# The Case of the Mysterious Malady

## Unit Summary

Students act as consulting investigators for the Environmental Protection Agency (EPA) to evaluate the illnesses of a family in the area. They receive memos with clues that guide them through their team's research of a potential toxin. Students use previous experience with gas laws and apply their knowledge to determine the source of the illness. Students evaluate four different claims and find research that either strengthens or weakens each claim. They use the *Showing Evidence Tool* to organize their evidence and come to a conclusion as to what is causing the illnesses. Students' research and persuasive skills are put to the test as teams argue their conclusions in a mock trial.

**At a Glance**

**Grade Level**: 10-12
**Subjects**: Chemistry
**Topics**: Environmental Science
**Higher-Order Thinking Skills:** Evaluation, Argumentation, Synthesis
**Key Learnings**: Evaluating Scientific Claims, Applying Gas Laws, Toxins
**Time Needed**: 2 weeks of instruction, 3 periods per week, 90-minute periods
**Background**: California, United States

**Things You Need**

Assessment
Standards
Resources

## Curriculum-Framing Questions

- **Essential Question**
  How do we decide which scientific claims to believe?
- **Unit Questions**
  How does one gather and process scientific data to support a claim?
  How can we apply gas laws to help us solve a problem?
  Why might symptoms not provide enough information when we are trying to diagnose an illness?
- **Content Questions**
  What is a toxin?
  How does the random motion of molecules explain diffusion of gases such as carbon monoxide, chlorofluorocarbons, and radon?
  How does the Ideal Gas Law apply to the diffusion of toxic gas indoors?

## Assessment Processes

View how a variety of student-centered assessments are used in The Case of the Mysterious Malady Unit Plan. These assessments help students and teachers set goals; monitor student progress; provide feedback; assess thinking, processes, performances, and products; and reflect on learning throughout the learning cycle.

## Instructional Procedures

**Prior to the Unit**

Students should have prior experience studying gas behavior using the Ideal Gas Law, Charles' Law, Avogadro's Law, and Boyle's Law. They should also understand how pressure, volume, and temperature affect gas behaviors.

**Look at Scientific Claims**

Review the concept of scientific claims with students by taping a few television commercials or choosing a few magazine ads that make claims that could be scientifically proven. Review the advertisements in class and ask the following questions to determine students' understanding of how to evaluate scientific claims in persuasive media:

- *What claims are made about the product being advertised?*
- *Do you believe in the claims made about these products? Why or why not?*
- *What makes some of these claims more effective than others?*
- *What evidence is provided to support the claims?*

- *How do you gather scientific data to support a claim?*

After students discuss the commercials, introduce the Essential Question, *How do we decide which scientific claims to believe?* Have students record their thoughts about the question in their science journals. Pair each student with a peer and have students share their ideas. Follow with a class discussion and record students' thoughts on chart paper.

**Set Up the Project**
Prior to introducing the activity to students, become familiar with the *Showing Evidence* Web site. Familiarize yourself with the tool and read associated resources such as Walk Through an Example, Try Out the Tool, Classroom Strategies, Project Examples, and Benefits. Before proceeding with the next activity, click here to set up the Mysterious Malady project in your workspace.

**Introduce the Task**
Explain to students that they will take on the role of consulting investigators for the Environmental Protection Agency while evaluating the sickness of a family in the area. Tell students that they will evaluate four different claims concerning the cause of the illness and apply what they know from studying gas laws to determine the source of the illness. Various memos describe the symptoms and the situation of the family being investigated to guide student research.

Divide students into teams of two or three. Give students the timeline handout to help them assimilate the large number of symptoms, potential sources, and side effects they will be tracking. Use this handout to do informal checks of students' organization and information tracking. Demonstrate the use of the *Showing Evidence Tool* by discussing the sample case together or creating a sample project to go over as a class. Show students how to add, describe, and rate evidence and claims. Be explicit in teaching students what is expected of them while using *Showing Evidence*. Discuss with them how much evidence will be needed to either strengthen or weaken a claim. Come to a consensus as a class if necessary. Work together with students to create an understanding of rating evidence reliability—create a rubric with the class to determine what one star means versus five stars as a rating of reliability. An example rating rubric is provided. Ask students to describe their understanding of claims and evidence in their journals.

**Research the Claims**
Provide students with memo 1 and read it aloud in class while student teams track the information on the timeline handout. The first memo introduces symptoms Sally Citizen is suffering from and the possibility of black mold as a potential cause of Sally's afflictions. Lead students in a discussion of the kinds of questions medical professionals ask when they are trying to diagnose someone's illness. Create a group discussion around the following questions:

- *Why might symptoms not provide enough information when you are trying to diagnose an illness?*
- *What other type of information might be needed?*

Record students' thoughts on chart paper and post the paper in the classroom for them to use as reference during research time.

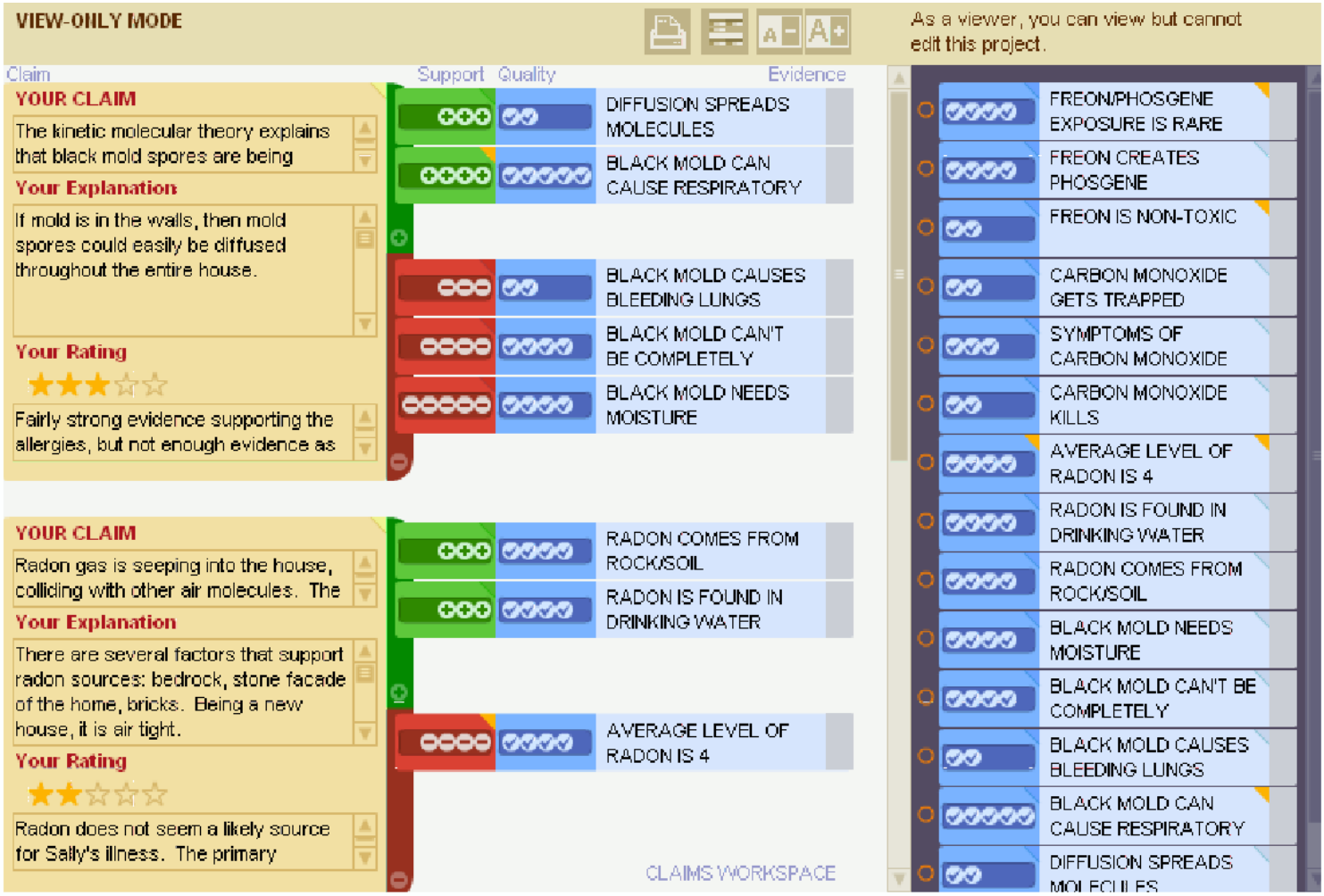
Present the evidence rubric and ask students to use the rubric to periodically self- and peer-assess their evidence as they work through the project. Direct students to the list of resources and have them begin to research the first claim, The kinetic molecular theory explains that black mold spores are being spread throughout the home by air molecules and causing Sally's allergic reactions.

Allow time for peer review of each team's work after each phase of student research. Peer review groups read and assess work of the group assigned to them. Each review group makes constructive comments and corrections where needed to the evidence and to the support or nonsupport of the claim. Refer to the discussion of scientific claims at the beginning of the unit. Encourage students to generate comments for their peer review sessions based on some of the ideas they came up with during the initial discussion. Periodically ask students to record their thoughts about the process of finding, evaluating, and using evidence to make decisions in their journals.

Continue with this research process as students receive memo 2, memo 3, and memo 4. As students read through each memo, have them input specifics into their timeline handout. Remind students that they should evaluate the symptoms detailed in the memo and research the source of the toxin causing the illness. If needed, review with students how gas laws can be applied to the situation being researched.

**Examine the Showing Evidence Activity:**
The *Showing Evidence Tool* space below represents one team's investigation in this project. The case you see is functional. You can double-click on any piece of evidence to read the team's descriptions.

**Project Name:** **The Mysterious Malady** **(Click here to set up this project in your workspace)**
**Prompt:** **What is cause and source of Sally's illness?**




**Draw Conclusions**
After students complete their research for each of the claims, they must synthesize what they learned to make a recommendation to the EPA as to the most-likely cause and source of the sickness affecting all members of the Citizen family. Students write their conclusions in the Comment section of *Showing Evidence*. Each conclusion should clearly state the most likely claim, include one or two sentences summarizing the evidence that supports the claim, and address why the evidence does not support the other claims. While students work in teams, use the collaboration observation checklist to assess collaboration skills.

Each team defends its claim in a grand jury mock trial. For the trial, join teams with the same conclusion. Each group presents its findings in a 5 to 8 minute oral presentation with a multimedia component. See a portion of one team's presentation. The team may use any supporting evidence gathered during research. The multimedia presentation should include the following:

- Evidence used to determine most likely cause and source of the toxin
- Diagram(s) to explain how the toxin gets from its source into Sally Citizen's body
- Explanation of how gas laws were applied to help solve the problem

Hand out the multimedia presentation rubric to help guide the process. After the presentation is created, ask students to self-assess their collaboration skills using the collaboration self-assessment rubric.

**Set Up the Simulation**
Tell students the mayor of Sally's town is being investigated by a civil grand jury. Students act as expert witnesses in the mock trial and testify as to the most likely cause and source of the Citizen family's illness. Distribute the grand jury investigation memo and investigation rubric and review the procedures and expectations for the mock trial. Explain to students that they will play two roles:

- Expert witnesses when their team gives testimony as to the most likely cause of the illness
- Voting member of the grand jury

After all testimony is complete, the entire grand jury will take a vote as to the cause of the family's illness, the source of the toxicant, the method by which the toxicant gets into the bloodstream, and whether indictments should be issued. Students vote by using the grand jury ballot.

**Wrap Up**
Ask students to reflect on the trial and consider whether another group presented a claim with evidence that convinced them to change their original opinion. If so, have students reflect in their journals and share the reasons that made them

change their mind. Share with students that this unit is based on an actual case. The EPA found that an air conditioner was actually leaking Freon, which thermally reacted with the fire from the pilot light and created the WWII nerve gas called phosgene. If the homeowners had actually used the central air conditioner, the Freon would have been depleted, and the air conditioner would have gone out, leading them to the leak.

Have students discuss whether their claim and outcome of the trial was similar to that of the actual results of the case. Have students reflect on their team's claim, if it has changed, and how this exercise relates to the Essential Question, *How do we decide which scientific claims to believe?*

## Prerequisite Skills

- Exposure to gas behavior, including the ideal gas law, Charles' law, Avogadro's law, and Boyle's lawExperience completing practice problems using the gas laws
- Knowledge regarding how pressure, volume, and temperature affect gas behaviors

## Differentiated Instruction

**Resource Student**

- Provide the student with additional templates or scaffolds to ensure project success
- Place the student in cooperative groups that will help the student achieve
- Provide extra time for study Reduce the amount of evidence required or preselect research materials

**Gifted Student**

- Provide the student with the option to substitute or participate in enhanced components of each project throughout the unit
- Expand the research components to accommodate the student's interests and ability level
- Encourage the student to find news items about toxic chemicals in the environment and relate the news items to the project

**English Language Learner**

- Provide a starter set of resources to help the student begin researching
- Allow the student to conduct research in the student's first language
- Encourage the student to ask clarification questions from team members and work with native English speaking students

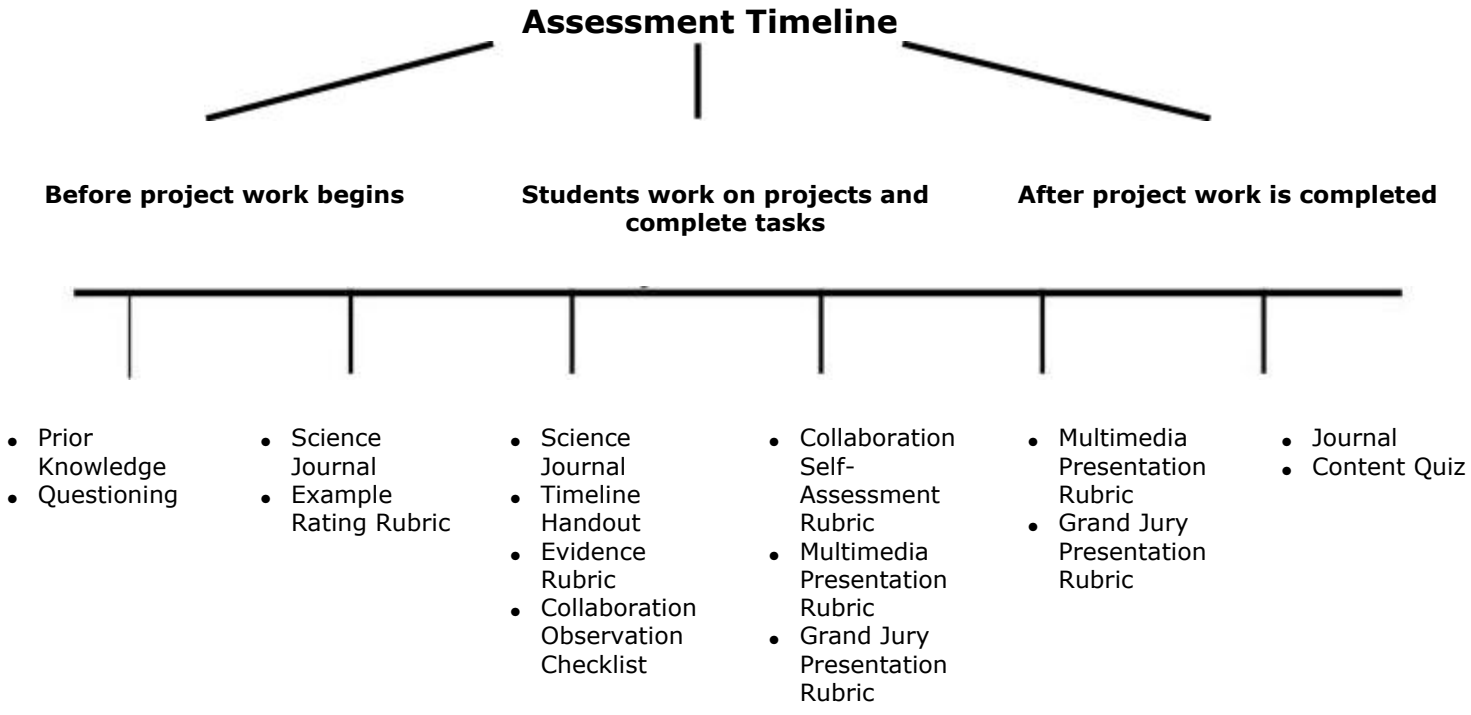
## Credits

Debra Power teaches Chemistry and Physics in Placerville, California. She participated in the Intel® Teach Program, which resulted in this idea for a classroom project. A team of teachers expanded the plan into the example you see here.

Showing Evidence Tool: The Case of the Mysterious Malady

# Assessment Plan

## Assessment Plan




Determine students' initial understanding of the components of effective argumentation through a discussion of the claims made in contemporary media and through writing in their science journals. Continue using the journals throughout the unit to assess students' understanding of chemistry content and the process of argumentation. Use the timeline handout to informally check students' organization and information tracking. Use the example rating rubric to explain the criteria for evaluating evidence and the evidence rubric to help students assess their progress as they perform the various parts of the project.

When students begin working on the project in teams, distribute the multimedia presentation rubric to guide the creation of their presentations. In addition, explain that group process skills are assessed using the collaboration observation checklist and that they use the collaboration self-assessment rubric to assess their individual and group performance at the end of the project. When students plan their presentation of their findings to the grand jury, provide the grand jury presentation rubric to help them prepare effectively.

After the presentations to the grand jury, students reflect on any information they heard that influenced their opinions about the cause of the family's illness. When the project is completed, the content quiz, the multimedia presentation rubric, and the grand jury presentation rubric are used to assess students' performances, products, and knowledge.

Showing Evidence Tool: The Case of the Mysterious Malady

# Content Standards and Objectives

## Targeted Content Standards and Objectives:

**California State Science Content Standards—Grades 9-12**
www.cde.ca.gov/be/st/ss/scmain.asp*

**Gases and Their Properties**
The kinetic molecular theory describes the motion of atoms and molecules and explains the properties of gases. As a basis for understanding this concept:

- Students know the random motion of molecules and their collisions with a surface create the observable pressure on that surface.
- Students know the random motion of molecules explains the diffusion of gases.
- Students know how to apply the gas laws to relations between the pressure, temperature, and volume of any amount of an ideal gas or any mixture of ideal gases.

**Investigation and Experimentation**

- Formulate explanations by using logic and evidence.
- Recognize the usefulness and limitations of models and theories as scientific presentations of reality.
- Recognize the cumulative nature of scientific evidence.
- Analyze situations and solve problems that require combining and applying concepts from more than one area of science.
- Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings.

## Student Objectives

**Students will be able to:**

- Apply gas laws to solve a real world problem
- Investigate and evaluate the credibility of claims
- Identify flaws of reasoning within arguments
- Present an oral argument

# Resources

## Materials and Resources

**Internet Resources**

- Tox Town
  http://toxtown.nlm.nih.gov/town/main.html*
  Animated resource providing an introduction to toxic chemicals and environmental health risks you might encounter in everyday life
- U.S. Environmental Protection Agency
  www.epa.gov/iaq/molds/moldresources.html*
  Topics addressing the issue of mold
- EPA: Radon
  www.epa.gov/iaq/radon/pubs*
  Radon-specific publications and resources
- National Safety Council
  www.nsc.org/ehc/radon.htm*
  Collection of radon resources
- EPA: Indoor Air Pollution
  www.epa.gov/iaq/pubs/hpguide.html#combustion%20products*
  Publication offering an overview of indoor air pollution challenges—includes diagnostic references
- Chlorofluorocarbons
  www.cmdl.noaa.gov/noah/publictn/elkins/cfcs.html*
  Brief history of chlorofluorocarbons use in refrigeration devices
- Freon
  http://inventors.about.com/library/inventors/blfreon.htm*
  Brief article on the history of Freon
- EPA: Phosgene
  www.epa.gov/ttn/atw/hlthef/phosgene.html*
  Background information on phosgene
- eMedicine
  www.emedicine.com/emerg/topic849.htm*
  Explores the toxicity of phosgene

**Other Resources**

- Guest presenters could include Environmental Protection Agency enforcement specialists or environmental lawyers

**Technology – Hardware**

- Computer with Internet connection to access the *Showing Evidence Tool*
- Projection system to show students how to use the *Showing Evidence Tool*

**Technology – Software**

- Multimedia software to create presentation for Grand Jury Investigation

Student(s): _____
_____
_____

**TIMELINE: THE CASE OF THE MYSTERIOUS MALADY**

**Case Question**: "What is causing Sally to be sick, and where is it coming from?

| POTENTIAL SOURCES OF SALLY'S ILLNESS | BLACK MOLD | RADON | CARBON MONOXIDE | FREON-22 CONVERTED TO PHOSGENE | HOUSE IS ABANDONED |
|---|---|---|---|---|---|
| **TIMELINE** 1st Month Citizens Move In | | | | | |
| **SYMPTOMS** | | | | | |
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| **MEDICAL EXPERT CONSULTED** | | | | | |

*This Timeline is available for you to keep track of all the symptoms that Sally and the Citizen family endure throughout the course of this research project. Keep this timeline for your own use. It will definitely help you in dealing with the large variety of symptoms that Sally is experiencing.*

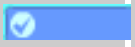
# Rate Your Evidence and Claims

**Minimum Requirements**

Each claim must have sufficient evidence that both supports and opposes the claim.

**Rating the Quality of Your Evidence**

How do we decide which scientific claims to believe? We must evaluate whether what we're being told is the truth. Part of that evaluation is considering whether we can trust the source, plus how accurate and credible we believe the information is. When reviewing and rating your evidence, use the following rubrics.

| Rating |  |  |  |  |  |
|---|---|---|---|---|---|
| **Author** | **Individual** | **Individual or Expert** | **Creditable Author** | **Expert in the field** | **Expert in the field** |
| **Sponsoring Organization** | **None** | **Biased Organization** | **Unbiased Organization** | **Credible Organization** | **Credible Organization** |
| **How strong is the evidence?** | **Based on opinion** | **Opinion based slant** | **Gives both pros and cons of the usage** | **Factually based** | **Facts that are statistically supported** |

**Rating How Well Your Evidence Supports or Weakens the Claim**

How does one gather and process scientific data to support a claim? The rating above is just to determine whether the evidence is true and reliable. This rating is to show how well the evidence supports or weakens the claim—where we determine the strength of the evidence in relation to the claim. For this rating, put aside any concerns about whether or not the evidence is true or valid. If the evidence is true, how well does the evidence support or weaken the claim? Is the evidence central to your argument?

|  |  |  |  |  |
|---|---|---|---|---|
| The evidence has little effect on the determination of whether the claim is true or valid. | The evidence seems to support the claim, but there are still significant uncertainties as to whether that support really proves the claim is true. | There are other elements that come into play so that this evidence is not terribly important, but it does help to build the case. | There is a small amount of room for interpretation or other variable, but basically the evidence is strong in its support of the claim. | Considering for the moment that the evidence is true, it makes a very strong case for the claim. |

|  |  |  |  |  |
|---|---|---|---|---|
| The evidence has little effect on the determination of whether the claim is not true or valid. | The evidence does seem to weaken the claim, but there are still significant uncertainties as to whether that opposition really proves the claim is false. | There are other elements that come into play so that this evidence is not terribly important, but it does help to build the case against the claim. | There is a small amount of room for interpretation or other variable, but basically the evidence is strong in its opposition of the claim. | Considering for the moment that the evidence is true, it makes a very strong case against the claim. |

**Rating Your Claim**

After you have collected, evaluated, and attached your evidence to a claim, you must determine whether the claim is actually true or valid or not. In the research process, things are rarely black or white. A rating scale is provided in the *Showing Evidence Tool* to help you communicate how strongly you believe all the evidence together supports or opposes the claim.

| (no stars) | ★ | ★★ | ★★★ | ★★★★ | ★★★★★ |
|---|---|---|---|---|---|
| Considering all of the evidence and the quality of that evidence, this claim has absolutely no merit and has been proven beyond a shadow of a doubt to be untrue. | Although there are elements of truth in this claim, the evidence casts such considerable doubt as to the truth of this claim, that it is fairly clear that the claim is not true and/or valid. | Circumstantial or minor evidence does seem to support this claim, but not enough to make a determination. "Reasonable doubt" exists. | The evidence provided does support the claim, but there are still uncertainties as to whether that support really proves the claim is true. This rating is the result of a "hung jury." | There is a small amount of room for interpretation or other variable, but considering all of the evidence and the quality of that evidence, the claim is strongly supported and is most likely true and/or valid. | Considering all of the evidence and the quality of that evidence, it is quite obvious that this claim is true and valid. |

**Conclusion**

The conclusion section is to be used when you have multiple claims to consider. Weigh the merits of each claim and explain your reasoning as to which claim is more true or valid than the others.

# The Mysterious Malady
# Evidence Rubric

**Memo 1**

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| **Quantity of Evidence** | Our evidence comes from at least 3 different kinds of sources specifically addressing the effects of black mold on health. | Our evidence comes from 3 sources specifically addressing the effects of black mold on health. | Our evidence comes from only 2 sources, or one of our sources only vaguely addresses the effects of black mold on health. | Our evidence comes from only 1 source, or none of our sources specifically address the effects of black mold on health. |
| **Quality of Evidence** | All our evidence comes from experts from credible organizations in the field and is supported with statistics about black mold's effects on health. | All our evidence comes from experts from credible or unbiased organizations in the field, is factually based, and/or gives pros and cons on black mold's effects on health. | Most of our evidence about black mold's effects on health comes from experts in credible or unbiased organizations, but some of our evidence is opinion without factual or statistical support. | Our evidence comes from biased organizations and consists of opinion without factual or statistical support. |
| **Relevance of Evidence** | All our evidence makes a strong and convincing case that black mold is or is not the cause of Sally's illness. | Most of our evidence makes a strong and convincing case that black mold is or is not the cause of Sally's illness, but a small part of our evidence may be open to different interpretations. | Some of our evidence makes a case that black mold is or is not the cause of Sally's illness, but much of our evidence may be irrelevant or open to different interpretations. | Very little of our evidence makes a case that black mold is or is not the cause of Sally's illness, and most of our evidence is irrelevant and open to different interpretations. |

**Memo 2**

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| **Quantity of Evidence** | Our evidence comes from at least 6 different kinds of sources, with abundant evidence relating to both black mold and radon. | Our evidence comes from 6 sources, with sufficient evidence relating to both black mold and radon. | Our evidence comes from only 4 or 5 sources, or one factor (black mold or radon) does not have a satisfactory amount of evidence. | Our evidence comes from two or fewer sources, or our sources do not address either topic (black mold or radon) satisfactorily. |
| **Relevance of Evidence** | The accumulation of our evidence makes a strong and convincing case that black mold, radon, or a combination of the two factors is or is not the cause of Sally's illness. | The accumulation of our evidence makes a strong and convincing case that black mold, radon, or a combination of the two factors is or is not the cause of Sally's illness, but portions of our evidence may be irrelevant or open to different interpretations. | The accumulation of our evidence attempts to make a case that black mold, radon, or a combination of the two factors is or is not the cause of Sally's illness, but much of our evidence is irrelevant or open to different interpretations. | The accumulation of our evidence does not make a case that black mold, radon, or a combination of the two factors is or is not the cause of Sally's illness, and most of our evidence is irrelevant and open to different interpretations. |

**Memo 3**

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| **Quantity of Evidence** | Our evidence comes from at least 3 different kinds of sources specifically addressing the effects of carbon monoxide on health, and at least one source convincingly identifies the source of the gas. | Our evidence comes from 3 sources specifically addressing the effects of carbon monoxide on health, and at least one source identifies the source of the gas. | Our evidence comes from only 2 sources addressing the effects of carbon monoxide on health, or none of our sources identifies the source of the gas. | Our evidence comes from only 1 source, or our sources do not specifically address the effect of carbon monoxide on health and do not identify the source of the gas. |
| **Quality of Evidence** | All our evidence makes a strong and convincing case that carbon monoxide is or is not the cause of Sally's illness.<br><br>Our evidence strongly supports our identification of the source of the gas in her home. | Most of our evidence makes a strong and convincing case that carbon monoxide is or is not the cause of Sally's illness, but a small part of our evidence may be open to different interpretations.<br><br>Our evidence supports our identification of the source of the gas in her home. | Some of our evidence makes a case that carbon monoxide is or is not the cause of Sally's illness, but much of our evidence may be irrelevant or open to different interpretations.<br><br>Our evidence weakly supports our identification of the source of the gas in her home. | Very little of our evidence makes a case that carbon monoxide is or is not the cause of Sally's illness, and most of our evidence is irrelevant and open to different interpretations.<br><br>We do not identify the source of the gas with any accuracy. |

**Memo 4**

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| **Quantity of Evidence** | Our evidence comes from at least 3 different kinds of sources that support our claim that Freon has or has not leaked into Sally's home and has created phosgene that is causing the family's sickness. | Our evidence comes from at least 3 sources that support our claim that Freon has or has not leaked into Sally's home and has created phosgene that is causing the family's sickness. | Our evidence comes from 2 sources that support our claim that Freon has or has not leaked into Sally's home. | Our evidence comes from 1 source that supports our claim that Freon has or has not leaked into Sally's home. |
| **Quality of Evidence** | All our evidence makes a strong and convincing case that Freon has or has not leaked into the home. | Most of our evidence makes a strong and convincing case that Freon has or has not leaked into the home, but a small part of our evidence may be open to different interpretations. | Some of our evidence makes a case that Freon has or has not leaked into the home, but much of our evidence may be irrelevant or open to different interpretations. | Very little of our evidence makes a case that Freon has or has not leaked into the home, and most of our evidence is irrelevant and open to different interpretations. |

# Multimedia Presentation Rubric

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| **Explanation of Claims** | Our explanation of claims specifically provides accurate, detailed information on what is responsible or not responsible for the illness.<br><br>We provide a detailed explanation of how gas laws were applied to help solve the problem. | Our explanation of claims provides a brief amount of information on what is responsible or not responsible for the illness.<br><br>We provide some explanation of how gas laws were applied to help solve the problem. | Our explanation of claims provides vague information on what is responsible or not responsible for the illness.<br><br>We provide minimal explanation of how gas laws were applied. | Our explanation of claims provides no information on what is responsible or not responsible for the illness.<br><br>We do not provide an explanation of gas laws. |
| **Analysis of Evidence** | Our analysis shows a thorough understanding of the complex ways in which evidence relates to and supports or opposes the claims.<br><br>Our rationale of support and nonsupport reflects an understanding of the complex interaction of factors causing the illness. | Our analysis shows a basic understanding of how evidence supports or opposes the claims.<br><br>Our rationale of support and nonsupport reflects some understanding of the complexity of the various factors causing the illness. | Our analysis shows a vague understanding of how evidence relates to the claims.<br><br>Our rationale of support and nonsupport reflects a superficial understanding of the various factors causing the illness. | Our analysis shows a general lack of understanding regarding how evidence and claims relate to each other.<br><br>Our rationale does not support our rating. |
| **Conclusion** | Our conclusion reflects a well-developed understanding of the factors that are most to blame for the illness based on evidence gathered.<br><br>Our final focus on what is ultimately to blame is convincing. | Our conclusion reflects an adequate understanding of the factors that are most to blame for the illness based on evidence gathered.<br><br>Our final focus on what is ultimately to blame is somewhat convincing. | Our conclusion reflects a basic understanding of the factors that are most to blame for the illness based on evidence gathered.<br><br>Our final focus on what is to blame is not clearly related to the claim. | Our conclusion is not related to our claim and does not show a relationship between claim and evidence.<br><br>Our final focus shows no understanding of what is to blame. |
| **Organization** | Our presentation is clear and logical, supports the message, uses a | Our presentation is somewhat clear and logical, adequately | Our presentation is not sequential, minimally supports the message, does | Our presentation is unclear, does not use a diagram, and does not cite |

| | | | | |
|---|---|---|---|---|
| | detailed diagram to explain the message, and cites sources appropriately. | supports the message, uses a diagram, and cites most sources appropriately. | not include a diagram or uses a diagram that does not enhance the message, or does not cite most sources appropriately. | sources. |
| **Time** | Our presentation thoroughly covers all of the required topics within the 5 to 8 minute time limit. | Our presentation covers the required topics within the 5 to 8 minute time limit. | Our presentation covers most of the required topics within the 5 to 8 minute time limit, but one or two topics are skipped or not adequately addressed. | Our presentation address very few required topics within the 5 to 8 minute time limit. |
| **Writing: Style** | We use an appropriate technical writing style in our presentation, organizing the information by headings, subheadings, and bullets with parallel construction so adequate information is conveyed in as few words as possible. | We use an appropriate technical writing style in our presentation, using headings, subheadings, and bullets to convey information efficiently. | We attempt to use an appropriate technical style of writing in our presentation, but our information is sometimes confusing, wordy, or difficult to find. | We do not use technical writing in our presentation, and the audience has difficulty understanding our presentation. |
| **Writing: Conventions** | The writing in our presentation has no errors in spelling, punctuation, capitalization, or usage, unless they are deliberately used to enhance the meaning. | The writing in our presentation has no errors in spelling, punctuation, capitalization, or usage that detract from meaning. | The writing in our presentation has some errors in spelling, punctuation, capitalization, or usage that detract from meaning. | The writing in our presentation has many errors in spelling, punctuation, capitalization, and usage that detract from meaning. |
| **Graphics and Special Effects** | We use various presentation features—such as transitions, animations, and sound—along with appropriate graphics to enhance our presentation's theme. | We use various presentation features to enhance our presentation. | We use some presentation features, but the features often detract from the meaning of our presentation. | We do not use presentation features, or we use features that overwhelm the meaning of our presentation. |

| | | | | |
|---|---|---|---|---|
| **Presentation: Public Speaking** | We begin our presentation with an introduction, end it with a conclusion, and accompany the slides with appropriate, relevant comments that enhance the meaning of our presentation. | We begin our presentation with an introduction, end it with a conclusion, and accompany the slides with appropriate, relevant comments. | We begin our presentation with an introduction and end it with a conclusion, but we read many of our slides or make only a few relevant comments. | We do not include an introduction and conclusion, or we just read our slides. |

# The Mysterious Malady
# Collaboration Observational Checklist

Date _____ Group _____

| | Name | Notes |
|---|---|---|
| **Interacts constructively with other group members** | | |
| • Listens attentively | | |
| • Exhibits attentive body language | | |
| • Asks questions | | |
| • Paraphrases comments | | |
| • Encourages participation by all group members | | |
| • Makes relevant and thoughtful contributions | | |
| **Solves problems effectively** | | |
| • Carefully and respectfully considers all proposed ideas | | |
| • Suggests creative and appropriate solutions | | |
| • Logically and respectfully evaluates proposed solutions | | |
| **Approaches task constructively** | | |
| • Considers short- and long-term goals | | |
| • Stays focused on task | | |
| • Shows enthusiasm and positive attitude about task | | |

# The Mysterious Malady
# Self-Assessment Collaboration Rubric

| 4 | 3 | 2 | 1 |
|---|---|---|---|
| I paraphrase what others say in my group to clarify understanding.<br><br>I ask probing questions.<br><br>I encourage and value the ideas and opinions of my group members.<br><br>I express my opinions and positions without hurting the feelings of others in my group.<br><br>I seek out diverse opinions and try to come to common understanding. | I respond verbally to the ideas of others in my group.<br><br>I am interested and curious about the ideas of others in my group.<br><br>I communicate my opinions without passing judgment, such as using “I” versus “you” messages.<br><br>I extend my discussions beyond my initial thoughts and ideas.<br><br>I resolve my differences with my group members in a positive way. | I acknowledge the ideas of others.<br><br>Occasionally, I repeat the ideas of others to acknowledge or indicate support.<br><br>Sometimes, I have a difficult time responding to the ideas of others in my group.<br><br>I pay attention to the consequences of what I say or do at times, but taking turns or accepting suggestions from others is difficult.<br><br>Sometimes, I try to resolve differences, but I often give in too easily or refuse to change my opinion, even when given good arguments. | I offer feedback only if requested.<br><br>I have difficulty responding to questions.<br><br>My contributions are neither acknowledged nor responded to.<br><br>I don’t pay attention to the consequences of what I say or do.<br><br>I don’t give reasons for my opinions and just give in when my opinions are questioned, or I refuse to change my mind no matter what anyone says. |

# The Mysterious Malady
# Grand Jury Presentation Rubric

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| **Preparation and Research: Witness Testimony** | Our witness statements are scientifically accurate, fully developed, completely consistent with the claim, and accurately portrayed.<br><br>The statements show a thorough understanding of the complex ways in which evidence relates to and supports our claim.<br><br>Our witnesses respond to all questions and keep their answers within the scope of the case. | Our witness statements are scientifically accurate, adequately developed, fairly consistent, and accurately portrayed.<br><br>The statements show a basic understanding of how evidence supports our claim.<br><br>Our witnesses respond to most questions and keep answers within the scope of the case. | Our witness statements, questions, and/or performances attempt to show a basic understanding of how evidence supports our claim.<br><br>The statements are sometimes inconsistent and irrelevant.<br><br>Our witnesses attempt to respond to most questions and sometimes keep their answers within the scope of the case. | Our witness statements, questions, and/or performances communicate very little relevant information.<br><br>The statements are inconsistent with evidence supporting or opposing our claim.<br><br>Our witnesses cannot respond to most questions, and they frequently wander outside the scope of the case. |
| **Voice** | Our speaking is easily understood.<br><br>We consistently speak with appropriate rate, volume, and intonation. | Our speaking is understood most of the time.<br><br>We speak with appropriate rate, volume, and intonation most of the time. | Our speaking is sometimes understood.<br><br>We occasionally speak with an inappropriate rate, volume, or intonation. | Our speaking cannot be understood.<br><br>We speak with an inappropriate rate, volume, or intonation. |
| **Authenticity** | Our portrayals of the characters in the courtroom | Our portrayals of the characters in the courtroom | Our portrayals of the characters in the courtroom | Our portrayals of the characters in the courtroom |

| | | | | |
|---|---|---|---|---|
| | are very realistic.<br><br>Our body and facial expressions, along with our words and gestures, enhance the meaning of what we are saying. | are believable.<br><br>Our body and facial expressions are appropriate and add to what we are saying. | are somewhat believable.<br><br>Our body and facial expressions are appropriate most of the time. | are not believable.<br><br>Our body and facial expressions are wooden or detract from what we are saying. |
| **Courtroom Decorum** | We interact appropriately with others.<br><br>We stay in character and follow courtroom guidelines. | We interact appropriately most of the time.<br><br>We follow courtroom guidelines. | We interact appropriately, but at times we seem distracted and unengaged.<br><br>We follow courtroom guidelines most of the time. | We interact inappropriately and seem distracted and unengaged most of the time.<br><br>We do not follow courtroom guidelines. |

**FOUR-SQUARE QUIZ**
**The Case of the Mysterious Malady**

*Divide your paper into four equal parts. Answer the four questions—one in each of the four quadrants.*

1) Use Avagadro's Law [ (PV=nRT), where P = Pressure, V = Volume, n = number of moles, R = Gas Constant, & T = Temperature] to explain how Freon-22 could be leaking from the unused air conditioner.

2) List 3 indoor air pollutants and the most likely source for each.

3) List 2-3 symptoms that led you to believe the claim that you defended in the Grand Jury Investigation.

4) Use the kinetic theory of gases to explain how Freon got from the leaky air conditioner to Sally's lungs.

**INTEROFFICE MEMO #1**

**TO:** CHEMICAL INVESTIGATIONS GROUP

**FROM:** DR. I. M. NOTAQUACK

ENVIRONMENTAL PROTECTION AGENCY

**RE:** MYSTERIOUS ILLNESS OF THE CITIZEN FAMILY

**PRIORITY:** [URGENT]

Dear Investigators,

Your excellent research in the fields of chemical and medical research has earned you a formidable reputation. To that end, the management at the Environmental Protection Agency (EPA) respectfully requests your assistance in evaluating the illnesses of a family in your area. Your task is to research and evaluate some of the principle causes of the homeowners' ailments.

The case has just recently been brought to our attention. A few months ago, Sally Citizen just couldn't believe that she was living her dream. Sally and her husband Bob had just completed their new custom-built home in the country. Their two girls, Ima and Ura, Citizen were quite happy in their new dwelling. Each girl finally got her own bedroom and truly enjoyed decorating her personal space. After moving in, the family quickly unpacked their belongings and went about their daily business. The girls went to High Sierra Mountain High School while Officer Bob went off to fight fires every day. Sally was the stay-at-home mom and continued with her duties of being the homemaker.

Sally noticed after a couple weeks had passed that she had a headache and the sniffles. Not thinking too much about it, she took an over-the-counter allergy medication. Two weeks passed and Sally decided she must have the flu. Two weeks after that, her sniffles had progressed into what she thought were full-blown allergies. Knowing that allergies can often cause toothaches (which she was now experiencing), Sally finally decided to see her family physician. He quickly prescribed allergy medication for Sally. The medication did seem to help her feel better for a while. Particularly when she went for her five-mile runs, Sally definitely noticed she could breathe easier.

Three months have now gone by and Sally still has allergies. Her respiratory ailments have progressed into asthma. She still has a pain in her jaw. Sally's skin rash continues to spread all over her body. Poor Sally seems to be the only one in the family with these symptoms.

Bob, the good husband that he is, recently found an article about the effects of black mold on the human body. When he brought it home to Sally, she immediately took the article to the family physician to ask about the possibility that black mold is causing her symptoms.

Your task today is to perform research of black mold as a potential cause of Sally's afflictions. Your research team will need to find evidence that supports or disputes the claim, The kinetic molecular theory explains that black mold spores are being spread throughout the home by air molecules and causing Sally's allergic reactions.

Thank you for your attention to this matter. I look forward to working with you and your team as we work toward the common goal of the health and well-being of the Citizen family.

Sincerely,

Dr. I. M. Notaquack

**INTEROFFICE MEMO #2**

**DATE:** 6 MONTHS LATER
**TO:** CHEMICAL INVESTGATIONS GROUP

**FROM:** DR. I. M. NOTAQUACK

ENVIRONMENTAL PROTECTION AGENCY

**SUBJECT:** MYSTERIOUS ILLNESS OF THE CITIZEN FAMILY

**CC:** MEDICAL INVESTIGATIONS GROUP

Dear Investigators,

Six months have elapsed. The Citizens have now had the southern-facing exterior wall removed in order to be rid of any potential black mold. Sally still has the symptoms mentioned in Interoffice Memo # 1, but she also has additional symptoms that are disrupting her life. Sally cringes when she has to brush her hair because it is falling out by the handfuls. Her toothache has progressed from jaw pain to a severe earache. Sally no longer takes the allergy medication and she is increasingly thirsty. Her nails are cracked with tiny white horizontal lines across them. Sally's family physician has just referred her to an oncologist.

Sally and Bob's new home sits on the hilltop overlooking the mountains. Although they had soil brought in and a new lawn installed, the house sits on granite bedrock located five feet below the topsoil. The house was built on a concrete slab. They have a single room in the lower floor that they use as a family room. The bottom floor is surrounded with cement cinder blocks. The facade of the house is covered with metamorphic rock from the local quarry. Dual-pane windows were installed on every exterior window. The family drinking water comes from a well that was drilled into a large underground aquifer.

The Environmental Management Group is still evaluating black mold as the potential source for Sally's illnesses. However, the EPA respectfully requests your assistance in evaluating a second potential source for Sally's symptoms—radon. Fearful of radon poisoning, Sally bought a small $10 radon test kit. The indoor radon level was 4.5 Pico curies per liter of air.

You will research, analyze, and synthesize information about radon. You will create an argumentation around radon seepage into the Citizen home. Use the *Showing Evidence Tool* to compile evidence that supports or refutes this claim: Radon is diffused throughout the Citizen home and is the primary indoor air pollutant. You need to find evidence that supports or refutes the claim about radon gas and provide evidence stating a possible source of the radon. Again, you are responsible for evaluating, synthesizing, and analyzing Web sites to find evidence that supports or refutes the claim.

Thank you for your attention to this matter. I appreciate your continued support.

Sincerely,

Dr. I. M. Notaquack

**INTEROFFICE MEMO #3**

**DATE:** 9 MONTHS LATER

**TO:** CHEMICAL INVESTICATIONS GROUP

**FROM:** DR. I. M. NOTAQUACK

ENVIRONMENTAL PROTECTION AGENCY

**RE:** INVESTIGATION OF POTENTIAL SICK BUILDING

**PRIORITY:** [URGENT]

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Dear Investigators,

Nine months have elapsed since the Citizens moved into their new home. Sally has developed major debilitating symptoms. She has heart palpitations that are brought on by anxiety attacks, which she now has on a regular basis. Sally wakes up at 4 a.m. with night sweats. She cries incessantly and finds she is frequently confused. Sally had a hysterectomy to try and alleviate some of her symptoms. Unfortunately, she still has all of the same symptoms that she has been having for the past year. In addition to those symptoms, she now has blurred vision and dizziness. She has begun having fainting spells and is afraid to drive the car. Since the hysterectomy did not improve Sally's ailment, she has now been referred to a neurologist.

All members of the family are also feeling sick. Ima Citizen now has regular stomachaches. She has pain in her joints and her shoulder hurts so badly she can no longer throw a softball. Ura Citizen also has aching joints. Sometimes her ankle joint pain is so severe that she can hardly walk. Both girls have begun having severe menstrual cramps.

Although Sally and Bob have a central air system, they generally choose to use the fireplace for heating their home in the winter. In fact, the summers have even been so mild that they haven't even bothered to use their air conditioner at all.

The EPA has done more tests in the neighborhood, and scientists have now added carbon monoxide poisoning to the growing list of potential sources of the Citizen family's ailments. Your goal is to find evidence that supports or refutes this claim: Random motion of carbon monoxide molecules has caused it to be diffused throughout the home, causing the Citizens' symptoms. At least one piece of evidence must include a reasonable source for the carbon monoxide in the Citizen home.

Thank you very much for your attention to this matter. Your assistance in finding the source of carbon monoxide and evaluating the symptoms is greatly appreciated.

Sincerely,

Dr. I. M. Notaquack

**INTEROFFICE MEMO #4**

**DATE:** 12 MONTHS LATER

**TO:** CHEMICAL INVESTIGATIONS GROUP

**FROM:** DR. I. M. NOTAQUACK

ENVIRONMENTAL PROTECTION AGENCY

**RE:** INVESTIGATION OF POTENTIAL SICK BUILDING

**PRIORITY:** [URGENT]

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Dear Investigators:

The Citizens have been in their new home for 12 months. Now, the entire family is experiencing extreme and frequent bouts of dizziness and confusion. In fact, the entire Citizen family is now experiencing many of the same symptoms that Sally has suffered over the past 12 months. Sally still has tremors and continued ringing in her ears. The muscles in her face are twitching. She still has blurred vision and heart palpitations. She continues to have trouble breathing and has a lump in her throat, phlegm, and cannot control her coughing. Her chest pains are frequently debilitating.

The neurologist has detected trace amounts of phosgene ($COCl_2$) as well as carbon monoxide in Bob's last blood test. The EPA scientists now speculate that phosgene can be formed by the thermal reaction with Freon. In order to evaluate the possibility of a toxic chlorofluorocarbons (such as Freon), you must again analyze and synthesize information. Again, you are responsible for finding evidence that supports or refutes your claim as to the plausibility of Freon being the indoor air pollutant in the Citizen home. Your team must evaluate this claim: Freon gas is under pressure, leaking into the home, thermally reacting to create phosgene, and is causing the Citizen family sickness.

Thank you for your attention to this matter.

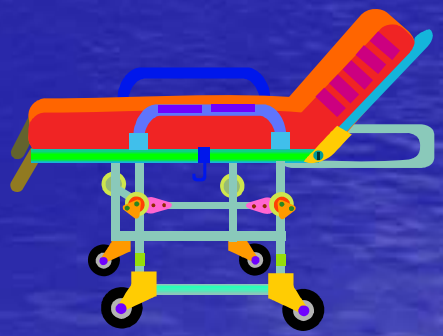
Sincerely,

Dr. I. M. Notaquack

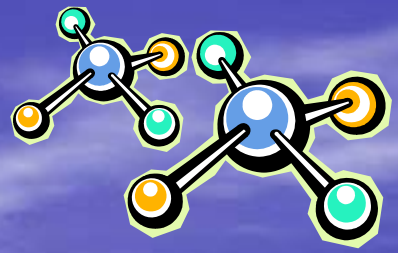


# The Mysterious Malady: INTRODUCTION

Sally was living the American Dream. She had a loving and caring husband, two wonderful children, and had just moved into her lovely new custom-built home in the foothills of the Sierra Nevada mountains. Sally was very happy…until she started getting sick.



# PURPOSE



**The purpose of our student research is to demonstrate evidence that supports or refutes four different claims made about the causes of Sally Citizen's illness:**

1. The kinetic molecular theory explains that toxic black mold spores are being spread throughout the home by air molecules & causing Sally's allergic reactions.

2. Radon gas is seeping into the house, colliding with other air molecules. The family is getting cancer from breathing in the radon.

3. Random motion of carbon monoxide molecules has caused it to be diffused throughout the house, causing Sally's illness.

4. Freon has thermally reacted with warm air and created phosgene causing Sally to be sick.

# GAS LAWS: WHAT IS KINETIC MOLECULAR THEORY?

- Kinetic Molecular Theory explains why molecules of gases are constantly moving, colliding with each other, & bouncing back and forth.
- The random motion of molecules explains the diffusion of gases
- The temperature of a substance is proportional to average kinetic energy of the moving molecules
- The higher temperature, the more rapid molecular motion, the higher the pressure will become.
- The gas laws relate pressure, temperature, & volume of any ideal or mixture of ideal gases.

# OUR FORMAT

**EVIDENCE:** This section of each slide shows the evidence that was researched. Two types of evidence were evaluated: 1) Potential sources of the toxins, & 2) Symptoms of the toxins; ALL with the understanding that kinetic molecular theory would explain the gas being diffused throughout Sally Citizen's house.

**EVIDENCE QUALITY (*****):** The source of the evidence (website) was rated on a scale from 1 - 5 stars.

**WHY SUPPORTING SALLY'S ILLNESS (*****):** How well the evidence supported each of the four claims was rated on a scale from 1 – 5.

**WHY REFUTING SALLY'S ILLNESS (*****):** Tells how well the evidence refutes the claim and is rated accordingly.

# DIFFUSION SPREAD MOLD TO SALLY'S LUNGS

- **EVIDENCE:** If the gas particles are subject to Brownian motion and there is no preferred direction for the random oscillations, then the particles will tend to be spread evenly throughout the medium over time.

- **EVIDENCE QUALITY (***):** The web site by Encyclopedia Britannica clearly explains diffusion by Brownian motion.

- **WHY SUPPORTING SALLY'S ILLNESS (***):** Because of the laws of diffusion, Sally is inhaling spores of black mold because they are traveling through the air.

http://www.britannica.com/nobel/micro/88_96.html

# BLACK MOLD CAN CAUSE RESPIRATORY AILMENTS

- **EVIDENCE:** Symptoms associated with mold exposures include allergic reactions, asthma, and other respiratory complaints

- **EVIDENCE QUALITY(*****):** The U.S. Environmental Protection Agency is a respected federal agency. This is an extremely reliable source because the agency obviously does in depth research to come to this conclusion.

- **WHY SUPPORTING SALLY**(****): Some of the symptoms that come with black mold exposure are the same symptoms that Sally Citizen is experiencing: flu-like symptoms, runny nose, sniffles, headaches, skin rashes, respiratory ailments.

http://www.epa.gov/iaq/molds/moldresources.html#Ten%20Things%20You%20Should%20Know%20About%20Mold

# RADON COMES FROM ROCK

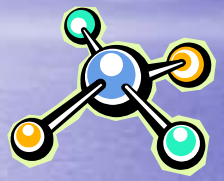
- **EVIDENCE:** Radon gas comes from radioactive decay of radium, a ubiquitous element found in rock and soil. It moves from soil into the air, emits alpha, beta particles, and gamma rays. Radiation damages cells & results in cellular transformation in the respiratory tract, which can lead to radon-induced lung diseases or cancer.

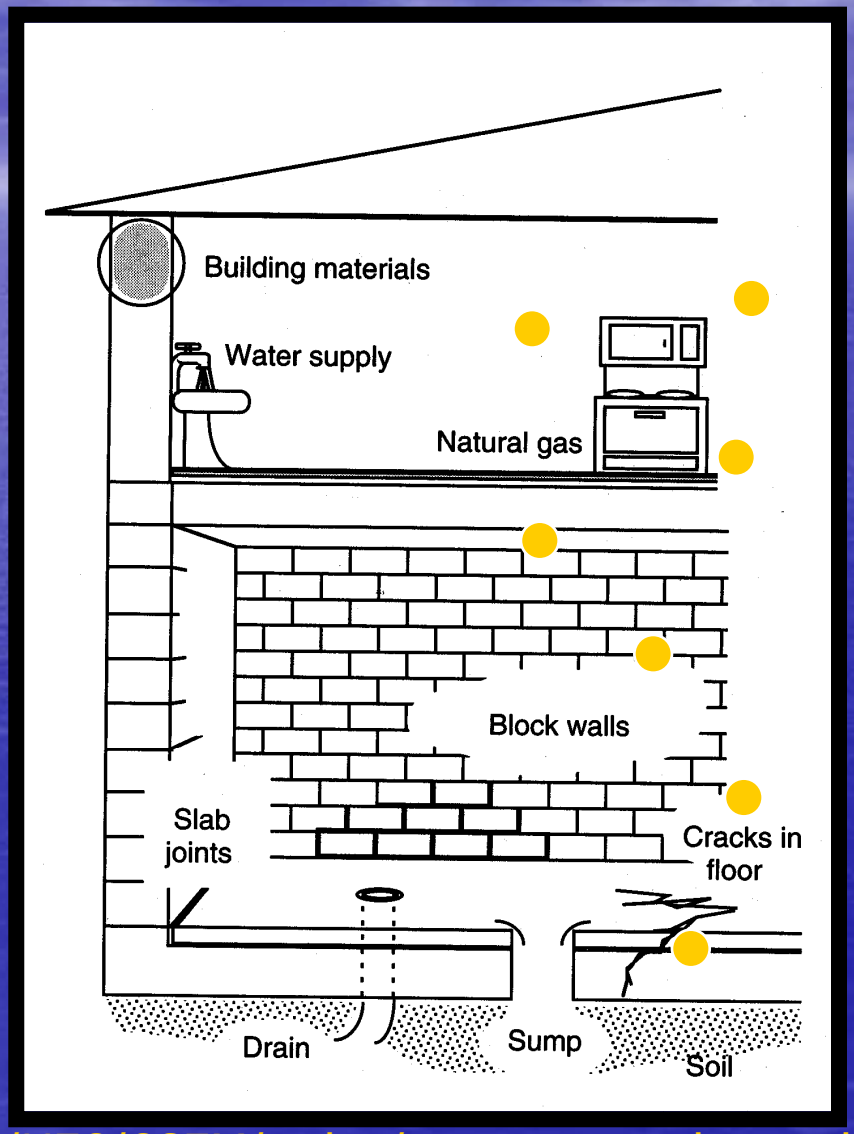
- **EVIDENCE QUALITY(**** ):** Agency for Toxic Substances & Disease Registry appears reputable. They work with the EPA and US Health & Human Services.

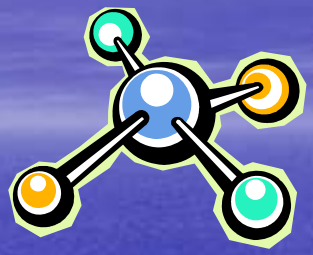
- **SUPPORT REASONING ( *** ):** Sally's house facade is covered with rock from a local quarry. Her house is built on a hilltop. Radon could be seeping from the rocks & infiltrating the house with radon gas.

http://www.atsdr.cdc.gov/HEC/CSEM/radon/

# RADON DIFFUSES INTO THE HOME

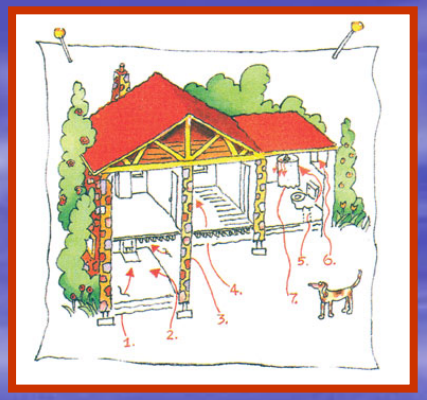




http://www.atsdr.cdc.gov/HEC/CSEM/radon/exposure_pathways.html#Figure%201

# RADON GETS IN THROUGH CRACKS



- **EVIDENCE:** Radon moves up through the ground to the air above and into your home through cracks and other holes in the foundation. Your home traps radon inside, where it can build up. Any home may have a radon problem: 1) new and old, 2) well-sealed and drafty, and with or without basements.

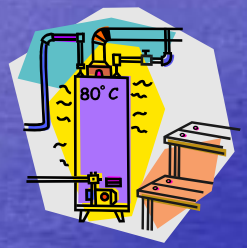
- **EVIDENCE QUALITY** (*****): EPA is a government site.

- **WHY REFUTES SALLY** (****): Sally's hair is falling out like she has cancer BUT there is NO MENTION of chemotherapy or any other cancer treatment that would cause her hair to fall out.

http://www.epa.gov/radon/pubs/citguide.html#howdoes

# CARBON MONOXIDE KILLS

**EVIDENCE:** Each year carbon monoxide gas kills 5,000 persons in the U.S. & injures over 10,000. Many of these deaths are due to faulty or defective products:




- fireplaces
- wood stoves
- hot water heaters
- furnaces
- Cooking Appliances
- Pool Heaters
- lawn mowers
- gas stoves
- snow blowers
- recreational vehicles

**EVIDENCE RATING (**):** This website is written by lawyers who are advertising for their business.

**WHY SUPPORTING SALLY (****):** Because the Citizens live in the mountains, faulty home heating appliances such as a fireplace, wood stove, or furnace are likely sources of carbon monoxide gases in the Citizen home.

http://www.carbon-monoxide-poisoning-injury.com/

# SYMPTOMS OF CARBON MONOXIDE

- **EVIDENCE:** CO toxicity causes headaches, dizziness, nausea and fatigue, plus flu-like symptoms. People feel a bit better outside in fresh air.

- **EVIDENCE QUALITY(***):** This website is written by lawyers who are advertising for their business.

- **WHY SUPPORTING SALLY(*****):** Sally had these symptoms. She felt better when she left the house. The other family members only got sick on weekends & holidays. Shortness of breath, light-headedness, tremors, aching joints, blurred vision. Billy Bob tested positive for traces of carbon monoxide in his blood.

http://www.carbon-monoxide-poisoning-injury.com/symptoms.htm

# FREON IS NON-TOXIC

- **EVIDENCE:** "Because Freon is non-toxic, it eliminated the danger posed by refrigerator leaks. Inventor Thomas Midgley held a demonstration of Freon by inhaling a lung-full of the wonder gas and breathing it out onto a candle flame, which was extinguished, thus showing the gas's non-toxicity and non-flammable properties."

- **EVIDENCE QUALITY(** ** **):** This website "About Inventors" appears reputable & informative, but Freon is NOT non-toxic to humans today.

- **WHY REFUTES SALLY ( **** ):** Freon exposure causes MANY of the same symptoms that Sally already has. This website implies that Freon is not toxic which is not true.

http://inventors.about.com/library/inventors/blfreon.htm

# FREON CREATES PHOSGENE

- **EVIDENCE:** Symptoms of phosgene ($COCl_2$) include:

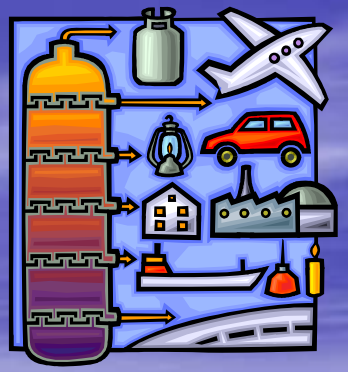
  - Nausea & vomiting
  - Lesions similar to frostbite or burns
  - Fluid in the lungs (pulmonary edema)
  - Shortness of breath
  - Coughing
  - Blurred vision
  - Difficulty breathing
  - Burning throat & watery eyes

- **EVIDENCE QUALITY(*****):** CDC is the Center for Disease Control. It's a government site that we can trust because it's their job to know symptoms and sources of toxic chemicals.

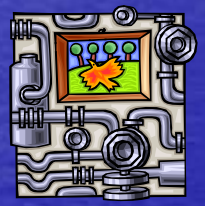
- **WHY SUPPORTS SALLY (****):** All the symptoms match Sally's except the lesions (frostbite). Unfortunately, Sally also has many symptoms similar to BOTH Freon/Phosgene AND Carbon Monoxide poisoning.

http://www.bt.cdc.gov/agent/phosgene/basics/facts.asp

# FREON/PHOSGENE EXPOSURE IS RARE



- **<u>EVIDENCE:</u>** Individuals are most likely to be exposed to phosgene in the workplace during its manufacture, handling, and use; from direct industrial emissions of phosgene, thermal decomposition of chlorinated hydrocarbons, and photooxidation of chloroethylenes in the air.



- **<u>EVIDENCE QUALITY</u> (****):** This is the EPA. We're supposed to be able to trust the EPA to do enough research to give us information..

- **<u>WHY REFUTES SALLY</u> (****):** Sally doesn't work in a factory or manufacturing of these chemicals.

http://www.epa.gov/ttn/atw/hlthef/phosgene.html

# CONCLUSION

- The evidence suggests the cause of Sally Citizen's illness is a combination of two toxic chemicals: 1) Carbon Monoxide, & 2) Freon. Both toxins are highly threatening to human health. The Citizen family had experienced symptoms of high concentrations of both.

- We believe the source of carbon monoxide is from their fireplace. Since the Citizen family never used their central air & heating system, we believe that carbon monoxide was coming from incomplete combustion of fuels &/or faulty venting of the fireplace. The Freon could have come from an appliance such as the refrigerator. Together, it was a toxic soup for poor Sally!

## GRAND JURY INVESTIGATION MEMO

**DATE:** 2 YEARS LATER

**TO:** MEMEBERS OF THE CITIZEN COMMUNITY

**FROM:** LEE GAL SISTIM, GRAND JURY FOR HIGH SIERRA COUNTY

**SUBJECT:** GRAND JURY INVESTIGATION OF POLLY TICIAN,
OWNER OF HIGH SIERRA ENERGY SOURCES, INC.

**CC:** ENVIRONMENTAL PROTECTION AGENCY, CHEMICAL INVESTIGATIONS GROUP

Dear Member of the Citizen Community,

Because of the exemplary research performed by you and your investigation team, you have been selected to testify in front of the High Sierra County Grand Jury. This civil grand jury will act as an independent investigative body and is empowered to investigate complaints by individuals regarding the actions or performances of county or public officials. Your local public official, Mayor Polly Tician, is being investigated for unlawfully ignoring complaints made about her company, High Sierra Energy Sources, Inc. Several complaints have been filed in regards to questionable business practices such as allowing poor craftsmanship of workers who install fireplaces. Complaints about installation of faulty air-conditioning systems and wood stoves have also been made. Mayor Polly Tician has been accused of taking questionable campaign contributions from the manufactures of these heating/cooling systems, possibly to keep quiet about these faulty operating systems.

To perform this grand jury investigation in an orderly manner, your team's testimony will be presented in the following format. As you enter the grand jury room, you will be seated with other experts who have the same beliefs about the source of Sally Citizen's illness: 1) black mold, 2) radon exposure, 3) carbon monoxide, or 4) freon-22/phosgene poisoning. You will sit together in rows of 4 that are facing opposing groups with different beliefs.

| | |
|---|---|
| X X X X | O O O O |
| X X X X | O O O O |
| X X X X | O O O O |
| X X X X | O O O O |

Only those at the front of the row are allowed to testify. Members of the group will take turns citing evidence that supports the claim your team has selected. After speaking, a 10-second delay allows the speaker to go to the back of the row while the other students shift forward. The opposing team then speaks, shifts, and then your group can speak again. After all testimony is complete, time is allowed for clarification and follow-up questions. Once this is complete, the entire grand jury will take a vote as to the cause of the Citizen's illnesses, the source of the toxicant (if any exists), the method by which the toxicant gets into the Citizen's bloodstream, and whether indictments for Polly Tician should be issued.

Moderators for this hearing will include the grand jury judge, the district attorney, legal counsel, and the state attorney general. The bailiff is responsible for handling any misconduct from jury members.

Thank you for your attention to this matter. You testimony is crucial for this case. We sincerely appreciate your taking time out of your busy schedule to serve your community.

Sincerely,

Lee Gal Sistim

**GRAND JURY VOTE**
**The Case of the Mysterious Malady**

*After all the testimony is complete, each grand jury member will have one vote. Please select one of the following:*

- ❑ Yes, Mayor Polly Tician should be indicted for **carbon monoxide** leaks caused by her employee's poor craftsmanship at installing substandard fireplaces.
- ❑ Yes, Mayor Polly Tician should be indicted for **Freon-22/phosgene** leaking from a faulty air conditioning system.
- ❑ No, there should be no indictments. I still believe the claim that natural **radon** is leaking into the house and making Sally sick.
- ❑ No, there should be no indictments. I still believe the claim that **black mold** is making Sally sick.

**GRAND JURY VOTE**
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