Journal Prompts for the next two weeks (Sep 21 through Sep 27). The slide numbers correspond to the file Session03_ALL-CONTENT

These are merely suggestions to take your learning to another level. They are intended to nudge you but they are purposefully not overly descriptive. Take these prompts where you want to based on your personal experience, interests, and creative pursuits.

1) SLIDES #3-5 - reference: https://pubs.acs.org/doi/abs/10.1021/ed083p791
Using the definitions on SLIDE #3, construct a table like Table 2 (SLIDE #5) for the following entries:
CO2 (carbon dioxide), HCO2H (formic acid), CH2=O (formaldehyde), CH3-OH (methanol), CH4 (methane). SLIDE #4 shows how to calculate oxidation state.

2) SLIDE #6 -
For each molecule discussed in prompt #1 above, show where that molecule belongs on SLIDE #6. Trace the progression of steps from CO2 to methane, from highest to lowest oxidation state. How many electrons are involved in each step? Show the direction of reduction reactions (addition of electrons) and oxidation (removal of electrons).

3) SLIDE #7 -
Calculate the oxidation state for each carbon in glucose. Respiration takes apart the six-carbon atom molecule glucose and converts them into six CO2 molecules. On SLIDE #7, show six reaction arrows, one for each carbon atom in glucose transforming into a molecule of CO2. Calculate the oxidation state change for each carbon. How many electrons in total are removed from glucose to transform it into six CO2 molecules?

4) SLIDE #4 -
Respiration also takes molecular oxygen to water. Oxygen is the acceptor of the electrons that come from glucose oxidation (Prompt #3). What is the oxidation state of each oxygen in molecular oxygen? What is the oxidation state of oxygen in water, H2O? Add O2 to the table 2 on SLIDE #5 (water is already there). Now draw a picture of oxygen, similar to what you drew in prompt #3 showing each oxygen atom transforming to water. Calculate the oxidation state change for each oxygen. How many electrons in total are added to oxygen in order to produce two water molecules? How many oxygen atoms are needed to accept all the electrons from glucose oxidation?

5) Reference: (Half Reactions for Oxygen + Glucose http://butane.chem.uiuc.edu/pshapley/GenChem2/B7/1.html)
Use the results from the previous two slides to rationalize the balanced equation in glucose respiration:
C6H12O6 (s) + 6 O2 (g) â†’ 6 CO2 (g) + 6 H2O (l) + heat

6) SLIDE #7 Interpret the statements on SLIDE #7 from the paper "Sugars as the Optimal Biosynthetic Carbon Substrate of Aqueous Life Throughout the Universe". https://link.springer.com/article/10.1023/A:1006627406047

7) SLIDE #16-17 Find the functional groups in the active ingredient of your favorite spice.
https://epoch.uky.edu/ace/public/fnalGroups.jsp

8) SLIDE #18 Explain the idea of biomarkers of origin wine and how they signal wines of the different regions in Italy.
https://pubs.acs.org/doi/10.1021/acs.jafc.0c00879

9) SLIDE #21 What are the two reasons given why phosphoric acid is well suited to construct the nucleic acids (DNA and RNA)?

10) SLIDE #23 How large is the Universe of Organic Molecules (i.e., the subset of molecules containing up to 30 C, N, O and S atoms?