AP BIOLOGY • EXERCISE SHEET

4.6 Regulation of Cell Cycle

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

Objective

Build the skills to answer exam questions on the **regulation of the cell cycle**.

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

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.

■ 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.

■ Regulatory proteins

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

■ 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.

■ Loss of control → cancer

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

2 Practice

Now apply the methods above.

2.1 What do cell-cycle checkpoints do? [1]

2.2 At which checkpoint does the cell decide whether to divide? [1]

2.3 What can result from a loss of cell-cycle control? [1]

3 Exam-style questions

3.1 Uncontrolled cell division caused by failed checkpoints can lead to [1]

- **A** apoptosis
- **B** cancer
- **C** homeostasis
- **D** meiosis

3.2 A cell has DNA damage at the G2 checkpoint.

(a) State what a healthy checkpoint should do. [1]

(b) Explain what could happen if the checkpoint fails. [2]

3.3 Explain why checkpoints are important for producing healthy daughter cells. [2]

4 Go further

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

- work through the **4.6 Regulation of Cell Cycle** lesson on the **Learn** page;
- read the **Regulation of Cell Cycle** section of the AP Biology handout on the **Know** page.

Solutions

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

2.2 The G1 checkpoint.

2.3 Cancer (uncontrolled cell division).

3.1 B —cancer.

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

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