

5.2 Excitable cells and muscle

Name: _____ Class: _____ Date: _____ **Total: 23 marks**

KEY WORDS refractory period

Objective

Compute rate ceilings from refractory periods and trace spike-to-force coupling.

1 Key knowledge and worked examples

■ **The sentence**

Rest -70 mV ; Na^+ upstroke $+30\text{ mV}$ (positive feedback); K^+ repolarisation; refractory $\sim 1\text{ ms}$ (nerve) $\rightarrow$ rate $\leq \sim 1000/\text{s}$; myelin $\rightarrow$ saltatory, $\sim 100\text{ m/s}$.

■ **Worked example: tetanus arithmetic**

Twitch 100 ms vs refractory 2 ms in skeletal muscle: $20/\text{s}$ summation gives tetanus ✓; cardiac refractory $\sim 200\text{ ms}$ forbids it ✓.

2 Practice

2.1 What sets the maximum firing rate of a neurone? [3]

2.2 Name the two conductances of the action potential in order. [3]

2.3 Why cannot the heart tetanise? [3]

3 Exam-style questions

3.1 Two axons: unmyelinated (1 m/s) and myelinated (60 m/s).

Compute the travel time over 1 m for each. Explain the mechanism of the speed difference. Predict the effect of demyelination on the fast axon. [7]

3.2 A myopathy shows a serum potassium of 2.8 mmol/L after a carbohydrate meal (fictional).

Explain the Nernst consequence for the muscle resting potential. Predict the effect on threshold reachability. State why the weakness is episodic. [7]