AP ENVIRONMENTAL SCIENCE • EXERCISE SHEET

1.8 Primary Productivity

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

Objective

Build the skills to answer exam questions on **primary productivity**.

You must be able to:

- define **gross** 总 and **net primary productivity** 净初级生产力 (GPP, NPP)
- use NPP = GPP − respiration
- identify the most productive ecosystems

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.

Productivity

Primary productivity is the rate at which producers capture energy (usually by photosynthesis).

- **Gross primary productivity (GPP)** —the **total** energy captured.
- **Net primary productivity (NPP)** —what's **left** after the producers' own respiration.

The equation

$$\text{NPP} = \text{GPP} - \text{respiration}.$$

NPP is the energy actually **available** to consumers.

A worked calculation

If GPP = 1000 kcal/m^2/yr and respiration = 400, then NPP = 1000 − 400 = 600 kcal/m^2/yr.

Most productive ecosystems

Warm, wet, sunlit systems are most productive: **tropical rainforests**, **estuaries**, and **coral reefs** have high NPP; deserts and open ocean have low NPP.

2 Practice

Now apply the methods above.

2.1 Write the equation relating NPP, GPP, and respiration. [1]

2.2 For GPP = 800 and respiration = 300, find NPP. [2]

2.3 Name one highly productive ecosystem. [1]

3 Exam-style questions

3.1 Net primary productivity is the energy [1]

- **A** captured before respiration
- **B** available to consumers after producer respiration
- **C** lost as heat only
- **D** stored in rocks

3.2 A grassland has GPP = 1200 kcal/m^2/yr and respiration = 500.

(a) Calculate the NPP. [2]

(b) Explain what NPP represents for the ecosystem. [1]

3.3 Explain why a tropical rainforest has higher NPP than a desert. [2]

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **1.8 Primary Productivity** lesson on the **Learn** page;
- read the **Primary Productivity** section of the AP Environmental Science handout on the **Know** page.

Solutions

2.1 NPP = GPP − respiration.

2.2 NPP = 800 − 300 = 500.

2.3 Any one: tropical rainforest, estuary, coral reef, wetland.

3.1 B —available to consumers after producer respiration.

3.2 (a) NPP = 1200 − 500 = 700 kcal/m^2/yr. (b) The energy available to the consumers (the rest of the food web).

3.3 A rainforest has abundant warmth, water, and sunlight, so producers photosynthesize much more than in a dry, resource-poor desert, giving higher NPP.