

1.8 Primary Productivity

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

KEY WORDS primary productivity 初级生产力 • net primary productivity 净初级生产力
 • producers 生产者 • gross 总 • ecosystem 生态系统

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

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

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

■ A worked calculation

If $GPP = 1000 \text{ kcal/m}^2/\text{yr}$ and $\text{respiration} = 400$, then $NPP = 1000 - 400 = 600 \text{ kcal/m}^2/\text{yr}$.

■ 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 $\text{respiration} = 300$, 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 $GPP = 1200 \text{ kcal/m}^2/\text{yr}$ and $\text{respiration} = 500$.

(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]

Solutions

2.1 $\text{NPP} = \text{GPP} - \text{respiration}$.

2.2 $\text{NPP} = 800 - 300 = 500$.

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

3.1 B — available to consumers after producer respiration.

3.2 (a) $\text{NPP} = 1200 - 500 = 700 \text{ kcal/m}^2/\text{yr}$. (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.