# AP® ENVIRONMENTAL SCIENCE
2008 SCORING GUIDELINES

Question 4

(a) Create a graph of the data from table 1 below on the axes provided.

(Two points can be earned: 1 point for correctly plotting the data [no more than one data point may be misaligned], and 1 point for correctly setting up BOTH axes with a consistent scale interval.)

Notes: Bar graphs are acceptable. Students need not connect the data points. Award no credit for flipped axes.
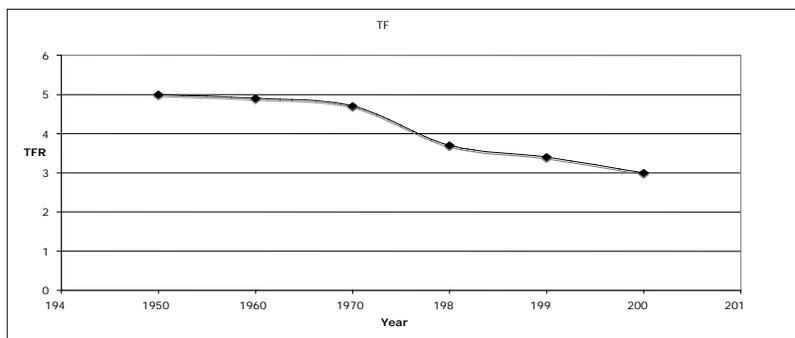
(b) Identify and discuss TWO of the causes for the trend in the worldwide TFR that you graphed in part (a).

(Three points can be earned: 1 point for each valid cause, and 1 point for discussion of a valid cause—cause and discussion MUST BE LINKED. Two points maximum may be earned for causes; 1 point maximum for discussion. A single discussion point may be earned by itself.)

Cause	Discussion
Increased/improved family planning	• Fewer pregnancies/control of fertility/choice in number of children born
Increased education for women (stay in school longer)/improved social status of women	• Delay having children/choosing to have fewer children
More women enter the workforce	• Delay having children
Reduced need for children in workforce/on farm	• More industrialization/less agriculture/increased urbanization
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Cause	Discussion
Improved health care (lower infant mortality)	• More children will survive to adulthood
People marry later	• Childbearing delayed/fewer children
Changing cultural values	• Socially acceptable to have fewer children
Government policies that restrict number of children allowed per woman	• Countries are facing overpopulation issues
Increased cost of raising children	• Standard of living and education costs have increased
Increased urbanization	• Lessens living space for more children

(c) Consider the data in table 2 above. Identify and discuss TWO economic or societal factors that account for the difference between the TFR of Kenya and that of the United States.

(Four points can be earned: 1 point for each correct factor, and 1 point for each correct discussion of the factor. Discussion points may be earned without an identified factor. However, if factors are given, discussion and factors MUST BE LINKED.)

Factors (Societal or Economic)	Discussion
Kenya has a much higher infant mortality rate.	• There is a shortage of prenatal and pediatric care due to poverty in Kenya. • Kenyans have more children to ensure that some survive.
Kenya is more agricultural (second stage of demographic transition).	• In Kenya more children are needed to help farm.
Kenya is a less-developed country (lower per-capita income)/poorer/nonindustrialized.	• Children provide income to the family. • Contraceptives are not affordable.

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2008 SCORING GUIDELINES

Question 4 (continued)

Factors (Societal or Economic)	Discussion
Women in Kenya lack education and job opportunities.	• Women in Kenya have fewer career/work choices so they have children at an earlier age than women in the United States do. • Women in Kenya do not delay childbearing, in contrast with women in the United States who often delay starting a family due to the high cost of childcare.
There is no pension system to support people as they age in Kenya.	• More children are needed to support parents in old age.
There is less education about family planning in Kenya.	• There is less ability to control fertility.
Cultural values favor larger families in Kenya.	• More children mean greater social status.
Women in Kenya have a low social status /marry at an earlier age.	• Women have little or no choice/control of their fertility; they have more years of childbearing.
There is a preference for male children in Kenya.	• People have more children to get as many sons as possible, because sons will continue to support the family.
The cost of raising a child in the United States is much higher than in Kenya.	• People in the United States choose to have smaller families.
Abortion is illegal in Kenya.	• Results in more births.
Religious values in Kenya prohibit contraception/abortion.	• Results in more births.

(d) Describe TWO human activities related to the rapidly growing world population that are having an impact on Earth's biodiversity.

(Two points can be earned: 1 point for each accurate description. The student must link a specific activity to a specific impact on biodiversity.)

- Deforestation for the following purpose destroys habitats and reduces biodiversity (may use two activities for 1 point each):
  - farming (i.e., creation of monocultures);
  - housing/development (i.e., urbanization);
  - fuel (wood);
  - fossil-fuel recovery (mining and drilling).
- Fossil-fuel burning releases carbon dioxide resulting in climate change, altering global/regional/local temperature and precipitation patterns leading to reduction of biodiversity within ecosystems where organisms have very specific climatic requirements for survival.
- Pollution (student must identify specific contaminants linked to human activity that have a negative impact on species and biodiversity).
- Intensive fish farming spreads parasites and disease to native species, reducing biodiversity.
- Diversion of freshwater for agricultural, municipal, and industrial use reduces water supply for biodiverse freshwater ecosystems.
- Damming of rivers makes it difficult for species that breed/spawn upstream (e.g., salmon) to reproduce, reducing biodiversity.
- Overfishing leads to small, unsustainable populations of fish species, reducing biodiversity.
- Building landfills for increased amounts of trash destroys habitat, reducing biodiversity.
- Poaching of wild animals (e.g., bush meat) due to increased human population and demand for food leads to dwindling populations that may not be sustainable.
- Using genetically modified crops to increase yield of food crops can negatively impact other species (e.g., monarch butterfly larvae can be killed when they ingest toxin-containing genetically modified corn pollen that has settled on milkweed leaves near genetically modified corn fields).
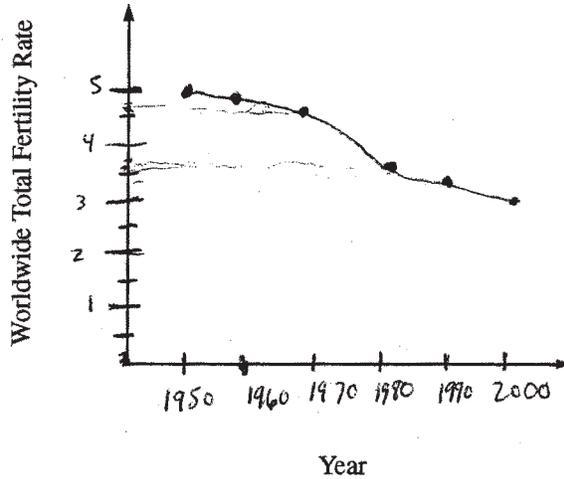
4. Answer the following regarding world human population.

(a) Create a graph of the data from table 1 below on the axes provided.

Table 1:
Worldwide
Total Fertility
Rate (TFR)

Year	TFR
1950	5.0
1960	4.9
1970	4.7
1980	3.7
1990	3.4
2000	3.0

Year

(b) Identify and discuss TWO of the causes for the trend in the worldwide TFR that you graphed in part (a).

Table 2: Population Data for Selected Nations (2005)

Country	TFR	Crude Birth Rate*	Crude Death Rate*	Infant Mortality Rate*	Per Capita Income (U.S. dollars)
China	1.6	12	7	27	6,500
Japan	1.3	9	8	2.8	31,400
Kenya	5.9	43	19	100	1,000
United States	2.0	14	8	6.7	42,000

* rates are per thousand per year

(c) Consider the data in table 2 above. Identify and discuss TWO economic or societal factors that account for the difference between the TFR of Kenya and that of the United States.

(d) Describe TWO human activities related to the rapidly growing world population that are having an impact on Earth's biodiversity.

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B) One cause for the decline in the worldwide TFR is increasing education and rights for women. More education for women and increasing rights for women has been shown to decrease the number of children a woman has. As a women's education increases, her fertility decreases. Also the increasing widespread use and knowledge of contraceptives decreases the amount of babies a couple will have. As more people are also aware & informed on the subject of contraception, they will have less babies and the fertility rate, or the amount of children born per woman, will decline.

C) The TFR of Kenya is higher than the United States' because the per capita income is lower in Kenya. People who make less money usually have more children to help the family's economic situation. More kids means more work that can be done. Also the infant mortality rate is very high in Kenya, so couples have more babies in order to account for the high rate. people in Kenya know their child has a very high chance to die and thus they compensate by having more children. Also religious or societal pressures may dictate that a couple have more babies.

D) Humans are clearing more and more land for both agriculture and livestock to feed a growing population. This destroys forests and thus habitats, decreasing biodiversity. Also as the population grows rapidly, urbanization and urban sprawl destroys both habitats and food sources, which destroys biodiversity. The increasing use of oil, and gasoline, natural gas, and coal (and biomass) for energy sources release pollutants that can cause acid rain and global warming both contributing to species and habitat loss, and invariably, biodiversity will decrease
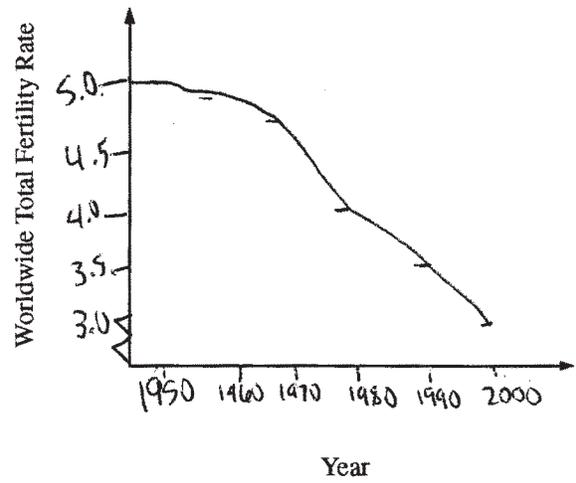
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I-4B₂

b) Total fertility rate has decreased because everything is a lot more expensive now than in the 1950s, so people cannot afford as many children. And there has been some laws, like in China, forbidding people to have more than one child.

c) Two reasons why Kenya has a much higher total fertility rate than the United States are that Kenya's infant mortality rate and death rate is much higher than the U.S so, the people there have more babies so some will survive. Another reason is that the people in Kenya make about $1,000 a year compared to the United States $42,000 per year. So the people in Kenya probably can't afford birth controls and they most likely aren't very educated, all making them more likely to have more children than educated, wealthy people.

D) Two human activities related to the rapidly growing world population would be modern medicine and health care and education. With modern medicine and immunizations people are living longer than ever. With growing education people know how to take care of themselves better and are able to live longer because of it. An increase in human population growth increases green house gas emissions causing things like global warming and more intense natural disasters, disrupting specialist species and decreasing biodiversity.
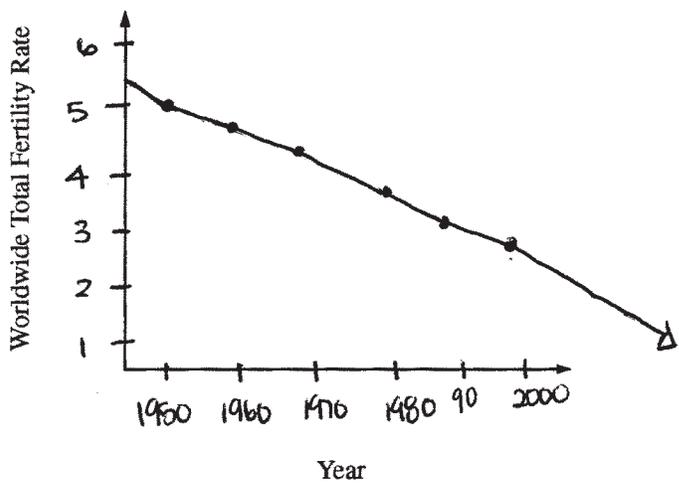
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(d) Describe TWO human activities related to the rapidly growing world population that are having an impact on Earth's biodiversity.

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I-4C₂

b. Two of the causes for the trend in the worldwide TRF that I graphed in part (a) could be that the per capita income of the world is not high enough for it or that the population is getting too crowded.

c. An economic factor could be that the U.S. is much more developed than Kenya is. Also, the U.S. has a much larger per capita income than Kenya. With that being said, the U.S. doesn't need a high total fertility rate because the U.S. is stable and can continue the way it is unlike Kenya where they need people to help make the country more developed.

d. Two human activities that are related to the rapidly growing world population that is having an impact on Earth's biodiversity are people wanting big families leading to producing more kids and more kids increases the world population and also impacts the Earths biodiversity because the families

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that want big families are in the developed Countries making that place more diverse than other places.

AP® ENVIRONMENTAL SCIENCE
2008 SCORING COMMENTARY

Question 4

Overview

The aim of this question was to assess students' knowledge of contemporary issues related to human population growth and its impact on the environment. Students were required to graph and analyze Total Fertility Rate (TFR) data, which should have shown a decreasing trend, and then to give two causes for this decrease over the past fifty years. Students were then asked to compare the TFR for a developed country (the United States) and a less-developed country (Kenya) and to discuss two factors that would account for the difference. Lastly, students were required to relate two effects of rapid human population growth on the biodiversity of the Earth.

Sample: I-4A
Score: 10

Part (a): 1 point was earned for correctly setting up both axes, but the second and third data points are misaligned.

Part (b): 3 points were earned. The student earned 1 point for identifying "increasing education and rights for women" and 1 discussion point for stating a decrease in "the number of children" per woman. Another point was earned for identifying "increasing widespread use and knowledge of contraceptives." The linked discussion did not earn a point since the maximum score is 3 points.

Part (c): 4 points were earned. The student earned 1 point for correctly comparing the per capita income of the United States and Kenya and 1 discussion point for the link to needing children "to help the family's economic situation." One point was earned for correctly comparing infant mortality rates in the United States and Kenya, and 1 linked discussion point was earned for needing to "have more babies" to ensure that some survive. The identification of "religious or societal pressures" did not earn a point since it is the third factor, and the maximum number of points was already earned.

Part (d): 2 points were earned. The student earned 1 point for describing the activity of "clearing more and more land for both agriculture and livestock" linked to the destruction of "forests and thus habitats," and 1 point for describing the activity of "urbanization and urban sprawl" linked to destroying habitats. A third activity did not earn additional points because the maximum number of points was already earned.

Sample: I-4B
Score: 7

Part (a): 1 point was earned for correctly setting up both axes, but the data points are not plotted clearly or correctly.

Part (b): 2 points were earned. The student earned 1 point for identifying the cause of "everything is a lot more expensive now . . . so people cannot afford as many children," and 1 point for identifying a second cause of China "forbidding people to have more than one child."

Part (c): 4 points were earned. The student earned 1 point for correctly comparing the infant mortality rates in Kenya and the United States and 1 linked discussion point for stating that "people there have more babies so some will survive." Another point was earned for comparing per capita income in Kenya and the United States, and 1 linked discussion point was earned for stating that "the people in Kenya probably can't afford birth controls."

Part (d): No points were earned. The student gives a list of two activities ("medicine" and "education") that do not correctly address the question. At the end the student correctly refers to "green house gas emissions" and links them to "specialist species," but because this is the third human activity the student lists, it did not earn a point.

Sample: I-4C
Score: 2

Part (a): 1 point was earned. The student correctly sets up both axes but does not correctly plot the data points 1970, 1980, 1990, or 2000, which causes the graph to show a straight line. Additionally, the student extrapolates beyond the data given.

Part (b): No points were earned. The student's identification of "per capita income of the world is not high enough" is not a correct cause, and the statement that "population is getting too crowded" does not specify any region or country.

Part (c): 1 point was earned. The student identifies the factor "that the U.S. is much more developed than Kenya." The second factor—"the U.S. has a much larger per capita income than Kenya"—is too similar to the first factor to earn a point.

Part (d): No points were earned. The student does not describe a human activity that impacts biodiversity.