The MEL Project Teacher Guide 1.0

MEL and baMEL Directions and Hints

The MEL Project Teacher Guide 1.0

This is a guide, but it is also a work in progress.

We hope for and appreciate your contributions.
(index cards)

Updated versions will be found at:

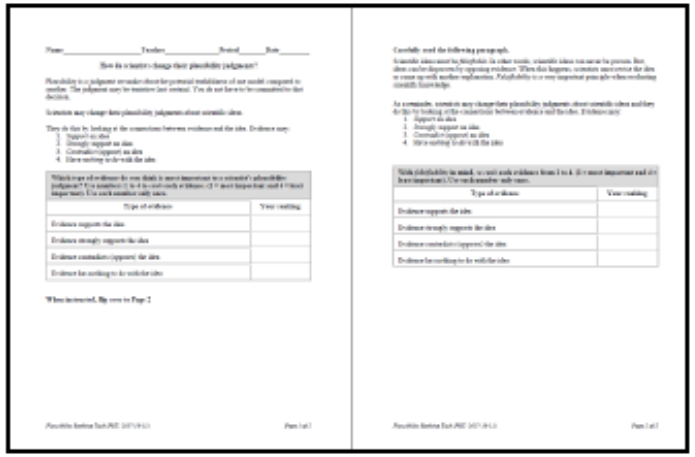
https://serc.carleton.edu/mel/teaching_resources/index.html

https://sites.temple.edu/slrg/bamel-instructional-materials/

Section 1: Plausibility Ranking Task

The MEL activities help students to be critically evaluative to support scientific thinking. Models must be coordinated with lines of evidence to help build an argument about the causes and effects of a particular phenomenon and its systematic relationships.

1. Complete the ***Plausibility Ranking Task*** (PRT)
   This task normally takes about 20 minutes and is only done once, or twice at most. If you do multiple MELs/baMELs with a given set of students, keep that in mind. This task helps develop understanding about how scientists make judgments about the connection between evidence and models.



   a. First, have students make an initial ranking of the importance of four categories of connections between evidence and models, where a line of evidence:
      i. strongly supports a model,
      ii. supports a model,
      iii. has nothing to do with a model, or
      iv. contradicts a model.

   Guiding Questions:
   Workshop teachers: What do you think?

   econd, have the students read the short
   assage about tentative nature of scientific information and falsifiability (the
   bility for a scientific idea to be proven false), as well as the relationship between
   ontradictory evidence and falsifiability

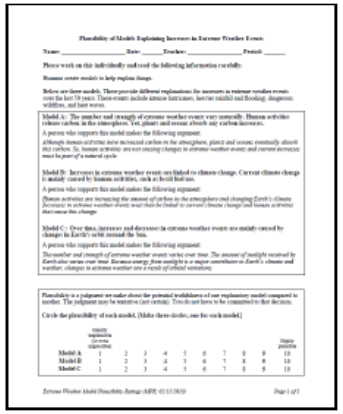
- You've heard us talk about it, now it's your turn.
- How do you talk about to your students about plausibility? Falsifiability?
- How do they talk about them?
- How are these topics articulated through your school's curriculum?
- How would you guide your students though this exercise?

Section 2: Model Plausibility Ratings

c. Third, conduct a short, whole class discussion with the students about the falsifiability passage.
d. Fourth, then have the students re-rank the importance of the categories.

2. Rate the plausibility of the three baMEL models using ***Model Plausibility Ratings*** (MPR) sheet

Completing this sheet takes about 10 minutes and introduces students to the models they will be considering for the baMEL and re-introduces students to idea of plausibility judgements. This should be done as the first activity for each baMEL



e. Students individually read about the three models and plausibility
f. Hold a class discussion to answer questions about the model and plausibility

1. Guiding Questions
Workshop Teachers: What do you think?

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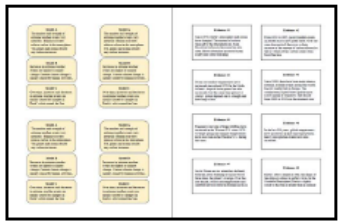
g. Have the students rate the plausibility of each model...make sure the draw a circle around one number for each model (there should be three circles)

2. Topic Hint: Origins of the Universe
The distinction between models A and C is subtle. Encourage students to look at the differences in vocabulary.

3. Use the ***baMEL*** lines of evidence and three models to construct a ***MEL diagram.***
This is a completely new activity and the essence of the new build-a-MEL (baMEL). We don't know how long this will take, but thinking that this, along with the MPR (see above) will take one traditional class period (~50 minutes). The students should have the opportunity to consider and discuss all the different models and lines of evidence when making their selections.

h. Give students the model cards and the evidence cards (these should be pre-cut prior to using). Have students lay these out. You may with to laminate the cards as they are intended for reuse.

3. Accommodation Hint:
Laminated cards can be annotated with dry erase markers by students with language difficulties.



i. Students should select 4 lines of evidence and 2 models from the set from which they will construct a MEL diagram.
j. To help them in their selection of lines of evidence, they should read the one-page evidence texts. An example of one of the evidence texts is below:

4. Teacher Hint
Have the students place unused evidence texts to the side, face down, to make collection easier at the end of the activity.

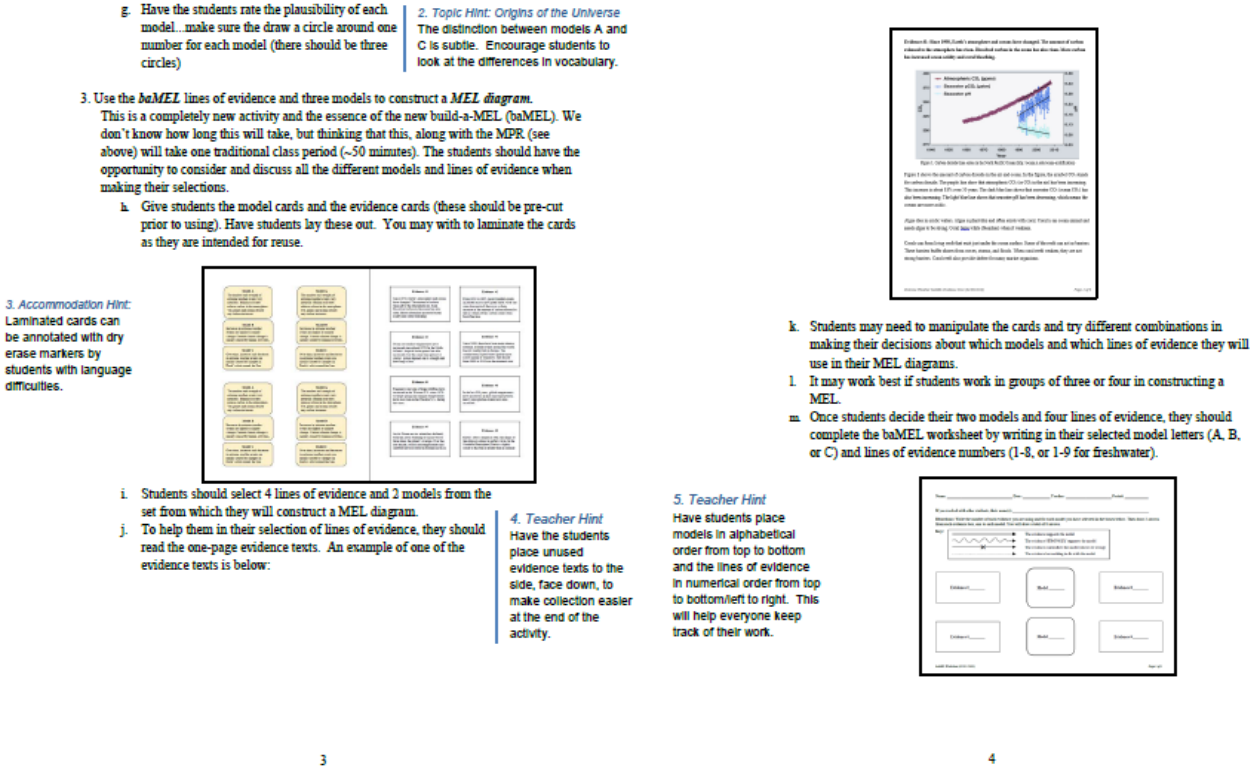
3

- Things to watch out for:
  - All the same number
  - All choices adding to 10
- Some of the models have subtle language differences
- Hands up surveys
- Input from you

Section 3: Constructing a MEL/baMEL Diagram

Particularly for the baMEL

- Choose models and evidences
  - There is a fine line here. We want to proper scaffold them, but we don't want to direct them too much.
  - Are there other things we can do to help kids with accommodations?



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k. Students may need to manipulate the cards and try different combinations in making their decisions about which models and which lines of evidence they will use in their MEL diagrams.

l. It may work best if students work in groups of three or four in constructing a MEL.

m. Once students decide their two models and four lines of evidence, they should complete the baMEL worksheet by writing in their selected model letters (A, B, or C) and lines of evidence numbers (1-8, or 1-9 for freshwater).

5. Teacher Hint
Have students place models in alphabetical order from top to bottom and the lines of evidence in numerical order from top to bottom/left to right. This will help everyone keep track of their work.

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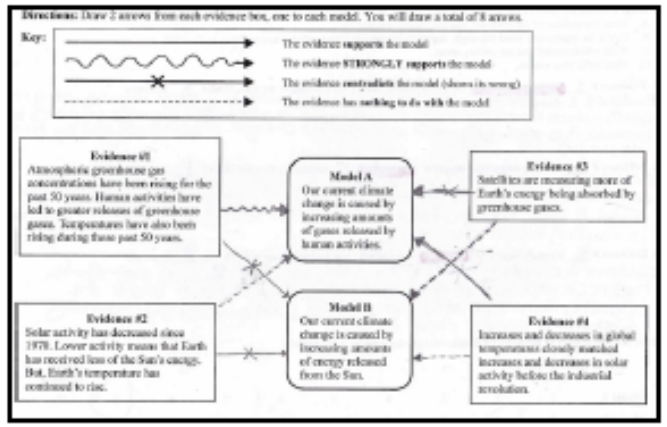
Section 4: Constructing a MEL/baMEl Diagram

Encourage students to be active participants in group discussion.

- Active does not necessarily mean talking.
- Taking notes would be helpful for when they move on to the explanation task.
- Of course, it helps us.

What else can we do to help them, but not too much?

4. Now students are ready to complete their own ***MEL diagram***.
Along with completing the Explanation Task (see below for a student example from the Climate Change pre-constructed MEL), drawing arrows on the MEL diagram and discussing arrows in groups takes just under 1 traditional class period (~30-40 minutes).



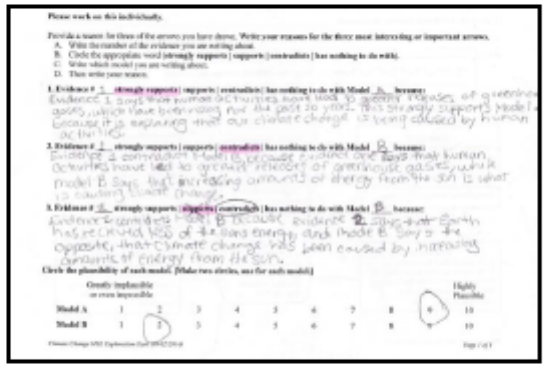
To do so:

a. Students draw arrows in different shapes to indicate their judgments (which correspond to the four categories in the ranking task) about the strength of the connection between each line of evidence and a model.
b. Straight arrows indicate that evidence supports the model; squiggly arrows indicate that evidence strongly supports the model; straight arrows with an "X" through the middle indicate the evidence contradicts the model; and dashed arrows indicate the evidence has nothing to do with the model.
c. Have students work in teams to discuss the types of connections made between the evidence and models; however, students should be told that if their thoughts lie with an arrow type that's different from their teammates, that they should not change it.

Section 5: The Explanation Task

5. Students next use completed MEL diagrams in an ***Explanation Task*** to critically evaluate their links and construct understanding. This task asks students to select and write about evidence-to-model links that they had made on their MEL diagram.

6. Conversation Tip
Students may ask which is "scientifically correct" model. Remind them that they have pieces of evidence to help them form their own ideas about that.



a. In their written explanations, students identify each end of the link, with an evidence statement (which are numbered) at one end and the model (either Model A or B) at the other.
b. Students write their judgment about the strength of the link (i.e., the evidence strongly supports the model, the evidence supports the model, the evidence has nothing to do with the model, or the evidence contradicts the model).
c. Students then provide a justification for their weighting of link strength.

- Remind students to be as thorough as possible
  - Even college students aren't!
- Ask why they chose "nothing to do with", if they did.
- There are different numbers of responses for different MEL's.
- Have them re-rate all three models, even the one they didn't do.

ACKNOWLEDGEMENTS

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