10.1 Cell injury, adaptation and death

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS necrosis • metaplasia

Objective

Match injury stage and death pattern to mechanism.

1 Key knowledge and worked examples

■ **Reversible to irreversible**

ATP ↓ → Na^+/K^+ pump fails → swelling (reversible); membrane damage with Ca^{2+} influx is the point of no return ✓. Adaptations: atrophy, hypertrophy, hyperplasia, metaplasia.

■ **Worked example: patterns name causes**

Coagulative (ischaemia, solid organs) · liquefactive (brain, abscess) · caseous (TB) · fat (pancreas) · fibrinoid (vessels) ✓. Apoptosis: regulated, quiet, single cells.

2 Practice

2.1 Name the ion whose influx marks irreversibility. [3]

2.2 Which necrosis pattern belongs to TB granulomas? [3]

2.3 Bronchial lining turning squamous under smoke – name the adaptation. [3]

3 Exam-style questions

3.1 A fictional ischaemic tubule experiment: 20 minutes of hypoxia then reperfused, versus 4 hours then reperfused.

Explain the first outcome (ATP-low swelling, pumps resume, recovery) and the second (membrane damage, Ca^{2+} entry, enzyme leak – LDH/ALT rise readable from blood). State which necrosis pattern a solid-organ infarct shows and why (slow proteolysis keeps outlines – coagulative) ✓. [8]

3.2 Four fictional scenarios: bed rest (disuse), hypertension (cardiac), pregnancy (uterine), smoking (bronchus).

Assign atrophy, hypertrophy, hyperplasia or metaplasia with the defining distinction for each (smaller cells / bigger cells / more cells / new lining type) ✓. [7]

Solutions

2.1

- Ca^{2+} – its influx with membrane damage is the point of no return ✓.

2.2

- Caseous necrosis ✓.

2.3

- Metaplasia – one mature lining type swapped for a hardier one ✓.

3.1

- At 20 min: pump failure only – swelling resolves on reperfusion ✓.
- At 4 h: membranes leak, Ca^{2+} enters, mitochondria die → necrosis ✓.
- Cytosolic enzymes (LDH/ALT) leak into blood – the cell's biography readable ✓.
- Solid-organ infarct = coagulative: proteolysis is slow, outlines persist ✓.

3.2

- Bed rest → atrophy (smaller cells); cardiac hypertension → hypertrophy (bigger cells) ✓.
- Pregnancy uterus → hyperplasia (more cells, plus hypertrophy) ✓.
- Smoking bronchus → metaplasia (squamous replaces columnar) ✓.
- Distinguish by what changes: size, number, or type ✓.