

Exercise walk-through

Regulation of Cell Cycle ■ 4.6

eXercise

You must be able to

- describe **checkpoints** 检查点 that control the cycle
- explain the role of regulatory proteins
- link loss of control to **cancer** 癌症

Method — Checkpoints

The cell cycle has **checkpoints** (mainly G1, G2, and M) where the cell verifies conditions are right — enough resources, DNA copied correctly, chromosomes attached — before proceeding.

Method — Regulatory proteins

Proteins (like cyclins and their kinases) control passage through checkpoints. They act as the “go/stop” signals for division.

Method — The G1 checkpoint

At the **G1 checkpoint** the cell decides whether to divide. If conditions are poor or DNA is damaged, it pauses or exits the cycle to repair or wait.

Method — Loss of control → cancer

If checkpoints fail (e.g. mutated regulatory genes), cells may divide uncontrollably, forming a tumor — the basis of **cancer**.

Practice 2.1 ■ 1 mark

What do cell-cycle checkpoints do?

Solution 2.1

Method: Checkpoints

Worked steps

They check that conditions are correct before the cell proceeds to the next phase

B1.

Practice 2.2 ■ 1 mark

At which checkpoint does the cell decide whether to divide?

Solution 2.2

Method: The G1 checkpoint

Worked steps

The G1 checkpoint **B1**.

Practice 2.3 ■ 1 mark

What can result from a loss of cell-cycle control?

Solution 2.3

Worked steps

Cancer (uncontrolled cell division) **B1**.

Exam-style 3.1 ■ 1 mark

Uncontrolled cell division caused by failed checkpoints can lead to

A apoptosis

B cancer

C homeostasis

D meiosis

Solution 3.1

A apoptosis

B cancer



C homeostasis

D meiosis

Worked steps

B — cancer.

Exam-style 3.2 ■ 1 mark

A cell has DNA damage at the G2 checkpoint.

- (a) State what a healthy checkpoint should do.
- (b) Explain what could happen if the checkpoint fails.

Solution 3.2

Method: The G1 checkpoint

Worked steps

(a) It should pause the cycle to repair the DNA (or prevent division) **B1**. (b) If it fails, the cell divides with damaged DNA, passing the errors on and possibly leading to uncontrolled division (cancer) **M1 A1**.

Exam-style 3.3 ■ 2 marks

Explain why checkpoints are important for producing healthy daughter cells.

Solution 3.3

Method: Loss of control → cancer

Worked steps

Checkpoints ensure the DNA is copied correctly and conditions are right before division, so each daughter cell receives a complete, accurate set of chromosomes

M1 **A1**.