

POPULATION FUTURE



People
and the
Planet

Lessons for a Sustainable Future

INTRODUCTION

The global population, currently made up of 7.4 billion people (2016), continues to grow by more than 80 million people each year. Even though the overall growth rate has slowed in recent decades, **demographers** expect population to grow through this century. Current projections for 2100 range from a low of 9.4 billion to a high of 13.3 billion (UN, 2015). This trajectory of growth will be determined largely by fertility trends in different parts of the globe, so demographers closely track the factors that may impact family size decisions. There are, of course, limits to population growth, such as the resources needed to meet human needs. Only a sustainable balance of people and resources will enable a decent quality of life for humanity in the coming decades.

MATERIALS

For each group:

- Markers (green, red, brown, yellow, blue and purple)
- Student Worksheets 1 – 4

PART 1: POPULATION 2100 PROCEDURE

1. Display the UN Population Projections graph. Explain the following:

*“Demographers are social scientists who analyze populations. They can make projections about how a population will grow based on a variety of factors that center around trends in **fertility** (births) and **mortality** (deaths). Every two years, the demographers at the United Nations release projections for world population. They do this by examining trends in each*

CONCEPT

Demographers project global population growth through the 21st century by considering trends in fertility and mortality for different world regions.

OBJECTIVES

Students will be able to:

- Interpret a population projections graph.
- Describe factors that affect fertility and mortality trends.
- Create bar graphs to represent the population sizes of different world regions over time.
- Draw correlations among different pieces of demographic data to help explain population trends in different world regions.
- Define demographic terms including fertility rate, infant mortality rate and life expectancy.

SUBJECTS

Social Studies (history, geography), math

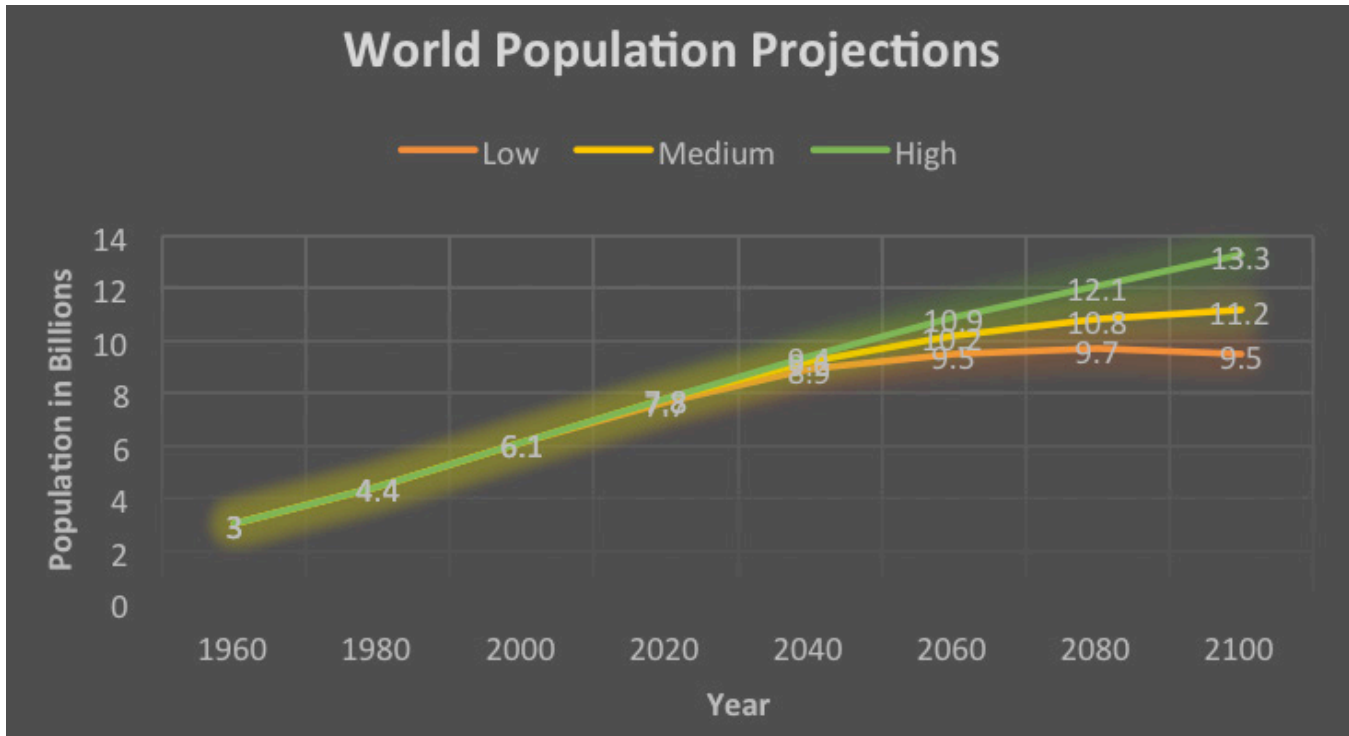
SKILLS

Graphing and analyzing data, interpreting bar graphs, drawing correlations among data, identifying trends and patterns

METHOD

Students interpret a graph showing global population projections through 2100, then create gridded bar graphs to represent the relative size of different regions' populations for different years (past and future).

country and projecting how these trends might play out in the coming decades. Because there are so many different scenarios for trends in births and deaths, the UN demographers actually release several projections – low, medium and high – to represent these different scenarios. The range from the low to the high projections actually represents a “95 percent confidence interval,” meaning that demographers are 95 percent sure that the population will reach somewhere between 9.5 billion and 13.3 billion by 2100. The medium projection (11.2 billion) is their best estimate at this time.”



2. Help students understand what they are seeing by asking the following questions:

a. What is the difference between the low estimate and the high estimate for 2100?

Answer: 3.8 billion

b. Do all three scenarios show sustained world population growth through 2100?

Answer: No. The low estimate shows world population decreasing between 2080 and 2100.

c. Projections are based on possible trends in fertility and mortality. What conditions/situations can affect or influence fertility and mortality trends?

Fertility: People choosing to have more or fewer children. This could be influenced by economic conditions (such as availability of jobs and the costs of raising children); educational and employment opportunities for women (in societies where women have more options, they tend to have smaller families); availability of reproductive healthcare (including birth control) and child survivability.

Mortality: Life expectancy can be affected by the quality of healthcare, breakthroughs in combatting diseases, lifestyles (healthy or unhealthy), pandemics (widespread contagious diseases), economic conditions, wars and crime

PART 2: WHERE ARE WE GROWING?

As the projections graph shows, demographers expect world population to grow by about 4 billion between now and the end of the century. However, this growth is not expected to be equally distributed around the globe.

PROCEDURE

1. Divide students into groups of four and distribute one of each Student Worksheet to every group. These provide regional population sizes in 1980 and 2015, as well as projections for 2050 and 2100. Each group member will complete one of the four Worksheets.
2. Provide each group with six different colors of marker as noted on the Worksheets.
Note: It's best if within groups, students use the same colors for the same regions for comparison as suggested on the Worksheet.
3. Students will be creating bar graphs using the data and grids on the Worksheets. They will first need to fill in the table at the top of the Worksheet to find how many grid squares will be needed in each bar. They can decide the width and height of each bar. For example, a population of 750 million would require 30 grid squares (because each square = 25 million people). The student can create the bar as 3 squares across by 10 squares high or 5 squares across and 6 squares high, etc. Some bars will be uneven based on the number represented.
4. When all of the bar graphs are completed, have students lay all four in front of their small group to compare and discuss what they see using the questions on their Student Worksheets as a guide.
5. Go over the following questions as a whole class, referring to both the numerical data on the four Worksheets and the gridded bar graphs they created from that data.
 - a. Which regions grew the most between 1980 and 2015?
Answer: Asia grew the most in raw numbers (1.7 billion); Africa grew by the largest percentage – more than doubling.
 - b. Which region is expected to grow by the most between 2015 and 2100?
Answer: Africa, which is expected to quadruple in population size.
 - c. Are any regions' populations expected to shrink by 2100?
Answer: Europe, by about 13 percent (96 million).
 - d. How are these demographic changes expected to alter each region's representation in the world population?
Answer: Africa will grow in representation (from 16 to 39 percent of world population). Asia will remain the largest region, population-wise. Europe, Latin America and Northern America will represent smaller percentages of world population.
6. Ask students why they think demographers are expecting such large shifts in global population among these world regions. Then project the following data table and give the class time to read through the chart and ask if they have any questions about the data or definitions. With the chart still projected, transition to the Discussion Questions.

	World	Africa	Asia	Europe	Latin America	Northern America	Oceania
Fertility rate (number of children per woman)	2.5	4.7	2.2	1.4	2.1	1.8	2.5
Infant mortality rate (Deaths per 1,000 children under age 1)	37	59	33	6	17	6	22
% of population under age 15	26	41	25	16	27	19	24
% of population age 65+	8	4	8	17	7	15	12
Life expectancy at birth	71	60	72	78	75	79	77

Answers to Student Worksheets
See Answer Key

DISCUSSION QUESTIONS

- Looking at the data column for Africa (green), do any of these statistics begin to explain why demographers expect Africa's population to grow by so much through this century? Why or why not?

Yes. The fertility rate in Africa is much higher than for any other world region. Also a much larger percentage of the population is very young, so those children will be having children in the coming years. On the other hand, Africa has a higher infant mortality rate and lower life expectancy than other world regions. Still, it is the fertility trends that are driving world population growth in this region.

- Looking at the data column for Europe (brown), do any of these statistics begin to explain why demographers expect Europe's population to shrink?

Yes. The fertility rate in Europe is low and there is a larger percentage of older people (65+) and smaller percentage of younger people than for other world regions.

- The data on the table above represents averages for each world region. Africa, for example, is a continent of 57 countries. Would you expect each of those countries to have the same demographics?


No. The averages are made of numbers much higher and lower. For example the fertility rate of African countries ranges from 2.1 in Tunisia to 7.6 in Niger.

- How would you describe the relationship between infant mortality rate and life expectancy?

A higher infant mortality rate means that fewer babies survive. This reduces the overall life expectancy.

- Do you think there may be a connection between a high infant mortality rate and a high fertility rate? If so, what might that be?

Parents may choose to have more children if they fear some may not survive.

- 
6. Think back to the earlier discussion on conditions/situations that can affect fertility trends. To better understand the reasons for the trends you see on the graphs and in the data table, what information would be useful to know about the world regions, especially related to economics and culture?

Answers may include: cultural traditions and attitudes about family size, children's role in the economy, education, gender roles, average age of marriage, access to reproductive healthcare.

7. What challenges might some African countries face with such rapid population growth?

Answers may include: providing residents with enough social services like schools, hospitals, roads, clean water and waste disposal. Also, having sufficient jobs and fertile land for growing crops, as well as housing.

8. What challenges might European countries face with a smaller population?

Answers may include: labor shortages, need for more elderly care, fewer people paying taxes.

9. What are some reasons it might be desirable for the global population to level off at the lower end of the projection range (9.5 billion)? Do you think this is possible? Why or why not?

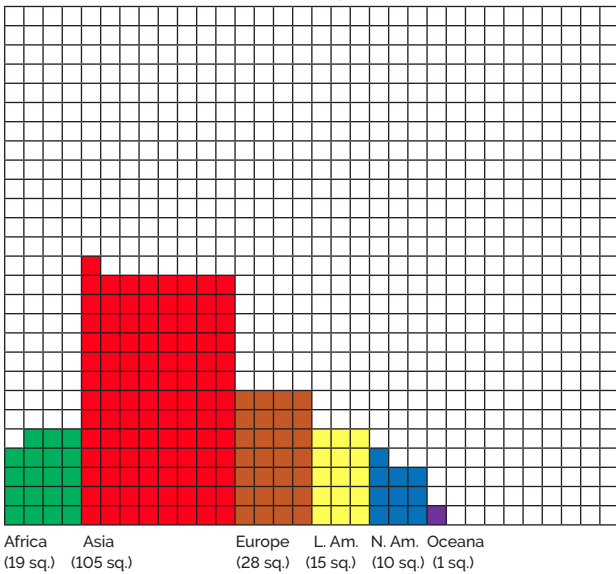
ASSESSMENT

Review students' completed graphs. Students complete an exit ticket naming three variables or trends that demographers would consider when making population projections for the global population.

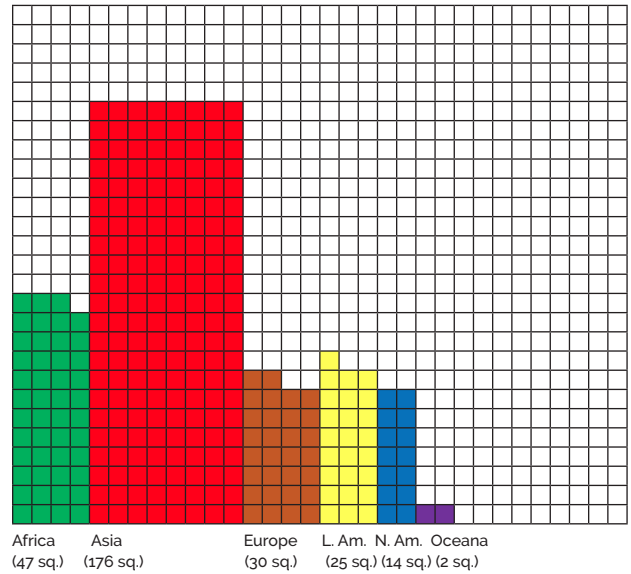
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ANSWER KEY

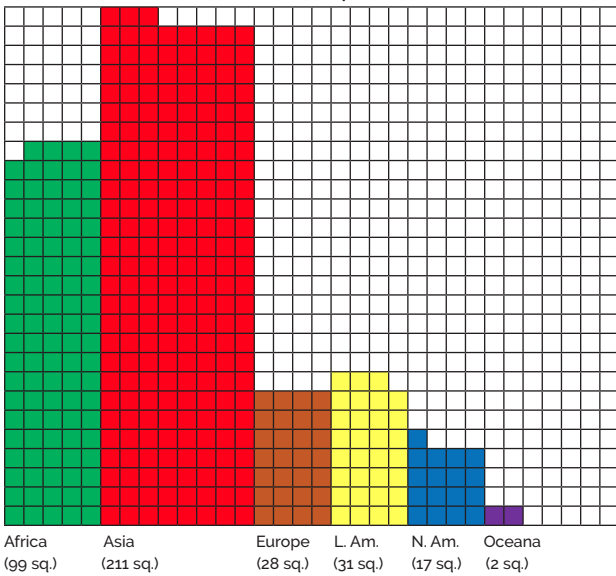
Student Worksheet 1: 1980 Population



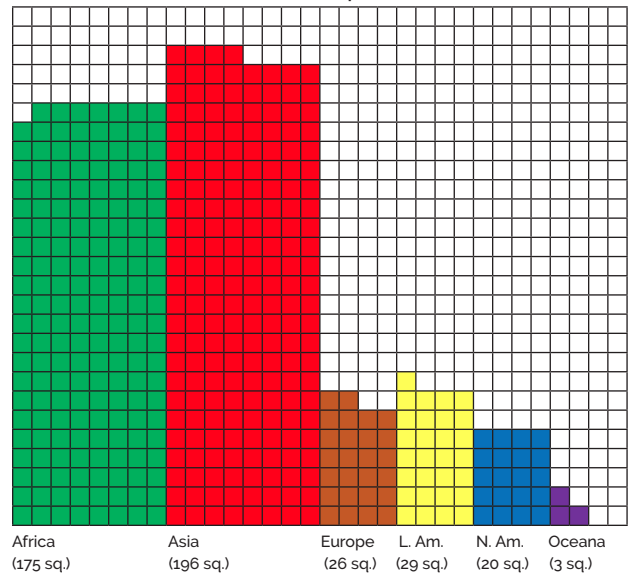
Student Worksheet 2: 2015 Population



Student Worksheet 3: 2050 Population



Student Worksheet 4: 2100 Population



Region	# Grid Squares 1980	% World Population 1980	# Grid Squares 2015	% World Population 2015	# Grid Squares 2050	% World Population 2050	# Grid Squares 2100	% World Population 2100
Africa	19	11	47	16	99	25	175	39
Asia	105	59	176	60	211	54	196	44
Europe	28	16	30	10	28	7	26	6
Latin Am.	15	8	25	9	31	8	29	6
N. America	10	6	14	5	17	5	20	4
Oceania	1	<1	2	<1	2	<1	3	<1
TOTAL	178		294		388		449	

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STUDENT WORKSHEET 1

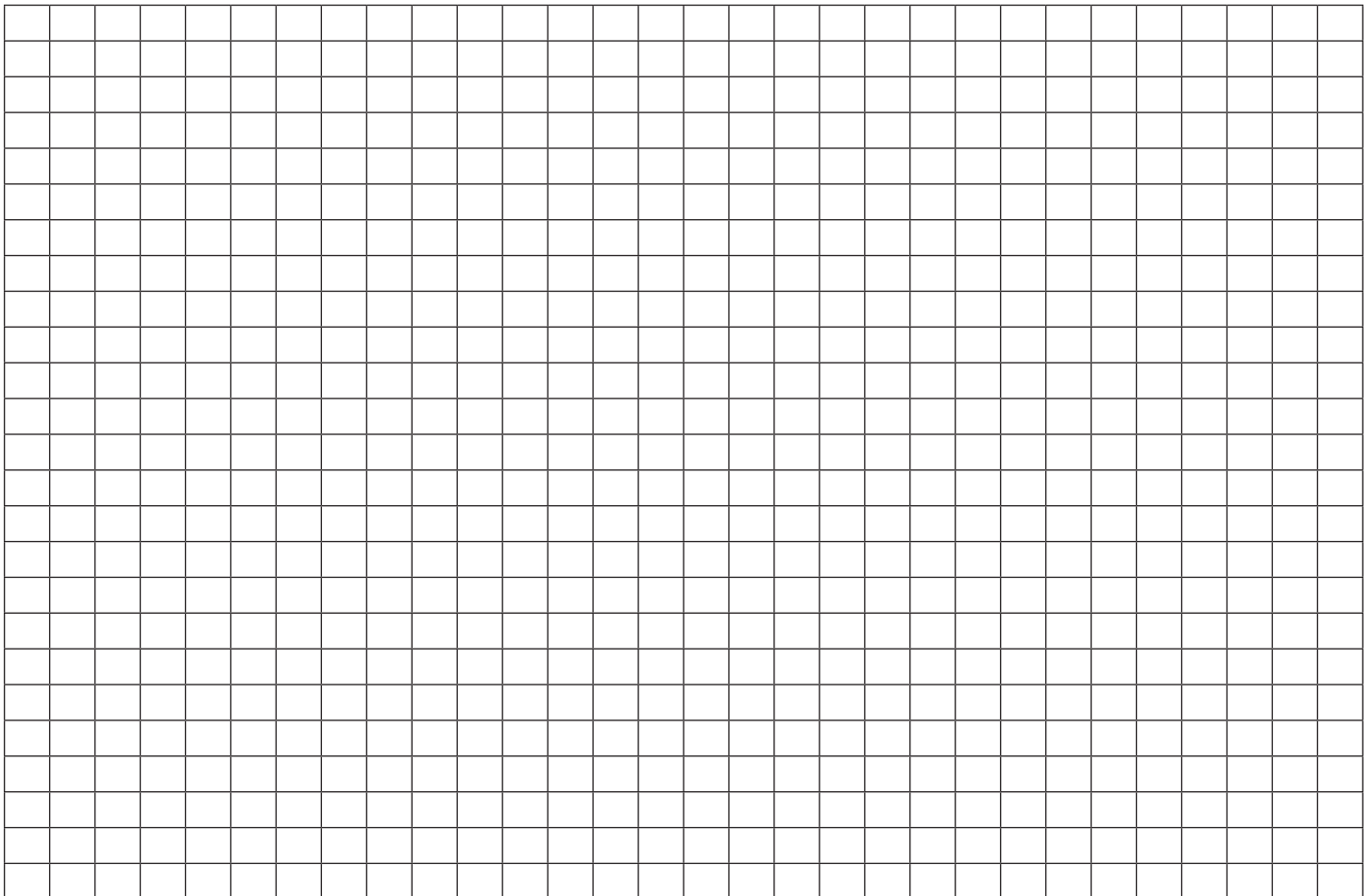
Name: _____ Date: _____

Construct a bar graph of the world's population by regional grouping.

WORLD POPULATION - 1980

Region	Population (in millions)	# of Grid Squares	% of World Population
Africa	478		
Asia	2,625		
Europe	694		
Latin America	365		
Northern America	254		
Oceania	23		
TOTAL			

1. Use the scale: 1 grid square = 25 million people. Calculate the number of grid squares needed for each region.
2. Plot the grid squares on the graph below. Use a different color to identify each region. (Colors: Africa – Green; Asia – Red; Europe – Brown; Latin America – Yellow; Northern America – Blue; Oceania – Purple)



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STUDENT WORKSHEET 1 - PAGE 2

When all group members have completed their graphs, lay them all out on a table and compare. Then answer the following questions as a group.

1. What are the trends you observe? Which regions have gotten larger? Smaller? What does this tell us about global population growth that has already happened and that is projected to occur?

2. Does seeing the data as a visual (bar graph) affect your thinking differently from viewing the data in table? Why or why not?

3. Which regions grew the most between 1980 and 2015?

4. Which region is expected to grow by the most between 2015 and 2100?

5. Are any regions' populations expected to shrink by 2100?

6. How are these demographic changes expected to alter each region's representation in the world population? (Think about a region's percentage of the total global population.)

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STUDENT WORKSHEET 2

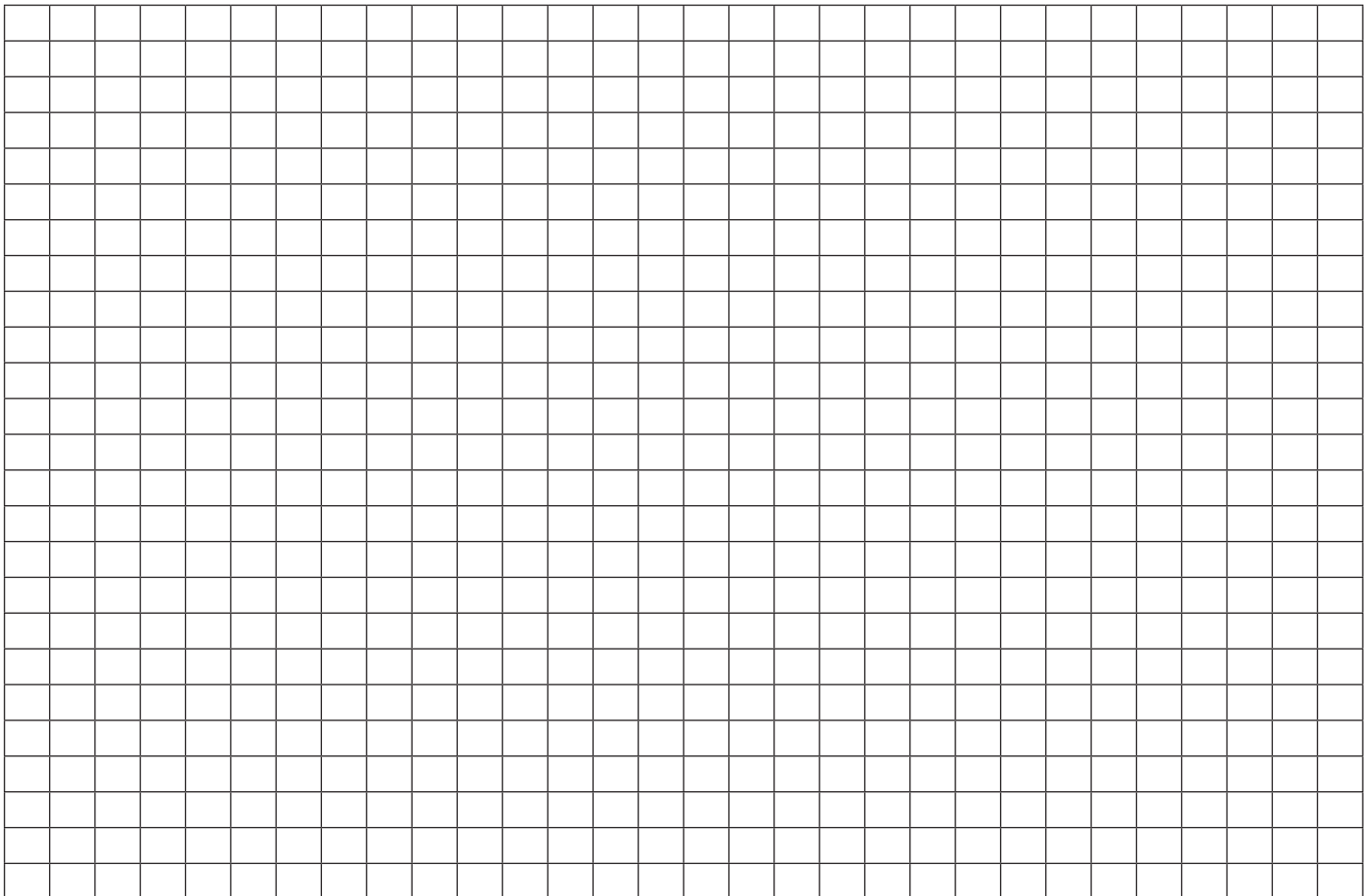
Name: _____ Date: _____

Construct a bar graph of the world's population by regional grouping.

WORLD POPULATION - 2015

Region	Population (in millions)	# of Grid Squares	% of World Population
Africa	1,186		
Asia	4,393		
Europe	742		
Latin America	634		
Northern America	358		
Oceania	39		
TOTAL			

1. Use the scale: 1 grid square = 25 million people. Calculate the number of grid squares needed for each region.
2. Plot the grid squares on the graph below. Use a different color to identify each region. (Colors: Africa – Green; Asia – Red; Europe – Brown; Latin America – Yellow; Northern America – Blue; Oceania – Purple)



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STUDENT WORKSHEET 2 - PAGE 2

When all group members have completed their graphs, lay them all out on a table and compare.

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STUDENT WORKSHEET 3

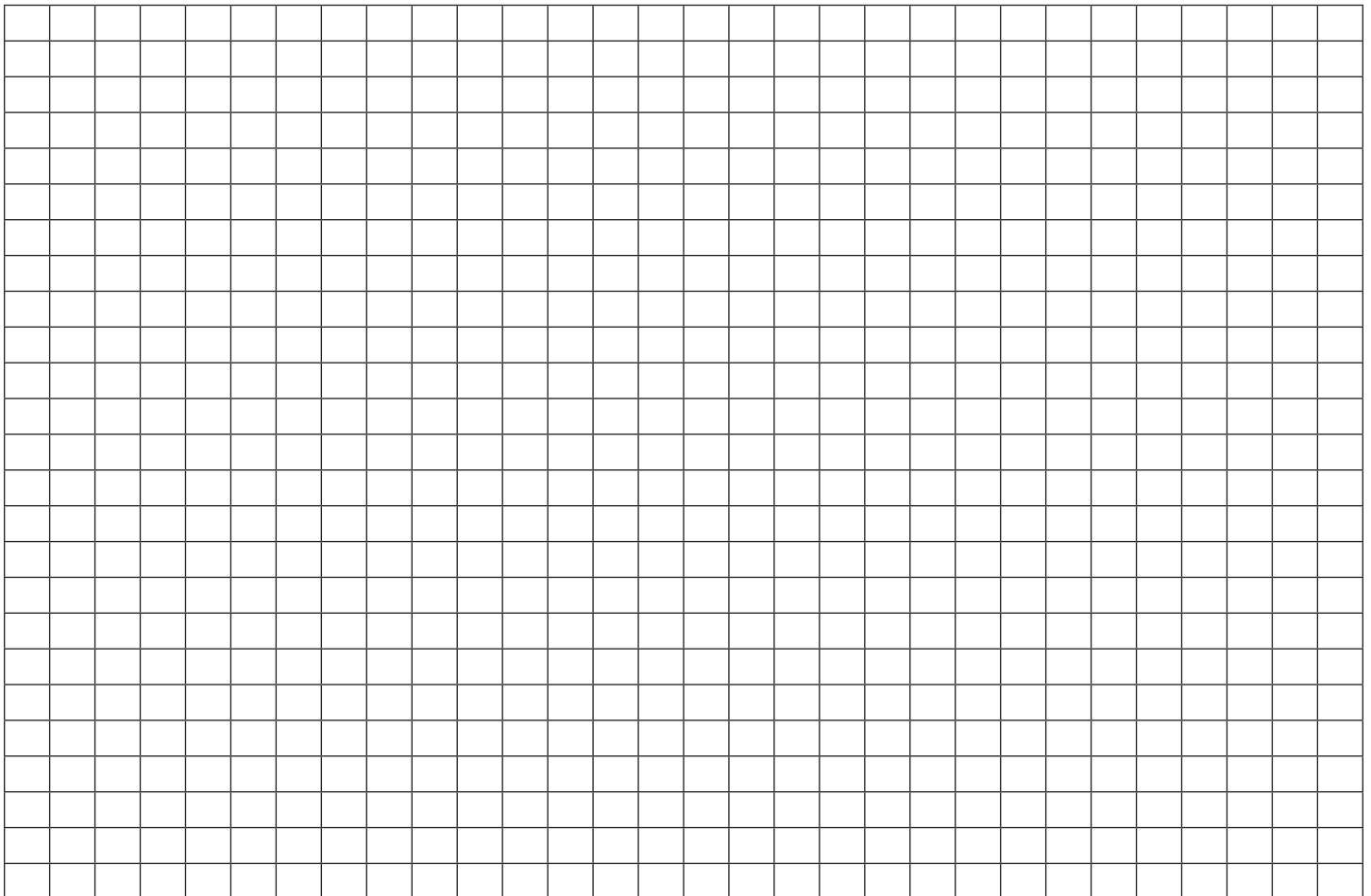
Name: _____ Date: _____

Construct a bar graph of the world's population by regional grouping.

WORLD POPULATION - 2050 Projection

Region	Population (in millions)	# of Grid Squares	% of World Population
Africa	2,478		
Asia	5,267		
Europe	707		
Latin America	784		
Northern America	433		
Oceania	57		
TOTAL			

1. Use the scale: 1 grid square = 25 million people. Calculate the number of grid squares needed for each region.
2. Plot the grid squares on the graph below. Use a different color to identify each region. (Colors: Africa – Green; Asia – Red; Europe – Brown; Latin America – Yellow; Northern America – Blue; Oceania – Purple)



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STUDENT WORKSHEET 3 - PAGE 2

When all group members have completed their graphs, lay them all out on a table and compare.

1. What are the trends you observe? Which regions have gotten larger? Smaller? What does this tell us about global population growth that has already happened and that is projected to occur?

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STUDENT WORKSHEET 4

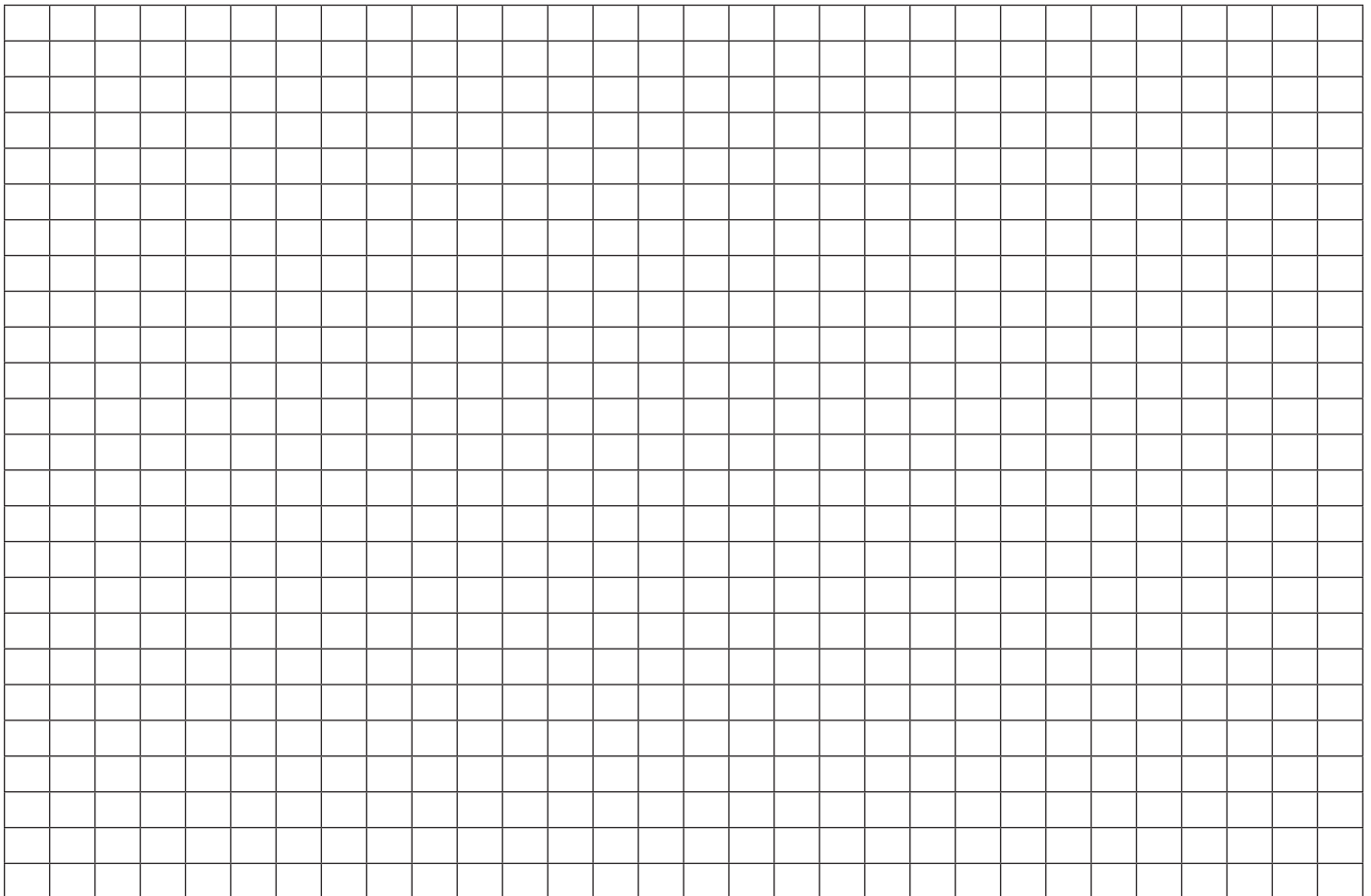
Name: _____ Date: _____

Construct a bar graph of the world's population by regional grouping.

WORLD POPULATION - 2100 Projection

Region	Population (in millions)	# of Grid Squares	% of World Population
Africa	4,387		
Asia	4,889		
Europe	646		
Latin America	721		
Northern America	500		
Oceania	71		
TOTAL			

1. Use the scale: 1 grid square = 25 million people. Calculate the number of grid squares needed for each region.
2. Plot the grid squares on the graph below. Use a different color to identify each region. (Colors: Africa – Green; Asia – Red; Europe – Brown; Latin America – Yellow; Northern America – Blue; Oceania – Purple)



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STUDENT WORKSHEET 4 - PAGE 2

When all group members have completed their graphs, lay them all out on a table and compare.

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