

## ***Teaching Activity: Population and World Diseases***

***Introduction:*** Throughout most of human history, the human population has been increasing. However, population has not always been steady and uninterrupted. For example, during the mid-1400s, there was a sharp decline in population as a result of the bubonic plague, or Black Death, that struck much of Europe and Asia. The plague killed more people than any other single disease; it claimed the lives of 25 percent of the adult population of Central Europe and Asia. The population of England was reduced by about 50 percent between 1348 and 1379. In addition to the plague, worldwide outbreaks of cholera, typhus, malaria, yellow fever and smallpox have claimed millions of lives. The more densely populated cities became, the more quickly diseases spread.

The biomedical revolution of the 20<sup>th</sup> century has also resulted in increased population growth. During this revolution, the death rates continued to drop as health and hygiene improved. The discovery of antibiotics and vaccines has wiped out or controlled many life threatening diseases. At the same time, birth rates have increased due to better prenatal care.

Many health specialists today feel that the world health situation can be summarized by the following statement " Wealth determines health and health determines wealth ". People with poor health are too sick to accumulate wealth and those with no wealth cannot afford the health care necessary to become well. Therefore, one third of the population of the world is sick, with the majority of the illness among children of developing nations. Every year, in developing nations, more than 14 million children under the age of five die because poor nutrition leaves them unable to fight common infections.

***Important Terms:*** Population dynamics, fertility rates, mortality, prediction, connections map, infectious disease, developed nation, developing nation, parasite, malaria, pie graph, vaccine, population density;

### ***Objectives:***

- To create two pie graphs comparing the causes of death in developing and developed nations;
- To analyze data comparing the causes of death in developed and developing countries;
- To create a map illustrating the availability of health care around the world;
- To compute and analyze the possible growth of infectious diseases as a result of global warming;
- To compute the increases in the distribution of infectious diseases for 2050;

***Materials:*** Student Activity Sheets, pencil / paper, colored pencils, calculator;

**Part A:**

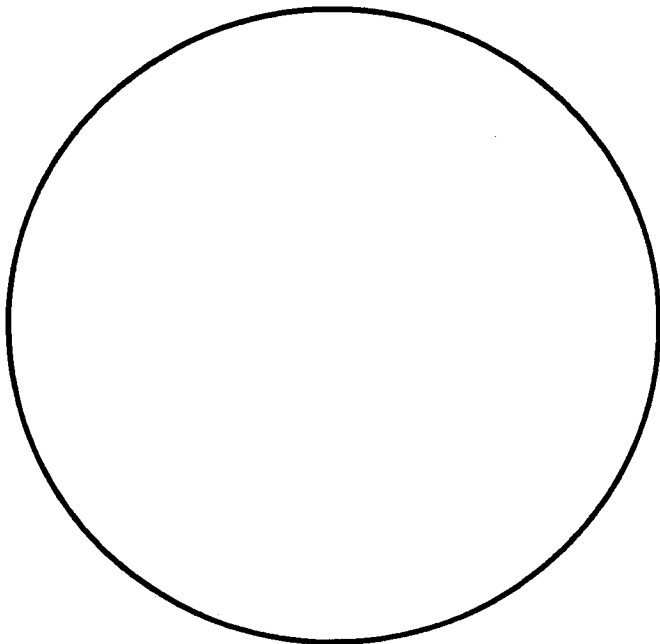
**Procedure:**

1. Based on the data presented in the Data Table, students should prepare two pie graphs comparing the causes of death in developing and developed countries.
  - Students should then answer the related questions in the Analysis section.

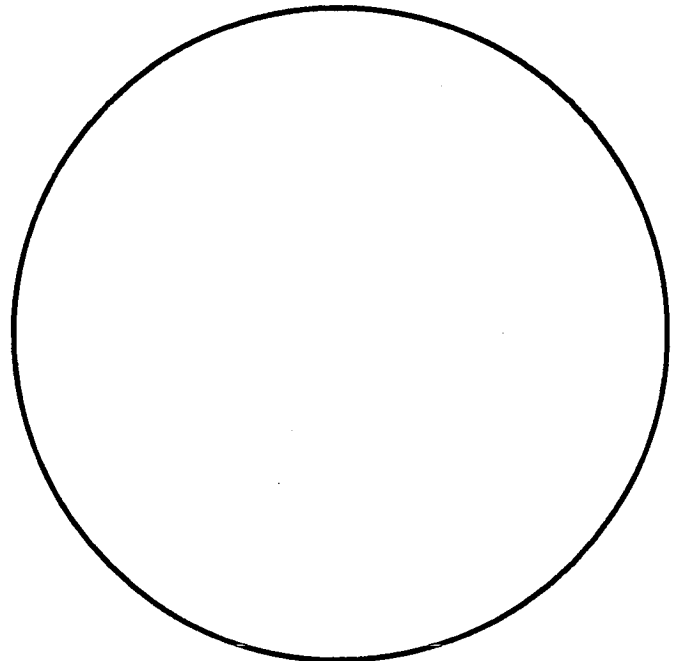
**Causes of Death (1980)**

CAUSES	DEVELOPED NATIONS	DEVELOPING NATIONS
Infectious and parasitic diseases	8%	40%
Cancer	19%	5%
Cardiovascular and degenerative disorders	53%	19%
Childbirth related	2%	8%
Injury and poisoning	6%	5%
Other	12%	23%

**Developed Countries**



**Developing Countries**



**Part B:** In developed nations, like the United States, there is one doctor for every 500 people. In poor nations, more than 10,000 people may share one doctor. In Africa, as a whole, there is only one doctor for every 25,000 people and many people live in regions that are so remote they have no access to a doctor at all.

**Procedure:**

1. On the map provided, students should identify the locations of the nations listed below.
  - Using different colors, they should indicate the availability of medical care in these countries.
  - Students should then create a key for the map.
  - Have atlases available to locate the countries students are not familiar with.

**Population Per Doctor**

50,000 and over	20,000 - 49,999	10,000 - 19,000	5,000 - 9,999	2,000 - 4,999	1,000 - 1,999	500 - 999	Under 500
Ethiopia Guinea, Burkina Faso	Mali, Niger, Chad, Gen.African Rep; Uganda, Nepal Rwanda, Bhutan Burundi, Tanzania Mozambique	Mauritania, Senegal, Gambia, Sierra Leone, Liberia, Ghana Benin, Zaire, Cameroon, Sudan, Angola Somalia, Kenya Madagascar, Afghanistan, Haiti;	Guyana, Togo Nigeria, Congo Zambia, Botsawana Zimbabwe Malawi, Yemen Sri Lanka, Bangladesh Thailand, Sumatra, Borneo, Indonesia, Philippines;	India, Iran Pakistan, Burma Meghalaya Rep.of Yemen, Tunisia, Algeria Morocco, Rio Muni Gabo, Guatemala El Salvador Belize;	Mexico Honduras Nicaragua Panama Dom.Republic Colombia Peru Chile Bolivia Brazil Paraguay Surinam South Africa Turkey, Syria Iraq, Jordan Egypt, China, Laos, Oman Korea, Malaysia	Canada, Ecuador, Venezuela French Guiana, Uruguay, United Kingdom, Ireland, Belgium Switzerland Yugoslavia Romania Vietnam Japan N.Zealand	U.S. Argentina Australia USSR Norway Denmark Sweden Finland Italy France Spain Portugal Germany Greece Bulgaria Hungary Austria Czecho- slovakia Iceland

**Part C:** About 80% of the illnesses in developing nations are caused by waterborne pathogens. For example, more than 5 million people each year die from malaria transmitted by mosquitos that breed in standing water. Another 20 million suffer from Guinea worm infections and over 200 million people are affected by Schistosomiasis.

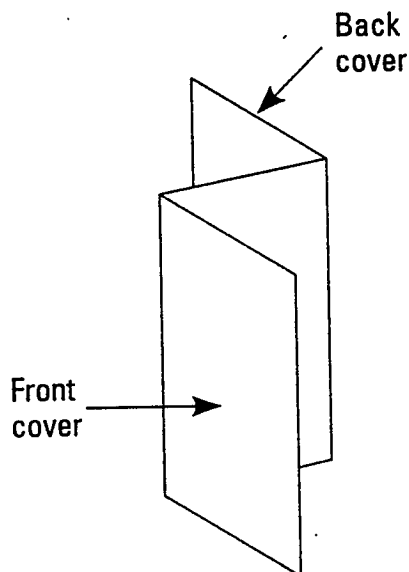
**TASK:** You have been hired as an educational consultant for the World Health Organization (WHO), a branch of the United Nations. Your job is to produce a small pamphlet about one of the diseases listed below. The pamphlet is to be used and distributed by volunteers in a developing nation to help educate the local population about the disease. Be sure to include the following information:

- Organism (or organisms) that causes the disease
- Method of infection
- Symptoms
- Treatment
- Preventative measures

1. Students may choose to report on any one of the diseases listed below:

- Malaria
- Schistosomiasis
- Guinea worm
- River blindness
- Sleeping sickness
- Filariasis

2. Pamphlets should be made from a single sheet of 8.5 x 11" paper (standard letter size) folded as shown below. The name of the disease and a map showing geographic location of the disease should appear on the front cover and any references that you used to research the information should be listed on the back cover.



**Part D:** Scientists know that the transmission of many infectious diseases is affected by climatic factors: temperature, humidity, surface water, wind, soil moisture and changes in forest distribution. Disease like malaria are especially influenced by changes in these factors, since they require an intermediate organism like a mosquito to transmit the actual disease. It is predicted that climate change altered weather patterns would affect range (latitude and altitude), intensity and seasonality of many infectious diseases. In general, increased warmth and moisture would enhance the transmission of these diseases.

**Procedure:**

1. Read over and discuss the **Introduction** and the **Data Table**.
2. Explain to students that they will be creating a map indicating the present ranges of the 10 diseases listed in the table.
  - They will need to create a code for each disease (either color or symbol).
  - They should include a key for the map explaining the code.
3. Students will compute the numbers for columns #7 and 8 on the **Data Table** using their calculators.
  - The new data should be added onto the **Data Table**.
  - Students should use the following formula:  
**Column #7**  
$$\text{New cases each year} \times \% \text{ alteration} = \text{New cases yearly in 2050}$$
  
**Column #8**  
$$\text{Population at risk} \times \% \text{ alteration} = \text{Population at risk in 2050}$$
4. Students should then answer the related questions in **Analysis** section.

## ***Student Activity Sheet #1: Population and World Diseases***

***Introduction:*** Throughout most of human history, the human population has been increasing. However, population has not always been steady and uninterrupted. For example, during the mid-1400s, there was a sharp decline in population as a result of the bubonic plague, or Black Death, that struck much of Europe and Asia. The plague killed more people than any other single disease; it claimed the lives of 25 percent of the adult population of Central Europe and Asia. The population of England was reduced by about 50 percent between 1348 and 1379. In addition to the plague, worldwide outbreaks of cholera, typhus, malaria, yellow fever and smallpox have claimed millions of lives. The more densely populated cities became, the more quickly diseases spread.

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Many health specialists today feel that the world health situation can be summarized by the following statement "Wealth determines health and health determines wealth". People with poor health are too sick to accumulate wealth and those with no wealth cannot afford the health care necessary to become well. Therefore, one third of the population of the world is sick, with the majority of the illness among children of developing nations. Every year, in developing nations, more than 14 million children under the age of five die because poor nutrition leaves them unable to fight common infections.

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**Student Activity Sheet #2:**

**Part A:**

**Procedure:**

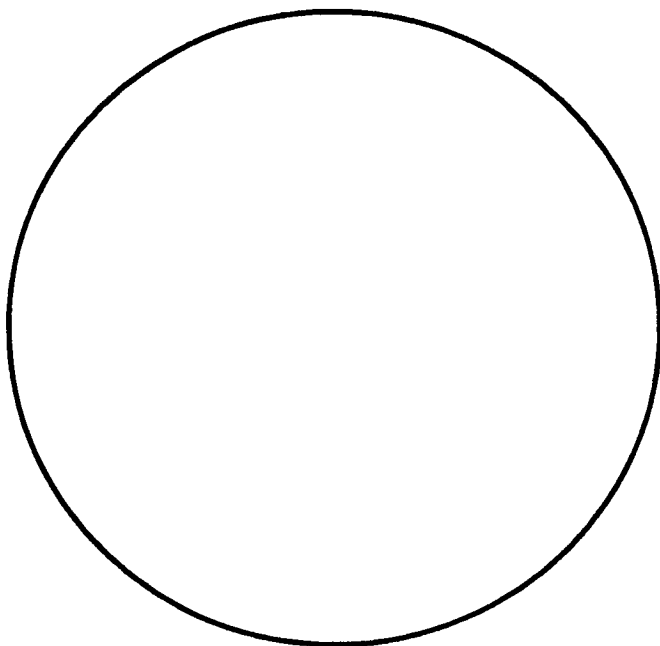
1. Based on the data presented in the **Data Table**, prepare two pie graphs comparing the causes of death in developing and developed countries.

- Answer the related questions in the **Analysis** section.

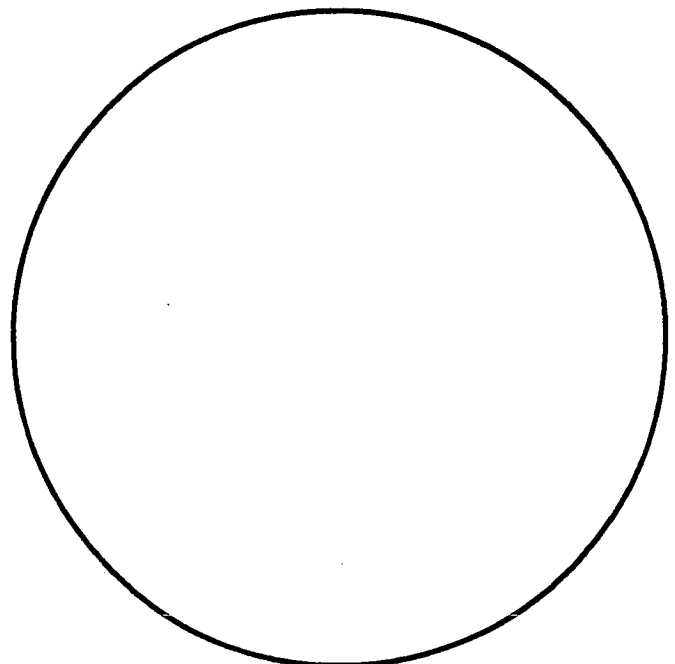
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### Student Activity Sheet #3

**Part B:** In developed nations, like the United States, there is one doctor for every 500 people. In poor nations, more than 10,000 people may share one doctor. In Africa, as a whole, there is only one doctor for every 25,000 people and many people live in regions that are so remote they have no access to a doctor at all.

#### Procedure:

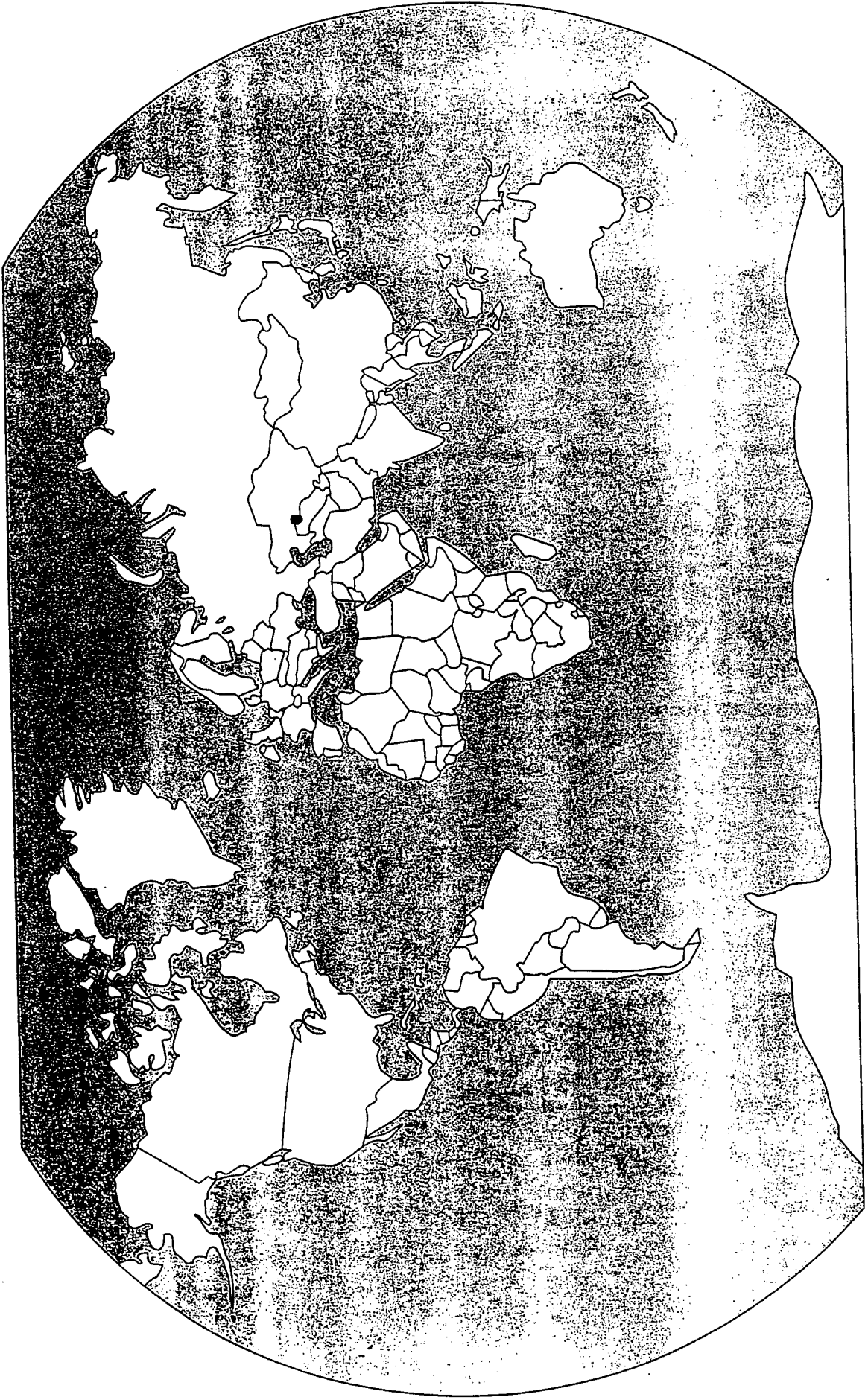
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Student Activity Sheet #3



## Student Activity Sheet #4

**Part C:** About 80% of the illnesses in developing nations are caused by waterborne pathogens. For example, more than 5 million people each year die from malaria transmitted by mosquitos that breed in standing water. Another 20 million suffer from Guinea worm infections and over 200 million people are affected by Schistosomiasis.

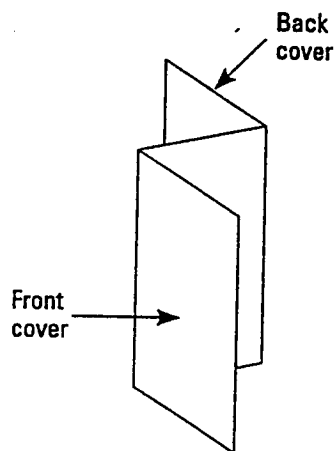
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## Student Activity Sheet #5

**Part D:** Scientists know that the transmission of many infectious diseases is affected by climatic factors: temperature, humidity, surface water, wind, soil moisture and changes in forest distribution. Disease like malaria are especially influenced by changes in these factors, since they require an intermediate organism like a mosquito to transmit the actual disease. It is predicted that climate change altered weather patterns would affect range (latitude and altitude), intensity and seasonality of many infectious diseases. In general, increased warmth and moisture would enhance the transmission of these diseases.

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## Data Table: Incidence and Locations of Infectious Diseases (1994 and 2050)

DISEASE	VECTOR	Population at risk 1994 (millions)	New cases yearly 1994	Present Distribution	Probability of Alteration	New cases yearly 2050	Population at risk in 2050
Malaria	Mosquito	2400	300 - 500 m	Tropics Subtropics	***		
Schistomiasis	Fluke	600	200 m	Tropics Subtropics	**		
Filariasis	Mosquito	1094	117 m	Tropics Subtropics	*		
Sleeping sickness	Tsetse fly	55	300000	Tropical Africa	*		
Guinea worm	Crustacean	100	100000	S. Asia Arabia Pen. C/W Africa	?		
Leishmaniasis	Sand fly	350	500000	Asia, S. Europe Africa Americas	*		
River blindness	Black fly	123	17.5 m	Africa and Latin America	**		
Chagas disease	Triatomine bug	100	18 m	Central and S. America	*		
Dengue	Mosquito	1800	10-30m	All tropical regions	**		
Yellow fever	Mosquito	450	<5,000	Tropical S. America Africa	**		

NOTE: \*\*\* = 40% alteration/increase  
 \*\* = 25% alteration/increases

\* = 12.5% alteration/increase  
 ? = No data available

## Student Activity Sheet #6

### Analysis:

1. Why is the death rate from infectious and parasitic disease so much higher in developing countries than in developed countries?

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2. Why do you think that cardiovascular and degenerative disease is so much higher in developed nations? \_\_\_\_\_

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3. Many cancer-causing chemicals, such as certain pesticides, are banned in the United States and other industrialized countries, but are still heavily used in developing nations. Why, then, do you think cancer rates are higher in the developed countries?

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4. Explain the relationship between infectious disease and climatic factors.

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5. What specific aspect of climate change would affect the intensity, range and seasonality of diseases transmitted by carriers (mosquitos, flies, etc.)? \_\_\_\_\_

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6. What one factor would you think would be the most important factor for all types of diseases? Why? \_\_\_\_\_

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7. How are the following diseases transmitted:

- |                          |                            |
|--------------------------|----------------------------|
| a. Dengue _____          | b. Yellow fever _____      |
| c. Schistomiasis _____   | d. Sleeping sickness _____ |
| e. River blindness _____ | f. Malaria _____           |
| g. Filariasis _____      | h. Guinea worm _____       |

**Student Activity Sheet #6**

8. Which disease are expected to experience an alteration of 25%? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

9. Which disease is expected to increase the most? \_\_\_\_\_

10. Which disease are scientists unsure about? \_\_\_\_\_

11. Considering an increase in temperature and precipitation to be the most evident direct affect of climate change, what will probably happen to the geographic distribution of diseases spread by mosquitos? Why? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

12. What regions of the world should be affected the most? \_\_\_\_\_

\_\_\_\_\_

13. What could the effect be on temperate regions like the southern U.S. and parts of Europe?

\_\_\_\_\_  
\_\_\_\_\_

14. Considering what health specialists feel is the reason for poor health in many parts of the world, what could climate change mean for the 1/3 of the world's population that is already sick? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

15. What do the facts suggest about the future health of people in Africa, S. Asia and some parts of Latin America? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

16. Do the facts presented on the data tables, "Causes of Death" and "Population Per Doctor" agree or disagree in their statements about health care and money? Explain.

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\_\_\_\_\_