

## 5.2 Excitable cells and muscle

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Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Total: 23 marks**

**KEY WORDS** refractory period

### Objective

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

### 1 Key knowledge and worked examples

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#### ■ The sentence

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

#### ■ Worked example: tetanus arithmetic

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

### 2 Practice

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

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

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**2.3** Why cannot the heart tetanise? [3]

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### 3 Exam-style questions

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**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]

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**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]

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