LESSON MAKER PRO

Population and Planet

Use population data to explain environmental impacts.

HIGH SCHOOL · ES.11.b

ES.11.b "Construct explanations of the types of environmental impacts produced by human populations in each stage of the demographic transition model."

NAME _____ DATE _____

CHANGE AND IMPACT

For one year without migration, population change = births - deaths. A demographic transition stage describes a pattern of births and deaths, but population change alone does not tell you the size of an environmental impact. Also consider how people use land, water, energy, and materials.

WORKED EXAMPLE

A coastal community is in stage 2. It is clearing wetlands to build homes. Find its annual population change and explain one possible environmental impact.

COASTAL COMMUNITY, ONE YEAR

Stage	Residents	Births	Deaths
2	8,000	320	80

1. Use population change = births - deaths.
2. Calculate 320 - 80 = 240.
3. Connect the increase and new construction to an environmental impact.

Answer: Increase of 240 people; clearing wetlands for homes could destroy wildlife habitat.

PRACTICE 6 problems

1 This rural region relies on wood for cooking. Find its annual population change. Explain one possible environmental impact of its fuel use.

RURAL REGION, ONE YEAR

Stage	Residents	Births	Deaths
1	12,000	480	450

ANSWER _____

2 This growing city builds roads across farmland. Find its annual population change. Explain one possible environmental impact of the new roads.

GROWING CITY, ONE YEAR

Stage	Residents	Births	Deaths
2	20,000	800	200

ANSWER _____

3 This town draws water from a river in a drought-prone area. Find its annual population change. Explain one possible environmental impact if water use per person stays the same.

RIVER TOWN, ONE YEAR

Stage	Residents	Births	Deaths
3	30,000	450	180

ANSWER _____

4 Residents of this city use air conditioning powered by fossil fuels. Find its annual population change. Explain why the city can still affect the environment.

AIR-CONDITIONED CITY, ONE YEAR

Stage	Residents	Births	Deaths
4	40,000	360	360

ANSWER _____

5 Residents of this city discard many electronics each year. Find its annual population change. Explain why discarded electronics can remain an environmental concern.

ELECTRONICS-USING CITY, ONE YEAR

Stage	Residents	Births	Deaths
5	50,000	250	400

ANSWER _____

6 This town sends trash to an already crowded landfill. Find its annual population change. Explain one possible environmental impact if trash per person stays the same.

LANDFILL TOWN, ONE YEAR

Stage	Residents	Births	Deaths
3	25,000	375	125

ANSWER _____

APPLY IT Show your work

1 A stage 2 city is planning bus service near a new high school. Assume no migration and that each additional resident takes 2 bus rides per day. Use this year's population change to estimate how many additional daily rides the city should plan for. Explain one environmental benefit if those rides replace car trips.

BUS-PLANNING CITY, ONE YEAR

Stage	Residents	Births	Deaths
2	15,000	600	150

ANSWER _____

2 A stage 4 city's student council is studying trash sent to a landfill. Each resident produces an average of 2 kg of trash per day. Find the city's total daily trash and explain why a stable population can still have a large environmental impact.

LANDFILL STUDY, ONE YEAR

Stage	Residents	Births	Deaths
4	60,000	480	480

ANSWER _____

CHALLENGE One step up

A region is moving from stage 2 to stage 3. Assume no migration and water use of 10 L per resident per day in both years. Find the annual population change in each stage and the total daily water use shown for each stage. Explain how water pressure can rise even though annual population growth slows.

REGION AT TWO STAGES

Stage	Residents	Births in one year	Deaths in one year
2	20,000	700	200
3	30,000	600	300

WORK SPACE AND ANSWER

Population and Planet

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	This rural region relies on wood for cooking. Find its annual population change. Explain one possible environmental impact of its fuel use.	**Increase of 30 people; collecting wood for fuel could reduce forest cover.**
2	This growing city builds roads across farmland. Find its annual population change. Explain one possible environmental impact of the new roads.	**Increase of 600 people; new roads could replace farmland and wildlife habitat.**
3	This town draws water from a river in a drought-prone area. Find its annual population change. Explain one possible environmental impact if water use per person stays the same.	**Increase of 270 people; total water demand could rise, leaving less river water for aquatic life.**
4	Residents of this city use air conditioning powered by fossil fuels. Find its annual population change. Explain why the city can still affect the environment.	**No change, or 0 people; fossil-fuel electricity use can still produce greenhouse gas emissions.**
5	Residents of this city discard many electronics each year. Find its annual population change. Explain why discarded electronics can remain an environmental concern.	**Decrease of 150 people; residents can still produce substantial electronic waste even as the population shrinks.**
6	This town sends trash to an already crowded landfill. Find its annual population change. Explain one possible environmental impact if trash per person stays the same.	**Increase of 250 people; more total trash could require additional landfill space.**

PART 2 · APPLY IT

1. **900 additional rides per day; replacing car trips with bus rides could reduce emissions.** The population increases by 600 - 150 = 450 people. At 2 rides per additional resident, that is 450 × 2 = 900 additional rides per day.
2. **120,000 kg of trash per day; the city's many residents produce substantial waste even though its population is stable.** Births equal deaths, so the population change is 0. Multiply 60,000 residents by 2 kg per resident per day to get 120,000 kg per day.

CHALLENGE

Stage 2: increase of 500 people and 200,000 L of water per day. Stage 3: increase of 300 people and 300,000 L of water per day. Growth slows, but the larger stage 3 population uses more water in total at the same rate per person.

Accept equivalent impacts that follow from each setting. A decrease of 150 may also be written as a population change of -150.