not need a hole in Room B until Lesson 2's activities, so you may want to delay cutting this hole right now. Repeat steps 10 and 11 for Room B if doing now. Test that the flashlight can be inserted into Room B. Then remove the flashlight. Use a piece of scrap cardboard and duct tape to create a flap that will seal Room B's flashlight hole.



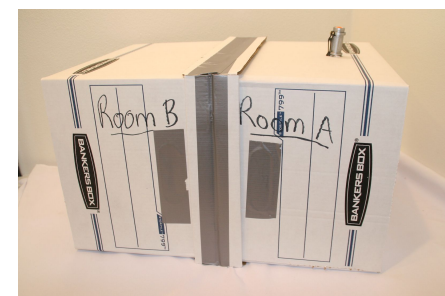
13. Add toys or objects to each room. Use removable mounting putty to adhere one toy or object in Room A and B. Place the toys in the middle of each room and press them firmly in place. If you have enough toys, consider putting a few in Room B to replicate the video as much as possible.



14. Put Rooms A and B together with the one-way mirror. Line up Room A, Room B, and the lids with the one-way mirror inserted from the bottom or top.



Close the boxes tightly together and ensure all openings are closed to minimize extra light entering the inside of the box model. Insert the flashlight into the flashlight hole for Room A and turn it on.



15. Check to make sure you're seeing the desired effect. When you look through the viewing hole in Room A, you should see the toy and its reflection. When you look through the viewing hole in Room B, you should see through to the toy in Room A.

