Electronic Supplementary Material (ESI) for Chemistry Education Research and Practice.


# Appendix B: Complete Interview Protocol and Example Assessment

1. As a broad definition, what do you believe assessment is?
2. What do you think regarding the role(s) and process of assessment in chemistry?
3. In your analysis, how do you use the results of your assessment to…
    a. …evaluate student learning of chemistry topics
    b. …evaluate your chemistry teaching practice
4. Has there been a time where you analyze the results of an assessment and then alter your lesson plans based on those results?

Yes

Please describe one specific time (not the one they've prepared) – content and assessment. What were the key characteristics of the assessment results that made you alter your plans? What alteration(s) did you make to account for the assessment results?

No

*If number 1 hasn't given explicit role of assessment*: Among the roles of assessment you commented on previously, do you believe that the results of assessment should inform your teaching practice? Why or why not?

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5. Describe your typical process of designing and analyzing assessments in your classroom.
6. Please describe your goals in giving this assessment to your students, addressing the targeted chemistry content.
7. Do your results support or do they not support the meeting of these goals you've stated?
8. Why do you believe that this assessment (*has / has not*) met your goals? Please identify specific reasons for the observed assessment results.

*If not made explicit, ask:* What criteria did you use decide if the results supported / did not support the meeting of these goals?

9. Please describe what your lesson plans (define) were for *this material*.
10. If you haven't already, please consider how the results of your assessment reflect the quality of your lesson plans.
11. Did you revisit *this material* for the class because of the results of the assessment?

*If yes:* What, if anything, did you change about your lesson plans for *this material* and why?

12. Considering these results, should you change your lesson plans for *this material* in the future and why or why not?
13. Considering these results, should you make revisions to your assessment and why or why not?

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> 4) What is the ratio of oxygen to hydrogen in the following equation?
> $2H_2 + O2 \rightarrow 2H_2O$

14. What were the goals for (*this item / these items)*?
15. Do the assessment results of (*this item / these items)* support or not support these goals?
16. Why do you believe that (*this item / these items)* (*has / has not*) met your goals? Please identify specific reasons for the observed results.
17. Are there any other reason(s) that would explain the observed results?

**Additional Probes:**

1. Do you think your students are correctly differentiating between hydrogen/oxygen molecules versus hydrogen/oxygen atoms?
2. Do you think that your students can demonstrate that they understand the concept behind ratios?

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> Post Lab #2
> 5) Now try this. Write a balanced reaction for sodium phosphate with barium nitrate:
> b. Calculate how many grams of Ba3(PO4)2 you can produce with 3.50 grams of Na3PO4.
> c. Calculate how many grams of Ba3(PO4)2 you can produce with 6.40 g of Ba(NO3)2.
> d. Which reactant will give you the least amount of barium nitrate? This is called the limiting reactant.

18. What were the goals for (*this item / these items)*?
19. Do the assessment results of (*this item / these items)* support or not support these goals?
20. Why do you believe that (*this item / these items)* (*has / has not*) met your goals? Please identify specific reasons for the observed results.
21. Are there any other reason(s) that would explain the observed results?

**Additional Probes:**

1. Did you see any difficulties with your students writing the correct formulae for species?
2. Do you think that some of your students had trouble writing the reaction or balancing the equation that lead to an incorrect (or correct) response?

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20. If you have any other examples that would better exemplify the process of making conclusions that lead to action based on assessment results, please describe that situation.

**Pre AP Chem** **Name:** ______________________

**Activity – S'mores** **Period:** __________

**Purpose**: Investigate the concept of limiting reagents by constructing S'mores.

**Background**: Two atoms or molecules must come together in just the right way in order for them to react. As a result, it is virtually impossible to obtain 100% yield in a chemical reaction by combining the reactants in exact proportions. In order to increase the odds that at least one reactant will react completely, we often add more than is needed of another reactant. This reactant is said to be in **excess**. The reactant that is used up in the reaction is called the **limiting reactant** because it limits the amount of product formed.

In this activity, you will use a recipe for S'mores as an analogy for a chemical equation in which reactants and products are in set proportions to each other. You will be given varying amounts of each reactant. One of these reactants will limit the number of S'mores you can produce. The other reactants will be in excess. After working with this culinary "reaction," you will identify the limiting and excess reactants in *chemical* reactions and perform stoichiometric calculations based on the amount of the limiting reactant.

**Prelab Questions:**

1. Use the following recipe to write a ***"balanced chemical equation"*** for S'mores.

| Recipe for 1 S'more | Symbol for "Reactant" |
|---|---|
| 2 graham cracker halves | G |
| 1 chocolate square | Ch |
| 2 marshmallow pieces | M |

2. What is the ratio of chocolate piece (C) to marshmallow pieces (M)?

3. What is the ratio of chocolate piece (C) to marshmallow pieces (G)?

4. What is the ratio of oxygen to hydrogen in the following equation?

$$2H_2 + O_2 \rightarrow 2H_2O$$

**Procedure**:

1. Obtain a plastic bag of S'mores ingredients.
2. Sort the reactants in the bag and complete the data table below.
3. Repeat with 2 different bags. When you complete the 3 bags and have the table complete you can show to your awesome teacher and you can make a real s'more to eat ☺

**Data Table:**

| Bag # | # of each reactant | # of product made S'mores | # of each reactant not used | Which reactant was "limiting"? | Which reactants are in "excess"? |
|---|---|---|---|---|---|
| | G = ________<br>Ch = ________<br>M = ________ | | G = ________<br>Ch = ________<br>M = ________ | | |
| | G = ________<br>Ch = ________<br>M = ________ | | G = ________<br>Ch = ________<br>M = ________ | | |
| | G = ________<br>Ch = ________<br>M = ________ | | G = ________<br>Ch = ________<br>M = ________ | | |

**Post Lab Questions:**
Think about using the ratios of reactants like this: Instead of 2 G (2 graham crackers) for every 1 Ch (chocolate piece), think 2 moles of G for every 1 mole of Ch. Remember, 1 mole is just a specific number of particles/pieces ($6.02 \times 10^{23}$ to be exact). Knowing this, try to answer the following questions.

1. Iron and oxygen combine to produce iron (III) oxide. Write the balanced equation below.

2. What is the ratio of iron to oxygen; how many Fe react with each $O_2$?

3. Complete the following statement using the ratio of iron reacting with oxygen.

**______ moles of iron react with __________ moles of oxygen.**

4. Complete the following table using the information from above.

| **Ingredients** | **<u>Possible</u> number of moles of Iron (III) oxide** | **Actual number of moles of Iron (III) oxide made** | **Excess Reactant** | **Limiting Reactant** |
|---|---|---|---|---|
| **30 moles iron** | ________________ | (Record the smaller of the 2 possible values below) | | |
| **25 moles oxygen** | ________________ | ________________ | | |

5. Now try this. Write a balanced reaction for sodium phosphate with barium nitrate:

b. Calculate how many grams of $Ba_3(PO_4)_2$ you can produce with 3.50 grams of $Na_3PO_4$.

c. Calculate how many grams of $Ba_3(PO_4)_2$ you can produce with 6.40 g of $Ba(NO_3)_2$.

d. Which reactant will give you the least amount of barium nitrate? This is called the limiting reactant.