



Human Population

The Earth is gradually becoming **overpopulated**. At present, more than 6 billion people inhabit the planet. If population growth remains the same, by the middle of the present century there will be more than 10 billion people on Earth.

The main reason for this growth is the simple fact that there are more people being born on Earth than people dying. Modern medicine has helped tremendously in the curing of many diseases and helping people to live longer while the **birth rate** remains high, especially in Asian and African countries.

Humans live in quite different fashion than all other living creatures on the planet. They grow their food, process it, pack it and transport it elsewhere. With the help of vehicles, people can cover vast distances in a short amount of time. Various fuels are used to accomplish this, as well as in heating and lighting. In contrast with animals, humans attempt to adapt the environment to their needs by consuming huge quantities of resources and energy. This makes their lives much more comfortable but can seriously damage the ecosystems in which they live.



Population growth raises the need to further utilise the Earth's resources. The more people, the more energy is consumed, and this in turn leads to problems such as global warming (the greenhouse effect), acid rain, oil spills, and production of more radioactive waste.

A greater number of people also means a **greater demand** for food and drinking water, thereby raising the need for more agricultural land. When agricultural area is already used, people begin employing artificial fertilisers to increase crop yield. After an initial increase in production, however, yield drops abruptly due to erosion and salinisation of soil.

The problem of overpopulation is very serious but not unsolvable. What is known today about the relation between the number of people and the ability of ecosystems to provide the necessary resources, materials, and suitable living conditions, has given many countries the motivation to take measures to regulate this process. Some good examples are the successful programmes operating in China and Thailand. Almost all European countries are considered not likely to have this problem given the present zero population growth.



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However, where such measures have not been taken, nature managed to control human numbers in simple though cruel fashion. Typical examples are the African countries Ethiopia and Somalia, in which population growth has led to the deforestation of enormous areas and the destruction of fertile lands. This, in turn, has led to droughts and the starvation of many.

This is why reasonable **population control** is one of the main tasks of present-day governments and international organisations. This problem is closely related to the need for protection of the ecosystems we live in.

Lesson plan: What does population growth mean?

Duration	2-3 class periods
Time of year	Any
Place	The classroom, in the open
Materials	Chalk, a bench in the garden, student fact sheet
Aims	<ul style="list-style-type: none">• To explain the meaning of the exponential growth of population• To demonstrate that the resources of the Earth are limited
Methods	Game, discussion, brainstorming, dilemma solving

Part I: What is exponential growth?

1 Explain to the class that exponential growth of a system means increase through doubling of numbers: 1, 2, 4, 8, 16, 32, 64...

2 Give the following illustration of exponential growth:

- An amoeba (a microorganism living in water) found itself in a puddle by chance.
- As you know, amoebas reproduce themselves by dividing in half each day (one amoeba two new ones every day).
- On the 10th day, the puddle was half-filled with amoebas. When will the puddle be full? (Some will answer "on the 20th day," but the correct answer is "on the 11th day.")

3 Draw a chalk circle on the ground with a diameter of about 2 metres. Ask a student to stand in the center and ask him or her if there is enough room in the circle. Have another volunteer join the first one, and ask them the same questions. Have two more students enter the circle. Ask the same questions. Have four more students join, then eight, always asking the same questions? Finally, ask the class, "Can this process go on forever?"



4 Present more information on population growth and on threatened resources using the introduction text of this chapter.

5 Organise a discussion on the theme, "What is the reason for population growth today?" (*Medicine development, better hygiene, more food, exponential growth, lack of awareness of the dangers of overpopulation*)

Part II: How many people can the bench hold?

- 1 Take the class to the park and stop by a bench.
- 2 Explain that, with population growth, the need for more resources and energy appears. Changes in lifestyle toward greater consumption influence the situation in the same way. Use additional information from the introduction part of the chapters “Resources” and “Human Population.”
- 3 Ask students to imagine that the bench symbolises the Earth’s resources — minerals, energy supply, water, etc. Use the following game to visualise the problem with resources and the number of people. Ask a student to sit on the bench. Ask him if it is comfortable to him and if the “resources” are sufficient. Let another student sit beside the first one. Repeat the question for both of them. Invite more and more students to join the first two, always repeating the questions. Continue until there is no room on the bench. Ask the class in what way they could compare the opportunity to sit on the bench with the Earth’s ability to supply people with resources. Ask students if there is a possibility to crush the bench if people continue sitting on it, and what would be the equivalent in nature.
- 4 Organise a brainstorming session on what can be done. (Discussing the issue within the family; raising public awareness; influencing governments and international institutions to initiate programmes encouraging population control, etc.).
- 5 Ask students to think of and describe similar examples in order to visualise the problem of population growth and limited resources. Read the most successful ones in class. Encourage students to discuss the bench experiment at home.



Part III: The price of peas

- 1 Using the story The Price of Peas may explain the idea of the exponential growth to the students in a more amusing way. Ask one or two volunteers to read the story aloud or organise a small play with the participation of several students in the roles of the stranger, the innkeeper and the guests at the inn.

Other activities

- Give the Population Growth test. Discuss the answers as a group.
- Work with the How Many Children? dilemma. Ask the students to discuss it in groups. Give them the freedom to support various arguments in favour of what they think should be done.
- Invite an expert from an ecology institution or a non-government organisation to give the students additional information about problems associated with the growing population and limited resources on Earth.
- Make copies of the picture on page 135 and hand them out to the students to colour in.





DILEMMA

How Many Children?

You love family very much and would like to have many children. But you know that population growth is a serious problem. What would you do?

- plan a big family with many children anyway;
- have no children;
- have no more than 1-2 children; or
- something else.



TEST

Population Growth

	TRUE	FALSE
1 At present, the human population is over 6 billion.	<input type="checkbox"/>	<input type="checkbox"/>
2 In coming decades, the number of people in the world will not increase.	<input type="checkbox"/>	<input type="checkbox"/>
3 People, unlike animals, try much more to adapt the environment to their needs.	<input type="checkbox"/>	<input type="checkbox"/>
4 In future, the Earth's resources (farming land, food, water, raw materials, energy) will be enough for the growing population of the planet.	<input type="checkbox"/>	<input type="checkbox"/>
5 The problem of regulating the number of people is serious, but it is not impossible.	<input type="checkbox"/>	<input type="checkbox"/>
6 The series of numbers: 2, 4, 6, 8, 10,... is an example of exponential growth.	<input type="checkbox"/>	<input type="checkbox"/>
7 The problem of fast population growth is most serious in countries in Asia and Africa.	<input type="checkbox"/>	<input type="checkbox"/>
8 Population growth brings extra pressure to bear on the ecosystems.	<input type="checkbox"/>	<input type="checkbox"/>

Answer key: 1. True 2. True 3. False 4. True 5. True 6. False 7. True 8. True





FACT SHEET

The Price of Peas

A crowd of people had gathered in an inn. Everybody's mood was at its height when they heard the clatter of hoofs and saw a strange rider on a beautiful white horse enter the yard. A minute later, he entered the inn and sat at an empty table. The innkeeper was very happy about the rich guest and wanted to get a lot of money from him, but the stranger only ordered a glass of beer.

"I'll make you loosen your purse strings," the greedy innkeeper thought and sat at the stranger's table. He tried to find out the stranger's name and where he was from, but the man didn't utter a word. The innkeeper then started saying nice things about the man's horse.

"Yes," the rider said, breaking his silence. "It's a wonderful horse. I crossed many lands riding it, but now I have to part with it, because I bought a ship and I'm going to continue my journey sailing along the Rhein. Would you like to buy it?"

The innkeeper's eyes sparkled, but he didn't give himself away. He calmly replied, "Why should I need a horse? I have four horses in my stable. But ... if you don't want too much money, your horse could be the fifth."

"We'll agree to terms about the price!" said the stranger, smiling. "I don't want money — you can pay me in peas."

"A horse for peas!" the innkeeper cried. "My cellar is full of peas. But you must be joking!" He was all ears, anticipating the bargain.

"I'm not joking at all," answered the rider calmly. "Let's settle our deal like this..."

The visitors in the pub were curious about the unusual bargain, and so they came closer as the rider named his conditions.

"My horse has four legs," he said. "He has a hoof on each leg and a horseshoe on each hoof. There are eight nails on each shoe. Remember this: four horseshoes with eight nails each — that makes thirty-two nails. And you, my dear sir," he said to the innkeeper, "will only pay for the nails..."

"With peas?" the eager innkeeper hurriedly interrupted him.

"Only peas and only for the nails," nodded the stranger. "I'll give you the horse for free!"

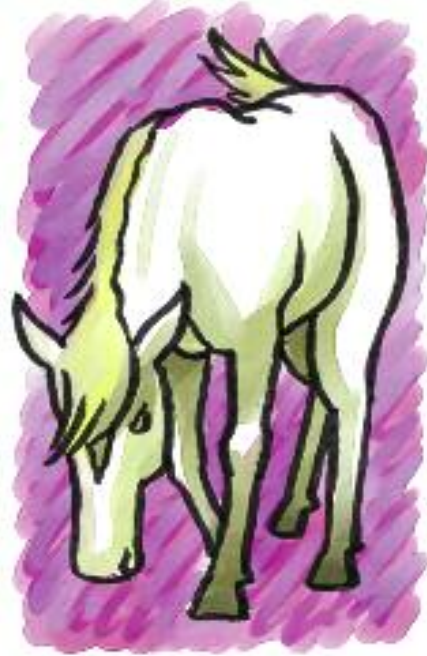
Everybody gasped at the amazing offer, but the cautious innkeeper asked, "And how many peas must I give you, my dear sir?"

"Not many. For the first nail, I want only one pea."

"One!" The happy innkeeper clapped his hands.

"For the second nail, two peas."

"Two peas!" whispered the people as they chuckled.



Continued on next page



FACT SHEET

The Price of Peas (continued)



“For the third nail, four peas,” the stranger calmly went on. “For the fourth, eight peas, and for the fifth, sixteen... And so on, for every following nail twice as many.”

The people couldn't keep quiet any longer and roared with laughter. “This freak will give away his horse for a handful of peas!” they cried. “He must be crazy!”

The innkeeper was at a loss with surprise, when one of the men shouted at him: “Why are you silent, innkeeper? If you can't make up your mind, I'll buy the horse!”

The innkeeper stopped hesitating.

“A handful of peas more or a handful less, who cares!” he exclaimed. “Let's shake hands and my guests will witness that this is a freely-made deal. But you watch out!” He pointed his finger at the stranger and said, “Don't back out in the end!”

They shook hands in front of all the witnesses. The guests closed the deal giving their word of honour, and the happy innkeeper took out a keg of his best pilsner. When they emptied the keg, he walked to the stranger, smiled and said, “Wasn't that stupid of you, my dear sir? Let's check how many peas I owe you for the beautiful white horse.”

“Give me a piece of chalk,” the stranger answered, ignoring the innkeeper's rude comment. He pushed his glass aside and started writing on the table: 1, 2, 4, 8, 16, 32, 64...

“Look, 64 peas for the seventh nail,” laughed the men.

But the stranger didn't seem to hear. He went on writing: 128, 256, 512, 1,024, 2,048, 4,096, 8,192, 16,384, 32,768 ... He got as far as the sixteenth nail when the innkeeper drew a long face. At the twentieth nail he was as white as sheet, and when they reached the thirty-second one they had to join five tables in a line, because the number was as long as a snake and three tables couldn't hold it.

“Wow!” exclaimed one guest. “If the horse had six legs, we'd have to open the door and write the numbers all the way to the town hall!”

But the joke wasn't funny for the innkeeper. There he sat, more dead than alive with astonishment. Finishing his calculations, the stranger turned to him with a kind smile.

“My dear friend, could I buy two hundred sacks from you to take away my peas? I think ten carts can take it to the port on ten trips.” The innkeeper jumped to his feet.

“This isn't fair!” he shouted. “You've made a fool of me! I don't agree with your conditions!”

“It's too late!” The stranger answered back calmly and the guests confirmed that it was a freely-made deal. The innkeeper collapsed on the table, powerless, covering his face in his hands while the guests laughed.

