

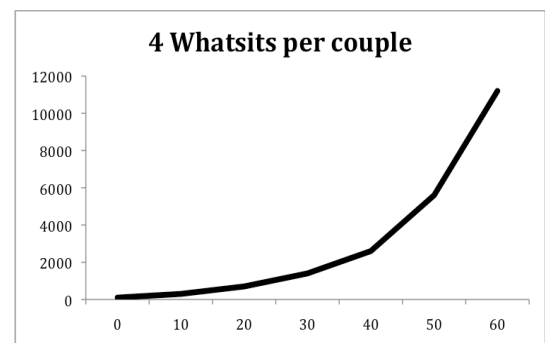
# Whatsits

Earth (100 ml beaker) has a new dominant species. They are called Whatsits. Whatsits' lifespan is only 30 seconds. After they die, they are removed from the Earth. Each female can reproduce when she is 10 seconds old, but has lost this ability by the time she is 20 seconds old.

1. Assume the average number of Whatsits per spoonful is 100 individuals, or 50 couples.
2. Follow this example to see how to record your data. In **this example** there are 100 Whatsits per spoonful and each couple has 4 offspring each time they mate. Follow this example carefully:

Time: 0 seconds	Generation 1 Total:	100 couples 100 couples	Age: Just born	
Time: 10 seconds	Generation 1 2 Total:	100 couples 200 couples 300 couples	Age: 10 seconds Just born	Reproduce
Time: 20 seconds	Generation 1 2 3 Total:	100 couples 200 couples 400 couples 700 couples	Age: 20 seconds 10 seconds Just born	Too old to mate Reproduce
Time: 30 seconds	Generation 1 2 3 4 Total:	<del>100 couples</del> 200 couples 400 couples 800 couples 1400 couples	Age: 30 seconds 20 seconds 10 seconds Just born	Remove (dead) Too old to mate Reproduce
Time: 40 seconds	Generation 2 3 4 5 Total:	<del>200 couples</del> 400 couples 800 couples 1600 couples 2800 couples	Age: 30 seconds 20 seconds 10 seconds Just born	Remove (dead) Too old to mate Reproduce
Time: 50 seconds	Generation 3 4 5 6 Total:	<del>400 couples</del> 800 couples 1600 couples 3200 couples 5600 couples	Age: 30 seconds 20 seconds 10 seconds Just born	Remove (dead) Too old to mate Reproduce
Time: 60 seconds	Generation 4 5 6 7 Total:	<del>800 couples</del> 1600 couples 3200 couples 6400 couples 11,200 couples	Age: 30 seconds 20 seconds 10 seconds Just born	Remove (dead) Too old to mate Reproduce

3. Now it's your turn. Calculate, generation by generation, what happens to a population of Whatsits over a period of 60 seconds. The birth rate is 1 Whatsit per couple. A generation is 10 seconds long. Start with 100 couples (2 spoonfuls).
4. **After** you have a chart similar to the one in the example, you may demonstrate your math. With the Earth, spoon, supply beaker, and Whatsits try out your data and observe the Whatsits as a dynamic population.
5. Graph the total number of Whatsits at the end of each 10 second period (see example).
6. Follow this procedure again but this time use a birth rate of 2 whatsits per couple. Include the graph and the trial run with the Earth and the Whatsits.
7. Run through this sequence a last time using a birth rate of 3 Whatsits per couple. Once again include the graph and the trial run.



Topics for discussion:

- How do you determine birth rate and death rate of a population?
- How do you express birth and death rate of a population?
- How can the 2 child family stabilize population growth?
- How do you explain the initial rise on the growth curve of the 2 Whatsit-child curve if each couple is just “replacing itself”? (this also applies to the 1 Wahtsit-child curve)
- What are some methods of controlling population growth that are available to us?
- How are we decreasing the death rate in the US?
- How would emigration and immigration affect this population dynamic?

Remember the equation:

$$\text{Population growth rate} = \frac{(\text{births} + \text{immigration}) - (\text{deaths} + \text{emigration})}{\text{Total population}}$$

8. Calculate the growth rate for time: 40 seconds in the first example. Then, calculate the **doubling time**. This is the time it will take for the population to double. To figure this out, you need the **rule of 70**. Divide 70 by your growth rate. This will normally give you the number of years until the population doubles. In this example, it gives you the number of rounds until it doubles. (Hint: Answer = 1.4)

9. Now, some practice problems:

	Country A	Country B	Country C
Present Population	639,711	327,564	890,220
Annual Births	27,642	4,920	9,866
Annual Deaths	7,293	3,112	8,722
Annual Immigrants	1,460	1,280	212
Annual Emigrants	2,078	312	2,670

- What is the annual population growth rate and doubling time for each of the above countries?
- Please describe what kind of economy each country is likely to have and what kind of agricultural methods that they probably practice.
- Please draw simplified age structure diagrams showing the probable distribution by age for each of the three countries.
- By looking at the age structure diagrams, what are some of the future problems that each of these three countries might be facing?