5.1 Food production

Name: _____ Class: _____ Date: _____ **Total: 21 marks**

Objective

Build the skills to answer exam questions on **food production** : crop yields in glasshouses, fertilisers, pest control, using microorganisms to make bread and yoghurt, industrial fermenters and fish farming.

You must be able to:

- explain how glasshouses increase crop yields
- compare pesticides and biological control
- describe how yeast and Lactobacillus are used to make food
- explain how conditions in a fermenter are controlled

1 Key knowledge and worked examples

Food production

idea	rule
glasshouses	control temperature, light and carbon dioxide, so photosynthesis is not limited
fertilisers	replace mineral ions such as nitrate, phosphate and potassium in the soil
pest control	pesticides kill pests with chemicals; biological control uses a predator or parasite of the pest
microorganisms in food	yeast in bread making; *Lactobacillus* in yoghurt making
percentage increase	(new − old) ÷ old ×100
profit	extra income − extra cost

Worked example 1: percentage increase. A heater raises the yield of a glasshouse from 40 kg to 52 kg a week. Find the increase.

1. Known: old 40; new 52.
2. Rule: change ÷ old ×100.
3. Numbers: $12 \div 40 \times 100$.
4. Result: 30%.

Worked example 2: profit. The heater costs \$30 a week. The extra 12 kg sells at \$4 per kg. Is it worth it?

1. Known: cost \$30; income 12×4.
2. Rule: profit = income − cost.
3. Numbers: $48 - 30$.
4. Result: **\$18 profit a week, so yes**.

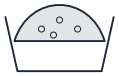
Answer shapes: for a fermenter, say what is controlled and why it matters to the microorganisms.

2 Practice

2.1 Name the microorganism used to make yoghurt, and the substance it makes that thickens the milk. [2]



2.2 Explain why bread dough rises when yeast is added. [2]



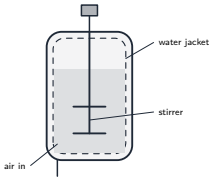
3 Exam-style questions

3.1 Compare the use of pesticides and biological control to protect a crop. [3]



3.2 A company grows a microorganism in an industrial fermenter to make a food protein. The yield at different temperatures is shown.

(a) Calculate the percentage fall in yield from 35 °C to 40 °C. [2]



temperature / °C	yield / g dm^{-3}
25	2.1
30	3.4
35	4.0
40	2.5

(b) Explain why the yield is lower at 40 °C than at 35 °C. [3]

(c) Explain why the fermenter has a water jacket and a stirrer. [3]

(d) Explain why the fermenter must be kept free from other microorganisms, and describe how this is done and what other conditions are controlled. [6]

exercises.lol exercises.com.cn

Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

- *Lactobacillus*
- lactic acid

2.2

- yeast respires (ferments) the sugar in the dough
- it gives off carbon dioxide, which is trapped as bubbles and makes the dough rise

3.1

- pesticides act quickly and kill most pests, but may also kill useful insects
- pesticides can build up in food chains, and pests can become resistant
- biological control is slower and does not remove all pests, but no chemicals are left, and the control animal may itself become a pest

3.2

(a) $(4.0 - 2.5) \div 4.0 \times 100 = \mathbf{37.5}\%$

(b) 35 °C is near the optimum for the microorganism's enzymes; at 40 °C the enzymes begin to denature; so the microorganisms respire and grow more slowly, giving less protein

(c) the microorganisms respire and release heat; the water jacket removes heat and keeps the temperature at the optimum; the stirrer mixes nutrients, oxygen and heat evenly

(d) points to include:

- other microorganisms would compete for nutrients and lower the yield (An)
- they could also make toxins or spoil the product (An)
- clean and sterilise the fermenter with steam before use (aseptic conditions) (K)
- sterilise the nutrients and filter the air going in (K)
- other conditions: pH is kept at the optimum with probes and adding acid or alkali (K)
- oxygen is supplied for aerobic respiration, and nutrients such as glucose are added (K)

Levels: **5–6** a full, logical answer with correct biology and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.

exercises.lol exercises.com.cn