

The teachFASTly.com resources are not intended as a complete curriculum. The activities are designed to be woven into your existing teaching. This Quick Stop Lesson Plan is therefore not a single lesson plan, but rather a quick way of exploring the themes of an activity map. It includes one Discover activity, one Delve activity, and one Debrief activity. Together, these may take more than a class period, and you may want to add other activities between them. For more information visit www.teachfastly.com.

Chemistry, Resources, and Faith

How might chemistry connect with faith? This Activity Map uses several clusters of activities, many involving lab work, to introduce students to two different ways of making this connection. Some of the activities focus on the connection between chemistry and virtue: how might our use of resources in the chemistry lab, and our use of resources in the wider world as enabled by chemistry relate to character qualities such as self-control? Other activities suggest ways in which questions related to chemistry can nest within a larger set of questions. How is the idea of a closed system related to chemical reactions and equations? Can we think of the universe as a closed system? If so, is there room for God in such a universe?

This activity map uses chemistry topics to engage students in reflecting on the existence of multiple connections between faith and science. The science of chemical reactions is easily seen as an abstract area of knowledge where letters and numbers are part of a puzzle that students simply write out, balance, and move on. But teaching FASTly involves exploring connections between scientific knowledge and our beliefs, commitments, and life choices, and thinking through what these connections might mean for our practices inside and outside the classroom. Here we explore a larger picture of where reflection on some of those chemical reactions might lead us.

It is recommended that work on this topic be coordinated between science and Bible teachers, and that good communication with parents be practiced.

This Quick Stop Lesson Plan on **Chemistry, Resources, and Faith** contains the following activities and attachments from www.teachfastly.com, which are combined for your ease of use in a downloadable ZIP file:

DISCOVER Activity: Chemical or Not?

Activity Attachment

- *Chemical or Not 1 Handout*
- *Chemical or Not 2 Handout*

DELVE Activity: Labs and Scarcity

Activity Attachment

- *Chemistry and Shalom PowerPoint*

DEBRIEF Activity: Chemistry FASTly Review

Activity Attachment

- *Chemistry FASTly Review Handout*

DISCOVER

Activity: Chemical or Not?

Time: 15 Minutes

In Brief

This activity raises the question for students of what virtues have to do with chemistry, making their assumptions explicit as a basis for further learning.

Goals

Students will identify their assumptions about whether chemistry is connected to virtue. Students will begin to reflect on how chemistry is connected to other aspects of life.

Thinking Ahead

This activity map begins with a step that aims at making students' existing assumptions visible, opening the possibility of seeing chemistry in a new light. When our assumptions become visible to us, the possibility that change may happen is increased. Many students may have never considered whether knowledge of chemistry could be related to virtues. This activity allows you to engage students in some initial reflection and also to walk around the classroom and get a quick visual overview of students' assumptions, which will help you to plan what to emphasize in future activities. Using the word cards, rather than having students write the words, allows students to try words in different places and move them around.

You may find it helpful to work through this activity yourself before class – use it to reflect on your own assumptions about what types of things relate to chemistry and how that might be reflected in your teaching practices and in the way you talk to students about why they should learn.

Preparing the Activity

For each pair of students copy a set of word cards from the **Chemical or Not Handout** and a template provided in the **Chemical or Not 2 Handout**. Either cut up the word cards and put them in an envelope for each pair or have students cut them up on receipt. Using an envelope will make it easier for students to keep the cards together.

Teaching the Activity

Have students work in pairs. Give each pair of students a set of word cards cut apart from the **Chemical or Not 1 Handout**. Tell students to arrange the cards on the template provided in the **Chemical or Not 2 Handout** so that words for things most closely connected to chemistry are towards the left and those least connected are to the right.

Avoid debating with students what “closely connected” means. Tell them that any kind of connection is fine. The question is whether they think chemistry and the thing named strongly belong together in some way.

Once students have completed the activity, discuss the outcome briefly with the class. Ask students what groupings they see among the words that they sorted and what assumptions they made about which groupings have anything to do with science. Look for examples of things that only some students see as connected and ask them to explain the connection.

Establish whether students already see much connection between chemistry and virtue, and let students know that they will continue to explore that connection in subsequent activities. Some of the groupings refer to scientific concepts, everyday objects, virtues and moral concerns, and non-scientific areas of study. Ask students to photograph their sorted arrangement of cards for future reference.

DELVE

Activity: Labs and Scarcity

Time: 60 Minutes

In Brief

Students conduct a lab and then are asked to see it differently in terms of the resources used and the implications for how we think about chemistry and character. This activity can be used with any experiment you currently use.

Goals

Students will conduct a lab and analyze what resources were used.

Students will understand that design of lab work is related to ethical questions about how to use resources of various kinds and character.

Thinking Ahead

It is important to avoid the temptation to preach at students at the end of this activity. Attend both to what you say as you lead the final part of the discussion and the tone in which it is said. The goal here is not to catch students out or to try to make students feel bad about their resource use or lack of virtue, but to create space to reflect on how virtue might be relevant to scientific work. Use “we” language, not “you” language, and ask questions in a tone of inquiry rather than pointing to individual behaviors. Remember the adult world is not a glowing model in this area. Think about how you can make your classroom a space for engaging students in ethical reflection without it turning into legalistic sermonizing.

Preparing the Activity

You will need whatever resources are necessary for the experiment you choose. To assess the activity, you have the option to use the final slide from **Chemistry and Shalom PowerPoint**.

Teaching the Activity

Conduct a chemistry lab that forms part of your standard curriculum.

After the experiment is completed, ask students to make a list of all the resources they used to complete the experiment. After giving them a few minutes to do this, discuss these lists with the class, and guide a conversation using the following questions:

- Did you include all of the obvious chemical resources including reactants?

- Did you think to include the power used for the experiment including heating and lighting the room and any resources used to generate that power?
- Did you include any water used to clean apparatus after the experiment?
- Did you include any paper and writing tools used to record results?
- Did you think to list everyone's time as a resource used?

Briefly draw students' attention to the fact that all of these are finite resources that have been used up, and ask:

- What difference would it make, in other words, what would be lost if we did the experiment in a way that took four times as long and went through lunch break?
- Or used a hundred gallons of water?
- Or used ten times as much power?
- What motivations might we have for controlling the amount of resources used?
- How might those motivations and the choices they lead to relate to love of God and neighbor and care for creation?

Finally, ask students:

- What knowledge and understanding helps us to be able to control the amount of resources used in an experiment?
- What kind of character qualities will play a role in how successful we are in controlling the quantity of resources? How are carelessness, self-control, consideration for others relevant?
- What might motivate us to seek those character qualities? How can we grow in them?

To test understanding, you can display the final slide from **Chemistry and Shalom PowerPoint** and ask students to write a brief explanation of how choices about the design of lab work can be connected to our relationships to God, creation, neighbor, and self.

DEBRIEF

Activity: Chemistry FASTly Review

Time: 40 Minutes

In Brief

This review activity is appropriate for the end of a semester or longer teaching sequence. It provides a communal way of reviewing material that creates interactions between students, invites students to consider the contribution of others to their learning, and reviews the connections between chemistry, character, and shalom.

Goals

Students will review their work in chemistry with an intentional focus on supporting and learning from others. Students will review the connections between chemistry, virtue, and shalom.

Thinking Ahead

This activity has the potential to engage students for an extended time with minimal teacher intervention. Consider how you can use your freed up time to listen in and diagnose areas of weakness, target particular learners for support, and offer positive feedback when students are working well together. Crouching by working pairs of students and offering help or feedback at eye level can create a stronger sense of solidarity and support. Such supportive behaviors on your part can model and reinforce the message of the activity: that each member of the community is valued and can contribute to the whole, and that we can gratefully receive from others as we learn. If you have been engaging students in reflection on the connection between chemistry, character, faith, and shalom through preceding activities, include each of these elements in a review session to help communicate that the connection to character and faith is not seen as an inessential aside. Teaching FASTly will be most effective if it engages all phases of learning.

Preparing the Activity

You will need: Assorted brief review sheets each containing a set of questions to be reviewed. Break the information for review down into a small amount for each sheet, enough for no more than five minutes of review, using a variety of sheets to cover the whole of the material. Also include the sheets provided in **Chemistry FASTly Review Handout**. This handout gives an indication of the intended format of the review sheets. For this activity to work well you will need a classroom with movable furniture where it is possible to create two large concentric circles of chairs, forming a circle of facing

pairs. The activity can also work with double rows of chairs facing each other. Arrange the seating before the class begins to avoid chaos, wasted time, and a distracting start to class. If you have an odd number of students make one of the pairs into a group of three. Place one cue sheet on each seat along the inner circle so that each pair of seats has a different review prompt sheet with different topics and questions.

Teaching the Activity

Tell students that they are going to work at reviewing what they have learned, and are going to do so collaboratively, in a way that seeks to support one another. Once students are seated facing a partner, make sure that each pair has a review sheet. Give a different sheet for each pair, or, if you have too many pairs, give copies of the same sheet to two pairs who are on opposite sides of the circle. Be sure the sheets from **Chemistry FASTly Review Handout** are interspersed around the circle between the chemistry review sheets that you have created. Give the pairs five minutes to work through reviewing the questions on their sheet. Encourage them to check in with you to clarify areas of uncertainty. If you are able to use a circle layout, you can be easily available in the center. Students should not write on the sheets themselves.

After five minutes have the students in the outer circle move one place to the left. The review sheets remain with the students in the inner circle, who do not move.

Repeat the five minutes of review. This time each pair contains an “expert” who has already reviewed and clarified the material, and a learner who is reviewing these questions for the first time. Make clear that the expert’s role is to make sure that the learner understands the material.

After five minutes have the students in the inner circle move one place to the left, leaving the cue sheet behind them for the next student. Now the student in the outer circle is the “expert” who is repeating the topic. Continue to alternate which circle rotates, and each topic will be reviewed twice while students alternate between expert and novice roles.

Continue the rotations for as long as needed. The continuing change of partners and topics sustains engagement since no single conversation lasts long enough to devolve into inactivity. Be sure to keep the time allotments tight and the rotations brisk to sustain a sense of pace.

At the end make time for a brief discussion about what was gained by reviewing with a variety of different people as compared with reviewing alone or with a favorite partner. How did a regular change of partner help? Did students learn anything from someone with whom they would not normally interact? How can we focus on strengthening one

another's learning rather than just on our own achievement? Allow for brief expressions of thankfulness through quiet reflection or journaling for what was received from others.

Alternate layout: if the shape of the classroom does not allow for large circles, essentially the same effect can be achieved using double rows of chairs facing each other. When one row moves to the left, the person at the left hand end of the row moves to the right hand end of the row to maintain the rotation.