AP BIOLOGY • EXERCISE SHEET

8.2 Energy Flow Through Ecosystems

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

Objective

Build the skills to answer exam questions on **energy flow through ecosystems**.

You must be able to:

- describe **trophic levels** 营养级 and the **10% rule**
- draw/read an **energy pyramid** 能量金字塔
- explain why food chains are short

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.

Trophic levels

Energy flows from **producers** (make their own food) to **primary consumers** (herbivores), to **secondary** and **tertiary consumers** (carnivores). Each is a **trophic level**.

The 10% rule

Only about **10%** of the energy at one trophic level passes to the next. The other ~90% is lost as **heat** and used for life processes.

A worked calculation

If producers store 10 000 kJ: primary consumers get ~1000 kJ; secondary ~100 kJ; tertiary ~10 kJ.

Why food chains are short

Because so much energy is lost at each step, there is **too little** energy left to support many levels —so food chains rarely exceed 4-5 links.

2 Practice

Now apply the methods above.

2.1 What percentage of energy passes to the next trophic level? [1]

2.2 Where does the ”lost” energy go? [1]

2.3 If producers have 8000 kJ, how much reaches primary consumers? [1]

3 Exam-style questions

3.1 Roughly how much energy passes from one trophic level to the next? [1]

- **A** 1%
- **B** 10%
- **C** 50%
- **D** 90%

3.2 An ecosystem's producers store 20 000 kJ.

(a) Estimate the energy reaching the secondary consumers. [3]

(b) Explain why so little energy reaches the top level. [1]

3.3 Explain why food chains rarely have more than four or five trophic levels. [2]

4 Go further

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

- work through the **8.2 Energy Flow Through Ecosystems** lesson on the **Learn** page;
- read the **Energy Flow Through Ecosystems** section of the AP Biology handout on the **Know** page.

Solutions

2.1 About 10%.

2.2 Lost as heat (and used in life processes).

2.3 About 800 kJ.

3.1 B —10%.

3.2 (a) Primary consumers: 2000 kJ; secondary consumers: 200 kJ. (b) About 90% of the energy is lost at each transfer, so very little remains after several steps.

3.3 So much energy is lost (~90%) at each level that after a few levels there is too little left to support another, limiting chain length.