

LESSON 5 - WATER WOES – POLLUTION AND SOLUTIONS

Overview:

Students are introduced to different categories of aquatic pollution, research how sources of water contamination are affecting our planet, and explore environmentally friendly solutions to pollution problems. Student research is shared with the rest of the class in an oral presentation or display.

Suggested Timeline: 3 hours research + presentation time (if applicable)

Materials:

- Water Woes (Teacher Support Material)
- Water Contamination – Research Project (Student Handout - Individual)
- Water Contamination – Research Project (Student Handout – Group)
- student access to computers with Internet

Method:

INDIVIDUAL FORMAT:

1. Hand out ‘Water Contamination – Research Project’ (Student Handout - Individual). Review the expectations for the project with the students, paying particular attention to the grading rubric. You may choose to have the students prepare the display as a bulletin board or as a display in a display case in the school.
2. Have the students choose topics and allow them research time in the library.

GROUP FORMAT:

1. Introduce the subject of water pollution by sharing the information on a sewage spill on ‘Water Woes’ (Teacher Support Material). Allow this to stimulate a discussion of the effects of pollution, accountability and how individuals can incite change.
2. Discuss the categories of pollution. Encourage students to come up with additional examples for each category.
3. Hand out ‘Water Contamination – Research Project’ (Student Handout - Group). Review the expectations for the project with the students, paying particular attention to the grading rubric.
4. Have the students choose topics and allow them research time in the library.

Assessment:

Student grade on project

Extension:

Lead a field trip to a local waterway and attempt to identify what (if any) pollutants are affecting it.

Water Woes



On July 19, 2008, a large quantity of raw sewage spilled into the South Saskatchewan River in Saskatoon. The exact amount of sewage spilled was not known, but, according to sewage treatment officials, could have been as much as 60 million liters. This is the equivalent of 24 Olympic-sized swimming pools of sewage.

What caused the spillage? The sewage treatment plant was being upgraded at the time, and there was only one screen in place to handle raw sewage. During the heavy rains of July 19, debris plugged the screen, so raw sewage had to be released into the river. For seven hours, raw sewage flowed into the river.

Source: <http://www.cbc.ca/canada/saskatchewan/story/2008/08/01/saskatoon-sewage.html>

Pollution such as this may be carried away by the current, but it never disappears. Downstream it will reappear again, sometimes diluted and sometimes in a different form. Some waste materials can be broken down by bodies of freshwater such as rivers, but not in the large quantities that are released by today's society.

Of all of the water present on Earth, only 0.01% is in river systems and freshwater lakes. Clean water is a precious resource.

Each day, water is being contaminated by many different sources of pollution. There are four main categories of pollution:

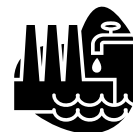
1. Chemical Pollution – the introduction of toxins into an ecosystem. Examples include: pesticides applied to crops flow into groundwater and airborne pollutants from factories causing acid rain.
2. Organic Pollution – adding excess nutrients to an ecosystem (e.g., lawn fertilizers contain the elements nitrogen and phosphorus that are added to the groundwater and flow to bodies of water. This causes large amounts of algae to grow which affects all other organisms in the ecosystem.)
3. Thermal Pollution – pollution that causes the temperature of a waterway to increase or decrease (e.g., heated water from a power plant being released into a river).
4. Ecological Pollution – pollution that takes place *without* human intervention. This can occur in one of two ways:
 - i) adding something to an ecosystem that is not usually there (e.g., high tides can add saltwater to freshwater pools found inland and acid rain after a volcanic eruption).
 - ii) increasing the amount of something already present (e.g., an increase in the amount of sediment in a river due to a landslide or avalanche)

Name: _____ Date: _____ Period: _____

Water Contamination

A Research Project

Due Date: _____



Background:

On July 19, 2008, a large quantity of raw sewage spilled into the South Saskatchewan River in Saskatoon. The exact amount of sewage spilled was not known, but, according to sewage treatment officials, could have been as much as 60 million liters. This is the equivalent of 24 Olympic-sized swimming pools of sewage.

What caused the spillage? The sewage treatment plant was being upgraded at the time, and there was only one screen in place to handle raw sewage. During the heavy rains of July 19th, debris plugged the screen, so raw sewage had to be released into the river. For seven hours, raw sewage flowed into the river.

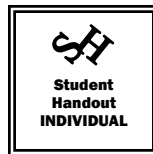
Source: <http://www.cbc.ca/canada/saskatchewan/story/2008/08/01/saskatoon-sewage.html>

Pollution such as this may be carried away by the current, but it never disappears. Downstream it will reappear again, sometimes diluted and sometimes in a different form. Some waste materials can be broken down by bodies of freshwater such as rivers, but not in the large quantities that are released by today's society.

Of all of the water present on Earth, only 0.01% is in river systems and freshwater lakes. Clean water is a precious resource.

Each day, water is being contaminated by many different sources of pollution. There are four main categories of pollution:

1. Chemical Pollution – the introduction of toxins into an ecosystem. Examples include: pesticides applied to crops flow into groundwater and airborne pollutants from factories causing acid rain
2. Organic Pollution – adding excess nutrients to an ecosystem (e.g., ex: lawn fertilizers contain the elements nitrogen and phosphorus that are added to the groundwater and flow to bodies of water. This causes large amounts of algae to grow which affects all other organisms in the ecosystem.
3. Thermal Pollution – pollution that causes the temperature of a waterway to increase or decrease (e.g., heated water from a power plant being released into a river)
4. Ecological Pollution – pollution that takes place *without* human intervention. This can occur in one of two ways:
 - i) adding something to an ecosystem that is not usually there (e.g., high tides can add saltwater to freshwater pools found inland and acid rain after a volcanic eruption)
 - ii) increasing the amount of something already present (e.g., an increase in the amount of sediment in a river due to a landslide or avalanche)



Purpose:

To research one type of water contamination, the effects it has on the environment and solutions to the problem. The research will be presented to the class in the form of a display.

Topic choices:

The following are possible choices for sources of water contamination.

- Mining
- Household and Yard Wastes
- Cosmetics
- Pulp and Paper Mills
- Sewage
- Agriculture
- Medication (Pharmaceuticals)
- Fossil Fuel Combustion
- Construction
- Fisheries
- Textiles
- Recreation
- Plastics
- Coal or Natural Gas Power Plants
- Nuclear Power Plants
- A topic of your choice (approved by your teacher before you begin)

General Guidelines:

Research your topic, using dependable websites and other books or magazines that you may find on the topic. Government websites are a good source of information. **You must have a minimum of 5 references. Your references must be listed in a spot that is visible on your display.**

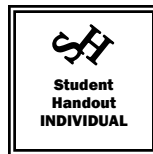
You **MUST** include the following information somehow in your display:

1. The name of the source of water contamination (make this your title?)
2. The category of pollution (as listed at the start of the handout) that the pollutant falls into
3. An explanation of what sort of contaminants this includes and where they come from
4. How the contaminants get into the environment
5. What effects the contaminants have on the environment – wildlife, humans, long-term potential effects
6. Solutions to the problem. These may be things that can be done by the industry or individuals that produce the pollutants (e.g., a power plant) or could be things that consumers could do to help with the problem (e.g., what purchases they make)
7. A list of the resources used (minimum of 5)

You may include additional information, provided that it is relevant, interesting and enhances your project.

You will be assembling your information, (photos, props) and any other learning aids that you think would attract students to your display and make them want to read it. Think about how you should organize your information. For example, you may organize the information into

Unit: Chemistry F – Water Pollution



logical paragraphs, each with a subtitle. You may pose a series of questions and have each paragraph answer that question. Perhaps you want to put it into story form! Be creative and have fun!

Be sure that your poster(s) or display (as decided upon by your teacher) has a large title that is bold and easy to read. Use colored paper to make the display attractive to the reader. What will you do to make your project unique?

The following rubric will be used for the grading of your project. You should read through it carefully to help to maximize your score on the project.

Water Contamination Project Grading Rubric

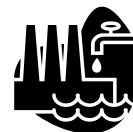
| CATEGORY | 35 | 25 | 15 | 5 |
|---|--|--|---|---|
| SCIENTIFIC ACCURACY <ul style="list-style-type: none"> the extent to which the source of aquatic pollution is accurately described | <ul style="list-style-type: none"> thorough understanding demonstrated through the use of many sources of information that are thoughtfully described and elaborated upon student's explanations give clear evidence of their understanding of the science of the topic it is likely that another science 21 student would have a clear understanding of the topic after reading the display 5 or more sources cited clearly | <ul style="list-style-type: none"> satisfactory understanding demonstrated through the use of several sources of information a clear scientific explanation of the pollutant is provided it is likely that another science 21 student would understand most of the display 3-4 sources cited clearly | <ul style="list-style-type: none"> some understanding demonstrated through the use of a few sources of information, although portions are confusing +/- or the science is inadequately explained it is likely that another science 21 student would not have a clear understanding of the topic from the display 1-2 sources cited clearly | <ul style="list-style-type: none"> inadequate understanding of the topic is demonstrated some obvious scientific concepts not included in the explanation another science 21 student would likely be confused by the explanations given sources not cited |
| | 10 | 7 | 5 | 3 |
| CREATIVITY <ul style="list-style-type: none"> the extent to which the student presents the information in an unpredictable manner that engages others | <ul style="list-style-type: none"> exceptionally unique approach to presenting a topic that is engaging, captivating, unique and thoughtful | <ul style="list-style-type: none"> somewhat unique method of explaining information students would most likely be engaged and interested in learning from the display | <ul style="list-style-type: none"> method chosen for presentation not unique or innovative it is likely that few students would be attracted to learn from the display | <ul style="list-style-type: none"> chosen method of presenting material is predictable and mundane display does little or nothing to attract learners to it |
| | 5 | 4 | 3 | 1 |
| REFERENCES | 5 or more references cited | 4 references cited | 3 references cited | 1 reference cited |

Name: _____ Date: _____ Period: _____

Water Contamination

A Research Project

Due Date: _____



Each day, water is being contaminated by many different sources of pollution. There are four main categories of pollution:

1. Chemical Pollution – the introduction of toxins into an ecosystem. Examples include: pesticides applied to crops flow into groundwater and airborne pollutants from factories causing acid rain
2. Organic Pollution – adding excess nutrients to an ecosystem (e.g., lawn fertilizers contain the elements nitrogen and phosphorus that are added to the groundwater and flow to bodies of water. This causes large amounts of algae to grow which affects all other organisms in the ecosystem.)
3. Thermal Pollution – pollution that causes the temperature of a waterway to increase or decrease (e.g., heated water from a power plant being released into a river).
4. Ecological Pollution – pollution that takes place *without* human intervention. This can occur in one of two ways:
 - i) adding something to an ecosystem that is not usually there (e.g., high tides can add saltwater to freshwater pools found inland and acid rain after a volcanic eruption).
 - ii) increasing the amount of something already present (e.g., an increase in the amount of sediment in a river due to a landslide or avalanche).

Purpose:

To research one type of water contamination, the effects it has on the environment and solutions to the problem. The research will be orally presented to the class.

Topic choices:

The following are possible choices.

- Mining
- Household and Yard Wastes
- Cosmetics
- Pulp and Paper Mills
- Sewage
- Agriculture
- Medication (Pharmaceuticals)
- Fossil Fuel Combustion
- Construction
- Fisheries
- Textiles
- Recreation



- Plastics
- Coal or Natural Gas Power Plants
- Nuclear Power Plants
- A topic of your choice (approval by your teacher before you begin)

General Guidelines:

Research your topic, using dependable websites and other books or magazines that you may find on the topic. Government websites are a good source of information. **You must have a minimum of 5 references. Your references must be listed in a spot that is visible on your display.**

You **MUST** include the following information in your presentation:

1. The name of the source of water contamination (make this your title?)
2. The category of pollution (as listed at the start of this handout) that the pollutant falls into
3. An explanation of what sort of contaminants this includes and where they come from
4. How the contaminants get into the environment
5. What effects the contaminants have on the environment – wildlife, humans, long-term potential effects
6. Solutions to the problem. These may be things that can be done by the industry or individuals that produce the pollutants (ex: a power plant) or could be things that consumers could do to help with the problem (ex: what purchases they make)
7. A list of the resources used (minimum of 5)
8. A question period at the end

You may include additional information, provided that it is relevant, interesting and enhances your presentation

Time Limit Of Presentation: 4-5 minutes

Present your information in a way that is interesting! Ideas: posters, powerpoint, videos, overhead projector.

Think about how you should organize your information. For example, you may pose a series of questions and have each paragraph answer that question. Perhaps you want to put it into story form! Be creative and have fun! What will you do to make your project unique?

The following rubric will be used for the grading of your project. You should read through it carefully to help to maximize your score on the project.

Water Contamination Research Project – Presentation Grading Rubric

| CATEGORY | 25 | 17 | 10 | 3 |
|--|--|--|--|---|
| Scientific Accuracy <ul style="list-style-type: none"> • the extent to which the source of water pollution is accurately described • how well the science of the topic is explained | <ul style="list-style-type: none"> • thorough understanding demonstrated through the use of many sources of information • the science is thoughtfully and thoroughly described • student's answers to questions asked give clear evidence of deep understanding | <ul style="list-style-type: none"> • satisfactory understanding demonstrated through the use of several sources of information • student answers questions asked with thoughtful answers that give evidence that adequate research has been done | <ul style="list-style-type: none"> • some understanding demonstrated through the use of a couple of sources of information • some of the science clearly absent or explained incorrectly • student answers most questions with a basic response | <ul style="list-style-type: none"> • inadequate understanding of the science of the topic is demonstrated through the use of few sources of information • student unable to correctly answer most questions |
| | 10 | 8 | 5 | 3 |
| Introduction and Closure | <ul style="list-style-type: none"> • student delivers opening and closing remarks that capture the attention of the audience, set the mood and summarize the main points of the presentation | <ul style="list-style-type: none"> • student delivers effective and clear introductory and closing remarks | <ul style="list-style-type: none"> • student delivers either an effective opening or closing remark, but not both | <ul style="list-style-type: none"> • student delivers either an opening or closing remark |
| CATEGORY | 2.0 each | 1.5 each | 1.0 each | 0.5 each |
| Presentation a) Body Language | <ul style="list-style-type: none"> • movements seem fluid and help the audience to visualize | <ul style="list-style-type: none"> • made movements or gestures that enhanced articulation and aided in emphasis of important points | <ul style="list-style-type: none"> • some movements or gestures that could sometimes be considered useful in emphasis and articulation | <ul style="list-style-type: none"> • very little movement or descriptive gestures |
| b) Eye Contact | <ul style="list-style-type: none"> • hold attention of entire audience with the use of direct eye contact and animated eye expressions | <ul style="list-style-type: none"> • consistent use of direct eye contact with audience; some eye expressions aid in information delivery | <ul style="list-style-type: none"> • often uses direct eye contact with audience | <ul style="list-style-type: none"> • displayed minimal eye contact with audience |

| | | | | |
|---|--|--|---|--|
| c) Pacing and Voice | <ul style="list-style-type: none"> good use of drama student meets time guidelines (4-5 min) use of fluid speed, inflection and good enunciation to maintain the interest of the audience | <ul style="list-style-type: none"> delivery includes appropriate drama and pace, but does not quite meet time guidelines satisfactory use of inflection, but does not consistently use fluid speech and does not always enunciate well | <ul style="list-style-type: none"> delivery is in bursts presentation quite off from time guidelines displays some level of inflection throughout the delivery | <ul style="list-style-type: none"> delivery is either much too quick or too slow presentation far off time guidelines very little inflection monotone voice frequently mumbles speech is not fluid |
| d) Poise | <ul style="list-style-type: none"> student displays relaxed, self-confident nature about self with no mistakes | <ul style="list-style-type: none"> makes minor mistakes, but quickly recovers from them; displays little or no tension | <ul style="list-style-type: none"> displays mild tension; has trouble recovering from mistakes | <ul style="list-style-type: none"> tension and nervousness is obvious; has trouble recovering from mistakes |
| CREATIVITY | 10 | 7 | 4 | 1 |
| <ul style="list-style-type: none"> the extent to which the student describes the workings of the object in an unpredictable manner that engages others | <ul style="list-style-type: none"> exceptionally unique approach to explaining how the object works that is engaging, captivating, unique and thoughtful | <ul style="list-style-type: none"> somewhat unique method of explaining information most students engaged and seemingly interested by method(s) of delivery | <ul style="list-style-type: none"> method chosen for presentation not unique or innovative, but some of the audience's interest and attention is still maintained | <ul style="list-style-type: none"> chosen method of delivery is predictable and mundane audience is not engaged and their attention wanes |
| REFERENCES | 5 | 4 | 3 | 1 |
| | <ul style="list-style-type: none"> 5 or more sources cited | <ul style="list-style-type: none"> 4 sources cited | <ul style="list-style-type: none"> 3 sources cited | <ul style="list-style-type: none"> 1 source cited |