Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

A (thumb): **C6**

B (umbilicus): **T10**

C (outer foot): **S1**

2.2

$1 \div 1 - 1 \div 20$

$=$ **0.95 s** later

2.3

in the spinal cord, within 1–2 segments of where they enter

they go up in the **spinothalamic tract** of the opposite side

2.4

nerves from the heart and from the arm skin enter the same spinal segments (T1–T4)

they meet the same neurons in the dorsal horn

the brain reads the signal as coming from the skin of the arm

3.1

(a) weakness of the right leg; loss of vibration and position sense on the right

(b) **pain and temperature**

(c) spinothalamic fibres cross within 1–2 segments of entry, so the right tract carries pain from the left

(d) the fibres go up a segment or two before they cross

(e) the **dorsal column**

3.2

(a) the nerves to the feet are the longest, and damage depends on nerve length

(b) she has lost protective feeling, so an injury or ulcer may go unnoticed

(c) check the feet every day; wear well-fitting shoes and see a podiatrist

3.3

(a) touch fibres (Aβ) switch on inhibitory cells in the dorsal horn, which reduce the pain signals sent up

(b) on μ receptors in the periaqueductal grey and the dorsal horn; they reduce transmitter release from pain fibres and switch on descending inhibition

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(c) **S1**

(d) the **L5/S1** disc

(e) blood irritates the diaphragm; its nerve (phrenic, C3–C5) shares segments with the skin of the shoulder