AP ENVIRONMENTAL SCIENCE • EXERCISE SHEET

3.5 Population Growth and Resource Availability

Name: _____ Class: _____ Date: _____ **Total: 11 marks**

KEY WORDS logistic 逻辑斯蒂增长 • carrying capacity 环境容纳量

Objective

Build the skills to answer exam questions on **population growth and resource availability**.

You must be able to:

- use the **growth-rate** formula (births − deaths, plus migration)
- calculate a percent growth rate
- link resources to exponential vs logistic growth

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

Growth rate

A population's growth depends on births, deaths, and migration:

$$\text{growth rate} = (\text{births} + \text{immigration}) - (\text{deaths} + \text{emigration}).$$

Percent growth rate

As a percentage of the population:

$$\%\ \text{growth} = \frac{\text{births} - \text{deaths}}{\text{population}} \times 100.$$

(For humans, often expressed per 1000 people.)

A worked calculation

A country of 1000 has 30 births and 10 deaths in a year: growth $= 30 - 10 = 20$; percent $= \dfrac{20}{1000} \times 100 = 2\%$.

Resources shape the curve

With abundant resources, growth is **exponential** (J-curve); as resources become limited, growth slows to **logistic** (S-curve), leveling at carrying capacity.

2 Practice

Now apply the methods above.

2.1 Write the percent growth-rate formula (births and deaths). [1]

2.2 A population of 2000 has 60 births and 20 deaths. Find the percent growth rate. [2]

2.3 What shape is growth with unlimited resources? [1]

3 Exam-style questions

3.1 With limited resources, population growth follows a [1]

- **A** J-shaped (exponential) curve
- **B** S-shaped (logistic) curve
- **C** straight line
- **D** decreasing curve

3.2 A town of 5000 has 100 births, 40 deaths, 30 immigrants, and 10 emigrants in a year.

(a) Find the net population change. [2]

(b) Find the percent growth rate. [2]

3.3 Explain why a population's growth slows as it approaches its carrying capacity. [2]

Solutions

2.1 $\% = \dfrac{\text{births} - \text{deaths}}{\text{population}} \times 100$.

2.2 $\dfrac{60 - 20}{2000} \times 100 = 2\%$.

2.3 J-shaped (exponential).

3.1 **B** — an S-shaped (logistic) curve.

3.2 (a) $(100 + 30) - (40 + 10) = 80$. (b) $\dfrac{80}{5000} \times 100 = 1.6\%$.

3.3 As the population nears carrying capacity, resources become limited and competition rises, so births fall and deaths rise, slowing growth.