



Cancer Education Project

Cancer Treatments

Overview:

This series of activities is designed to increase students' understanding of the variety of cancer treatments. Students also explore how the toxicity of a chemotherapy agent can be studied in a laboratory setting, and the issues that should be considered before participating in clinical trials.

Part 1: Cancer Treatment Center (80 minutes)

Students investigate different types of cancer treatments. They develop, peer review, and revise brochures for adult cancer patients on different cancer treatments.

Part 2: Finding the Right Chemotherapy Dose (80 minutes)

Students do a hands-on laboratory simulation to determine the highest dosage of chemotherapy drug that does not interfere with normal liver cell function.

Part 3: Clinical Trials for Cancer Treatments (40 minutes)

Students explore the phases of clinical trials and the importance of informed consent when considering participation in cancer clinical trials.

Teacher Instructions

Part 1: Cancer Treatment Center

Before Class, prepare for each student:

- One copy of "Cancer Treatment Center" letter
- One copy of "Cancer Treatment Brochure Guidelines"
- Four copies of "Feedback Form for Cancer Treatment Brochure"
- Arrange for Internet access or print resources for student research.

First Committee Meeting (20 minutes):

- Distribute one copy of "Cancer Treatment Center" letter to each student.
- Read the letter to the class.
- Assign students to work in committees of 4 students.
- Assign each team one of the following treatment methods:

- Chemotherapy
 - Radiation therapy
 - Surgery
 - Angiogenesis Inhibitors
 - Biologic Therapy
 - Targeted Therapy
 - Bone Marrow Transplantation
 - Gene Therapy
 - Hormone Therapy
 - Photodynamic Therapy
- Allow 10 minutes for the committee meeting during which parts of the brochure are assigned to team members.
 - Tell students that they are expected to do research and prepare their part of the brochure for homework (or during class).
 - Answer questions committee members may have about the assignment.
 - If your students do not have home access to Internet, you may choose to print and distribute the information obtained by following the links at:
 - <http://www.cancer.gov/cancertopics/treatment/types-of-treatment>
 - <http://www.oncolink.com/treatment/>

Note: If one or two students in each committee have home Internet access, they may be willing to print copies of resources that they find for students who do not have computer access.

Second Committee Meeting (40 minutes)

- Provide each student with 4 copies of “Feedback Form for Cancer Treatment Brochure.”
- Emphasize the importance of including key information and of creating a consistent approach for presenting the information in the parts the brochure.
- Allow 40 minutes for students to share and peer review their draft parts of the brochure using the “Feedback Form for Cancer Treatment Brochure.”
- For homework, students should use the feedback from the peer review to make appropriate revisions to their sections of the brochure.

Third Committee Meeting (20 minutes)

- Allow 20 minutes for students to combine the revised parts into a single team brochure.
- If time permits, allow an additional class period for students to share their brochures with their classmates.

Part 1

Cancer Treatment Center

University Medical Center
Anytown, New York



Dear Volunteer:

Thank you for adding your name to a list of individuals who would be willing to volunteer their help to support cancer patients and their families.

A significant number of our cancer patients have difficulty reading and understanding the medical information on cancer treatments that is provided on our current website. To solve this problem, we have established several committees to design brochures that explain cancer treatments to these patients. You will work on a committee that will create an engaging and informative brochure for adult cancer patients or their family members.

This committee will meet for three working sessions. In addition, each member of this committee should expect to spend a significant amount of time working independently to prepare for committee meetings.

Meeting 1: Planning for Committee Work (10 minutes)

Committee members collaborate to decide who will be responsible for each topic section of the brochure. See attached information on selected section topics.

Independent Work:

Committee members should:

- Review the information on cancer treatment on our current web sites:
<http://www.cancer.gov/cancertopics/treatment/types-of-treatment> and
<http://www.oncolink.com/treatment/>
- Select key information relevant for their assigned section of the brochure
- Produce a draft of their assigned brochure section
- Print copies of web site materials that they used in developing their brochure
- Bring a folder to the next meeting that contains: (1) their brochure section, (2) the other related web site materials

Meeting 2: Committee Review of Drafts (40 minutes)

Committee members should exchange their folders with at least two other committee members who will evaluate their draft section. To peer review these draft sections, committee members should review the web site information in the folder and then complete the feedback form provided by the cancer center staff.

- Make specific suggestions for revisions, additions, or deletions to the content of each section of the brochure.
- Provide specific suggestions on how to make the brochure more engaging and understandable for cancer patients.
- Provide specific suggestions on changes that could be made to improve the consistency between different sections of the brochure.

Independent Work:

Committee members would use feedback from the peer review to improve their draft portion of the brochure.

Meeting 3: Cancer Center Staff Review of Drafts (20 minutes)

Committee members meet to assemble the parts of the brochure into a complete brochure. Our goal is to have brochures ready for our patients by no later than

(date)

Thank you for agreeing to assist the cancer center by working on these committees. If you have any questions, please contact me by calling xxx-xxx-xxxx. I would be happy to answer any questions that you have.

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Director of Patient Services
Cancer Treatment Center

Part 1

Section Topics for the Cancer Treatment Brochure

Developed by the Cancer Treatment Center Staff

Subject for Cancer Treatment Brochure

Type of Cancer Treatment: _____

Each brochure should include the following sections:

Section Topics	Name of Responsible Committee Member
1. What is ____?	
2. How Does _____ Work?	
3. What Should I Expect During _____	
4. What Are The Side Effects of _____?	
5. What Are The Risks of _____?	
6. What Are The Benefits of _____?	
7. How Can I Cope With The Side Effects of _____?	
8. What Support Is Available During _____?	

Our current information on cancer treatment is provided through these two web pages:

- <http://www.cancer.gov/cancertopics/treatment/types-of-treatment>
- <http://www.oncolink.com/treatment/>

Be sure to follow the relevant links on these websites. Also do a web search to find additional information.

Teacher Instructions

Part 2: Finding the Right Chemotherapy Dose (80 minutes)

Citation: This activity was modified from “Cancer Warrior: What’s the Right Dose?”, a lab activity produced by PBS at http://www.pbs.org/wgbh/nova/teachers/activities/2805_cancer.html

Before class:

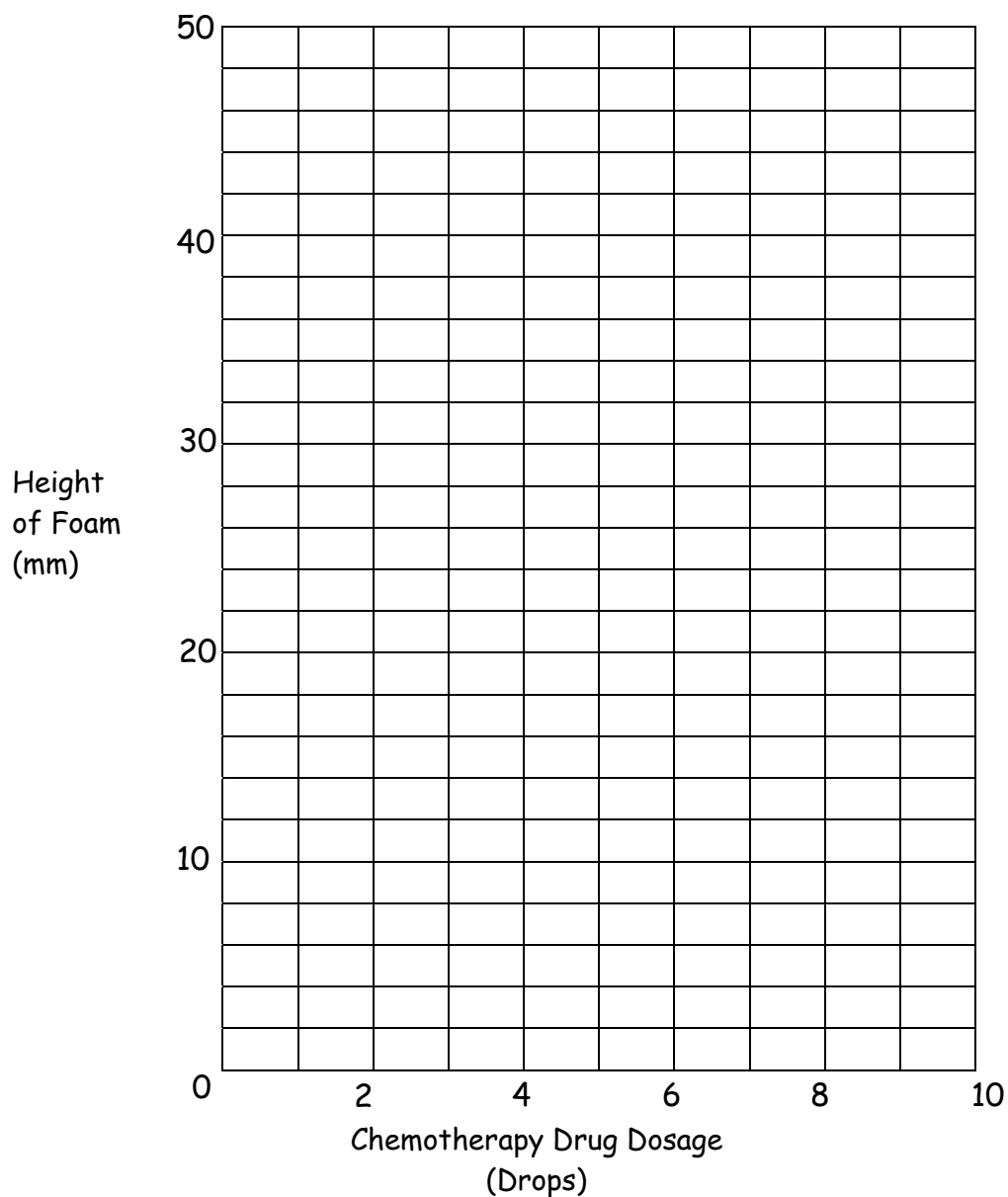
- Prepare one copy the lab handout (“Finding the Right Chemotherapy Dose”) per student.
- Copy and cut apart the “Drug and Dose Assignment Slips” on the next page. Each team should receive ONE of these slips. Depending on the number of teams, you should select dosage slips that include at least: 0 drops, 1 drop, 5 drops, and 10 drops.
- Prepare a kit of the following materials for each student team of two or three students.
 - 1 Drug and Dose Assignment Slip—see next page
 - 1 plastic well plate
 - 1 plastic dropper labeled “Liver Cells”
 - 1 plastic dropper labeled “Chemo Drug”
 - 3 toothpicks
 - 1 small (at least 20 mL) cup labeled “Liver Cell Homogenate”
 - 1 small (at least 10 mL) cup labeled “Chemotherapy Drug - Curol”
 - 3 clean test tubes (approx 25 mL)
 - 1 bottle of 3% hydrogen peroxide (purchase at drug or grocery store)
 - 1 dropper labeled “Glycerol” filled with glycerol
 - 1 stirring rod or coffee stirrer
 - 1 metric ruler
 - 1 pair of goggles
 - 1 small Post-it™ note

Immediately before lab class:

- Use a blender to prepare liver (fresh or frozen/thawed) homogenate. Chop approximately one half (1/2) pound of liver into small pieces. Put the chopped liver and 100 mL of distilled water into a blender. Blend for three minutes. Strain through a sieve to remove large pieces that may clog pipets. Dispense about 20 mL into cups labeled “Liver Cells.” Leftover liver homogenate may be frozen in a ice cube tray for other laboratory classes.
- Prepare simulated chemotherapy drug (“Curol”) by making a 200 mL of a 2% NaCl solution. Add one or two drops of yellow food coloring to the NaCl solution. Provide each team of students with about 10 mL of the simulated chemotherapy drug. Dispense in small plastic cups labeled “Chemotherapy Drug—Curol.”
- Fill “Glycerol” labeled droppers with about 1 mL of glycerol.
- Post a large class graph on the board or on poster paper. See sample graph on page 9.

Drug and Dose Assignment Slips

Chemotherapy Drug Name - Curol	Drug Dosage = 0 drops (control)
Chemotherapy Drug Name - Curol	Drug Dosage = 1 drop
Chemotherapy Drug Name - Curol	Drug Dosage = 2 drops
Chemotherapy Drug Name - Curol	Drug Dosage = 3 drops
Chemotherapy Drug Name - Curol	Drug Dosage = 4 drops
Chemotherapy Drug Name - Curol	Drug Dosage = 5 drops
Chemotherapy Drug Name - Curol	Drug Dosage = 6 drops
Chemotherapy Drug Name - Curol	Drug Dosage = 7 drops
Chemotherapy Drug Name - Curol	Drug Dosage = 8 drops
Chemotherapy Drug Name - Curol	Drug Dosage = 9 drops
Chemotherapy Drug Name - Curol	Drug Dosage = 10 drops

Sample Class Graph for Part 2**During lab class:**

- Distribute one copy of lab handout (“Balancing Act: Finding the Right Chemotherapy Dose”) to each student.
- Distribute one kit of laboratory materials to each team of students.
- Point out to students that they should refer to the Drug and Dose assignment slips in their materials kit. This provides information on the dosage of chemotherapy drug that they will be responsible for testing.
- Ask students to follow the laboratory instructions. They should be careful to use the appropriate dosage of chemotherapy drug they are assigned to test.

Part 2**Balancing Act: Finding the Right Chemotherapy Dose**

When testing a new drug for use as a chemotherapy drug, scientists must first determine how toxic the drug is over a range of dose levels. It is important to determine what dosage (concentration in the body) will kill cancer cells while minimizing harmful effects on normal cells. Before testing chemotherapy drugs on humans, scientists conduct “in vitro” (in a test tube) laboratory tests to determine what dosage of the drug will not dangerously interfere with normal cell processes.

Scientists test the drug on healthy cells to determine what dosage of a new chemotherapy drug could be used to kill cancer cells and still allow healthy cells to function normally. Liver cells are often used for these tests because the liver is important in deactivating and eliminating a wide range of toxic molecules that can damage cells. One such toxic material is hydrogen peroxide, a waste chemical produced by normal cell metabolism. The liver and many other cells in your body break down toxic hydrogen peroxide into harmless water and oxygen. If liver cells are unable to deactivate and eliminate hydrogen peroxide, they may be unable to carry out essential cell processes.

A drug research center has developed a potential chemotherapy drug that they would like to test further. Our class has been asked collaborate with the drug research center to determine the highest dosage of the drug that still allows liver cells to function normally. Each team of students will be assigned to test the effect of one concentration of this chemotherapy drug. Once each team has collected data for its part of the experiment, class data will be compiled to create dose-response curves for this potential chemotherapy agent.

The Drug and Dosage assignment slip in your materials kit indicates the name of the drug and the concentration your team will be testing. Record the dosage of the drug that your team is responsible for testing in each box in the third column of Table 1.

Table 1: The Effects of Curol on the Activity of Liver Cells

Trial #	Drops of Liver Cell Homogenate	Dosage of Drug (drops)	Height of Foam (mm)
1	20		
2	20		
3	20		

Student Team Procedure:

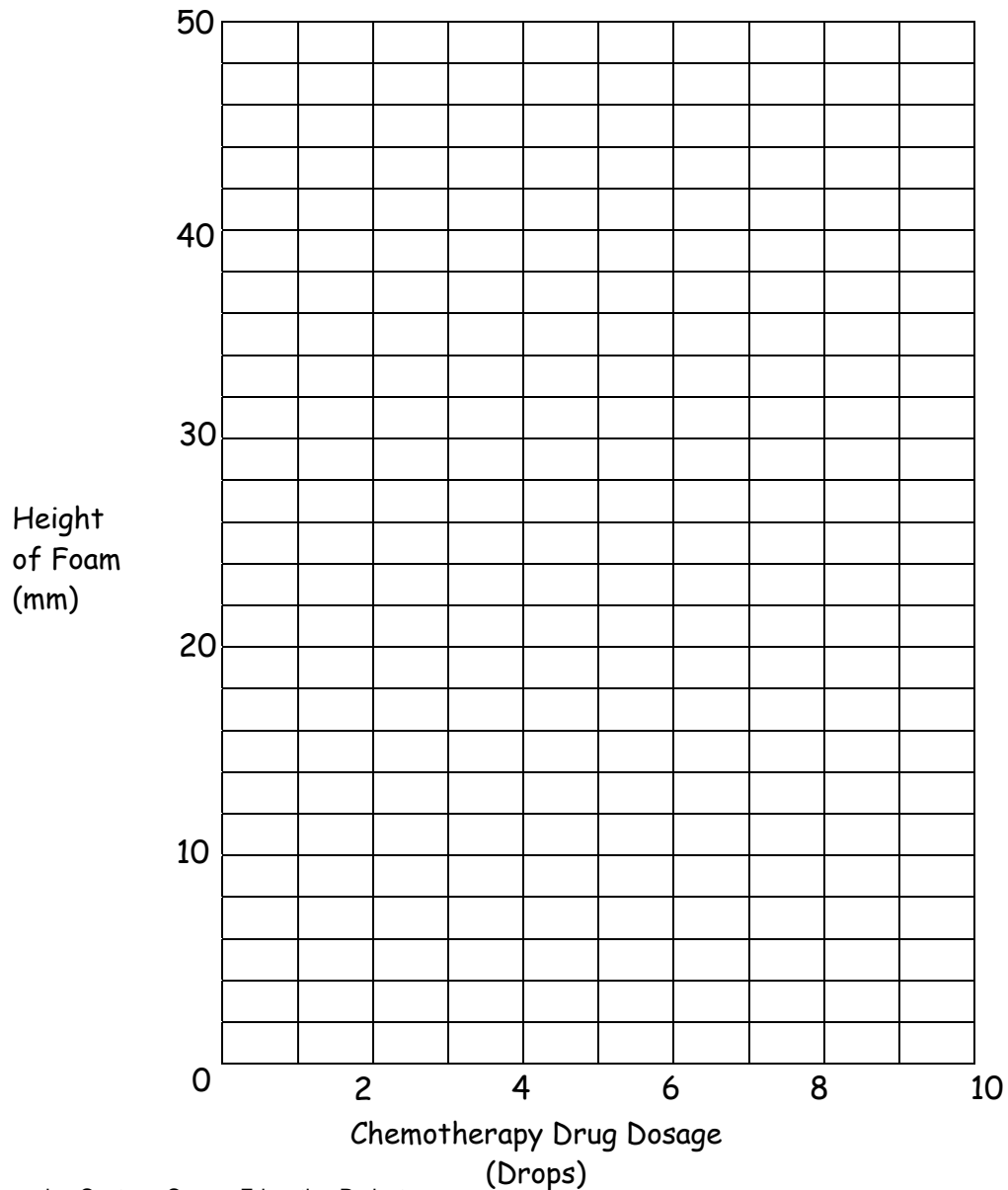
1. Add 20 drops of the liver cell homogenate (ground liver) to three different wells on the well plate.
2. Add the prescribed dose (number of drops) of the drug that has been assigned by your teacher. Stir using clean toothpick.
3. Wait four minutes for the drug to act on the cells. While you wait, prepare three test tubes with 10 mL of 3% hydrogen peroxide. Draw a line on the outside of each test tube to indicate the top of the hydrogen peroxide.
4. Begin Trial # 1. Use a pipette to add 3 drops of the cells/drug mixture from one well on the spot plate directly to the hydrogen peroxide in the test tube. Record the height of the foam (bubbles) in the tube (distance in millimeters from the line on the test tube to the top of the foam).
5. Repeat the above procedure for two more trials (Trail #2 and Trial # 3). Make sure you use cell/drug mixtures from the other wells on the spot plate. For example, use the cells/drug mixture from the second well for Trial #2 and use the cells/drug mixture from the third well for Trial #3.
6. Calculate the average height of foam for the drug dosage you are testing. Write your initials, the concentration of the drug, and the average height of foam (in mm) on the Post-it™ note provided in your materials kit.

7. Place your Post-it™ note in the appropriate location on the class graph. While other student teams finish their experiment, clean your team's test tubes, spot plates, and work area. Call your teacher over to check your lab clean-up.

8. Use the information on the class Post-it™ graph to complete the Graph 1 below. Be certain to include an appropriate title that includes both the independent variable and the dependent variable.

Graph 1

Title: _____



Questions for Analysis

1. Why is it important to conduct more than one trial at each dosage?
2. What is the independent variable in this experiment?
3. What is the dependent variable in this experiment?
4. According to the class graph, how does increasing the dosage of the drug affect the liver cells? Explain your reasoning.
5. State one advantage of using high doses, rather than low doses, of the chemotherapy drug to treat cancer?
6. State one disadvantage of using high doses, rather than low doses, of the chemotherapy drug to treat cancer?
7. Often it is impossible to find a dosage of chemotherapy drug that kills all cancer cells without having harmful affects on normal cells. The trick with chemotherapy is to find a drug dosage that is high enough to kill cancer cells, but low enough to harm relatively few normal cells. Use your graph to determine the highest dosage (drops) of the chemotherapy drug that will reduce normal liver cell function by 10%. Explain how you arrived at your answer.
8. What might happen to the other cells and tissues of the body if the liver is unable to eliminate hydrogen peroxide?
9. What are two possible sources of error in this experiment? What actions could be taken to avoid, or reduce, each of these sources of potential error?

Teacher Instructions

Part 3: Clinical Trials for Cancer Treatment (10 minutes + homework + 20 minutes)

Before class:

- Plan for computer access or make print copies of the resources suggested in the student handout “Clinical Trials for Chemotherapy Treatments.”
- Make one copy of “Clinical Trials for Chemotherapy Treatments” for each student.
- Make one copy of “Clinical Trials - Venn Diagram” for each student.

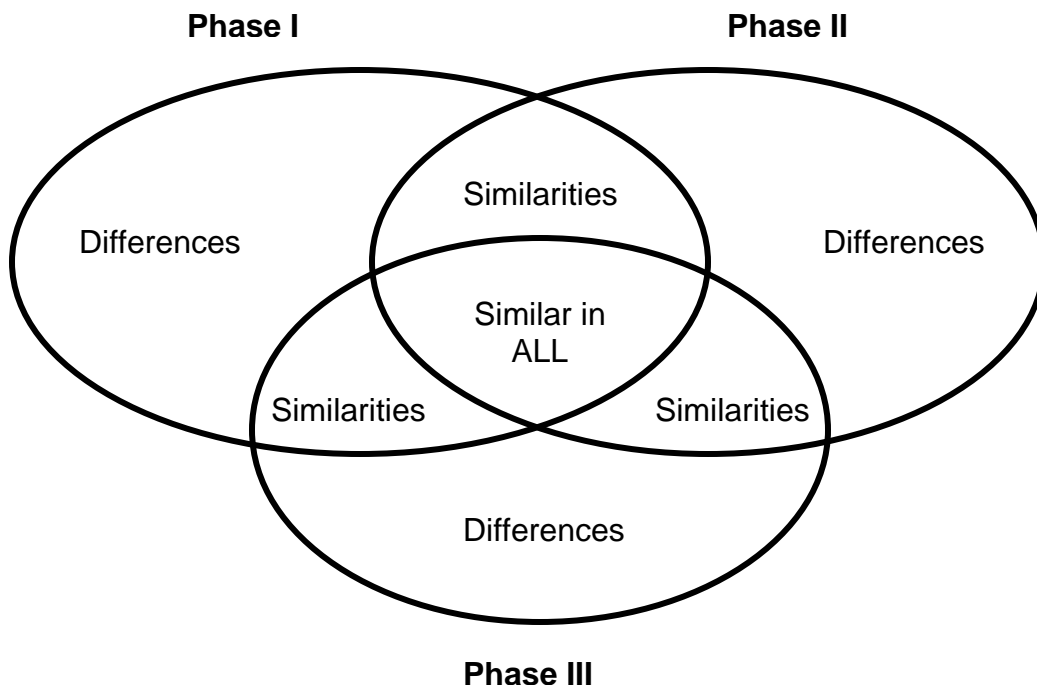
During first class (10 minutes + homework):

- Distribute a copy of “Clinical Trials for Chemotherapy Treatments” to each student.
- Assign students to work in teams of 3.
- Assign one student in each team to do research on one phase of clinical trials - Phase I, Phase II, or Phase III.
- Allow homework or time for individual students to read about clinical trials and answer the questions based on their assigned clinical trial phase.

During second class (20 minutes):

- Draw the sample Venn diagram below on the board.
- Explain how to do a Venn diagram, if students have not used this type of graphic organizer before.
- Distribute one copy of “Clinical Trials - Venn Diagram” to each team.
- Ask student teams to work together to prepare a Venn diagram that summarizes the similarities and differences between the three different phases of clinical trials.
- Allow time for students to share the results of their research with other students in their team and to work together to produce the Venn diagram.

Clinical Trials for Cancer Treatments



Part 3**Clinical Trials for Chemotherapy Treatments**

Once scientists have done laboratory tests on potential chemotherapy treatments, the scientists need to test the treatments on human subjects. Tests on human subjects are called clinical trials.

Patients must sign an informed consent form before they participate in clinical trials. Before patients agree to participate in clinical trials, doctors or scientists should explain both the benefits and risks of the clinical trials to the potential clinical trial participants. Patients should understand and carefully weigh both the benefits and the risks involved in the clinical trials.

Imagine that you are a cancer patient who had been asked to give his/her informed consent for participation in a **PHASE** _____ clinical trial for a new chemotherapy treatment.

Use the information at

http://www.cancer.org/docroot/ETO/eto_1_3_Chemotherapy_Principles.asp and <http://www.cancer.gov/cancertopics/chemotherapy-and-you> to answer the following questions:

1. What types of people participate in Phase ____ clinical trial?
2. How many people typically participate in Phase ____ clinical trials?
3. What are the risks of participating in Phase ____ clinical trials?
4. What are the benefits of participating in Phase ____ clinical trials?

5. What questions would you want your doctor to answer before you agreed to participate in Phase ____ clinical trials?

6. Would you be willing to participate in Phase ____ clinical trials? Explain why or why not?

Be ready to share the answers to these questions with other members of your team.

Clinical Trials - Venn Diagram

Team Members Names _____, _____, _____

Work as a team to prepare a Venn diagram to compare (show similarities) and contrast (show differences) among the Phase I, II, and III clinical trials.

