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1.1
Population—More Is Less: Background Information

What is the most pressing environmental issue of our time? Is it acid rain? Global climate change? Air pollution? Deforestation? While some authorities might answer differently, most would agree that the problem of human **population** growth is of major importance.

To see why this is so, we need to consider two aspects of human population growth: the *quantity* of human life and the *quality* of human life. First, let us consider the quantity of human life.

Population growth occurs when the number of organisms entering a population exceeds the number of organisms leaving it. The population of a city, for example, grows if the people moving into it (**immigration**) plus the number of people born in it is greater than the sum of the number of people moving out (**emigration**) and the number of deaths. When considering the Earth, we need to consider the **birth rate** (number of live births per one thousand people in a year) as compared to the **death rate** (number of deaths per one thousand people per year).

For most of human existence, the death rate nearly equaled the birth rate, and the population grew very slowly. It took millions of years for the human population to reach one billion, about the year 1810. It took only 117 more years to add the second billion (1927), only 33 years to add the third billion (1960), 14 years to add the fourth billion (1974), and only 13 more years to reach five billion in 1987. In 1999, 12 years later, the world's population reached six billion. It is predicted that the Earth's population will reach seven billion people by 2013. Notice that the rate of growth is now slowing, but that the population is still increasing.

The type of growth exhibited for most of the time since about 1810 is called **exponential growth**. Part I of this activity will allow you to investigate exponential growth.

As you do Part I, keep the following growth rates in mind:

The World:	1.2% per year	Africa:	2.4% per year
Latin America:	1.5% per year	Asia:	1.2% per year
United States:	0.6% per year	Europe:	–0.1% per year

Those who study populations, **demographers**, often consider the **doubling time** for a population. We can see that the population of Earth doubled between 1960 and 1999, a doubling time of less than forty years! Compare this to the 117 years that it took to double from one billion in 1810 to two billion in 1927, and the 47 years that it took to double again to four billion.

Any place on Earth can support only a certain number of any type of organism. That is its **carrying capacity**. We do not know what the Earth's carrying capacity for people is. Some demographers feel that we have already exceeded it. Others think that our ability to manipulate our environment will enable us to support even more people. Regardless of how many people can possibly subsist on Earth, how many of us *should* there be? Is our goal to have as many people as possible existing on Earth, or is our goal for people to have happy, healthy, fulfilling lives? The United States has about 4.3 percent of the world's population but uses about 30 percent of the resources that are consumed each year. Is it possible for all people to achieve the standard of living that we in the United States now enjoy?

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1.2A
Population—More Is Less: Instructions

Part I: Exponential Growth

Your team will be assigned a population growth rate, stated as a percentage. Note that a negative population growth rate means simply that the population is getting smaller.

Use a calculator to determine the population each year for a population that starts at 100. Round off decimals to the nearest whole number. As you do your calculations, record your data on the table below.

For example, if you were assigned a growth rate of 7 percent, the first part of the table would look like this: [calculations: 100 × 1.07 = 107 107 × 1.07 = 114.49]

Year #	*Population*	*Year #*	*Population*
0	100	11	
1	107	12	
2	114	13	

As you do your calculations, one team member should graph the population change. Before beginning your graph, your team should:

- Decide which axis should represent the year and which should represent the population
- Decide what the units should be on the population axis
- Graph a population growth of 0 percent

Population growth rate assigned: _____

Year #	*Population*	*Year #*	*Population*
0	100	11	
1		12	
2		13	
3		14	
4		15	
5		16	
6		17	
7		18	
8		19	
9		20	
10			

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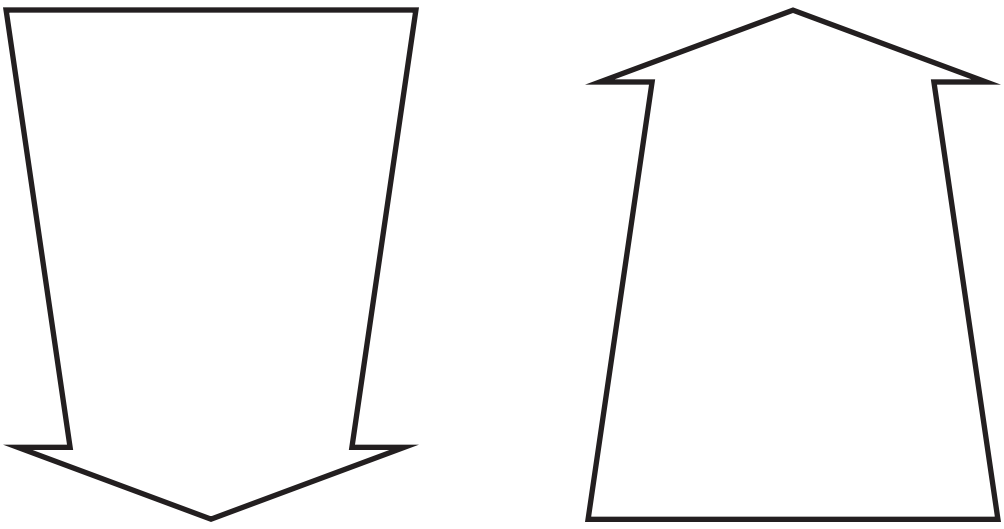
1.2B
Population—More Is Less: Instructions

Part II: Quality or Quantity?

1. As a team, discuss the items listed below. Decide whether each item is generally "good" for people and the environment or generally "harmful."
   - If it is "good," place a green "+" in the space beside the item.
   - If it is "harmful," place a red "–" in the space.
   - If your team really can't decide, place a black check in the space.

___Clean water	___Energy	___Noise
___Buildings	___Overgrazing	___Hunger
___Material luxuries	___Polluted air	___Minerals
___Space to live	___Cars and roads	___Unemployment
___Soil erosion	___Forests	___Food
___Wildlife	___Acid rain	___Garbage
___Poverty	___Oil spills	___Crowded cities
___Opportunities for solitude	___Endangered species	___Contagious disease
___Traffic congestion	___Available housing	___International conflicts
___Recreational space		

2. Now consider the effect of a significantly increased human population on each item. If increasing the human population would tend to increase the item, write the item inside the arrow pointing upward. If increasing the human population would tend to decrease it, write the item inside the arrow pointing downward.
   - Use a red writing tool for the "harmful" things.
   - Use a green writing tool for the "good" things.



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1.2C
Population—More Is Less: Instructions

Part III: Dear Grandchild

If current trends continue, the population of the world will be about twice as large forty years from now. What do you think your life will be like in forty years? Will you have children? Grandchildren? What will their lives be like? What will the environment be like in the area where you now live?

Write a letter to your ten-year-old grandchild. In your letter, discuss:

- What you do for a living
- What you do for recreation
- How the world has changed
- What you eat
- Your energy source
- What you would have done differently
- Your hopes and dreams for your grandchild
- One simple piece of advice for your grandchild

Date: _____

Dear _____,

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Continue on the back of this paper or on a separate paper.)

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1.3
Population—More Is Less: Questions

1. Summarize the effect of exponential growth on a population.

_____

_____

2. In Part II of this activity, you saw some relationships between population and some parts of the environment. What sorts of things tend to increase with population increases? What sorts of things tend to decrease?

_____

_____

_____

3. The United States has about 4.3 percent of the Earth's human population and is responsible for about 30 percent of the annual resource use and pollution. What does this tell us about the lifestyle that is possible for the *world's* population?

_____

_____

_____

_____

4. Which is more important, to halt population growth in rapidly growing, less developed areas such as Africa, or in more slowly growing developed areas such as the United States? Discuss your answer.

_____

_____

_____

5. List some advantages of a reduced human population.

_____

_____

_____

6. Discuss the relative importance of *quantity* of life versus *quality* of life.

_____

_____

_____

7. How does human population growth affect the following?
   a. Extinction of other species

      _____

   b. Quality of air and water

      _____

   c. Space available for recreation

      _____

   d. Food available for people

      _____

   e. Stress and conflict

      _____

   f. Energy resources available per person

      _____

   g. Competition for jobs and housing

      _____

   h. The spread of contagious diseases

      _____

   i. Your lifestyle in the next forty years

      _____

   j. Your descendants' lifestyles

      _____

8. Should governments enact and enforce laws to limit population? Explain your answer.

   _____

   _____

9. Should governments encourage population control through such measures as education, tax incentives for smaller families, and making birth control more available? Explain your answer.

   _____

   _____

10. What can you do, personally, to help with the overpopulation problem?

    _____

    _____