9.6 Higher functions: sleep, memory and language

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

KEY WORDS slow-wave sleep • arcuate fasciculus • conduction aphasia

Objective

Use sleep architecture, memory dissociations and aphasia tables.

1 Key knowledge and worked examples

■ Sleep and memory

~90-minute cycles × 4–6: N3 delta (0.5–4 Hz, growth hormone) early; REM ~20–25 %, atonia, lengthens toward morning ✓. Hippocampus episodic, striatum procedural, amygdala emotional, cerebellum conditioned ✓.

■ Worked example: the three aphasias

Broca: non-fluent, comprehension intact. Wernicke: fluent, empty, comprehension impaired. Arcuate (conduction): fluent, comprehending, repetition destroyed ✓.

2 Practice

2.1 Which sleep stage dominates the first cycles, and at what frequency? [3]

2.2 HM lost new episodic memory but kept skill learning – name the two systems. [3]

2.3 Which aphasia destroys repetition with fluency and comprehension intact? [3]

3 Exam-style questions

3.1 A fictional sleep study: 8 hours, five cycles.

Explain the architecture (N3 dominates cycles 1–2; REM episodes lengthen toward morning) and predict what early-night sleep loss costs (growth-hormone-rich N3) versus late-night loss (REM) ✓. State the REM percentage and two REM features. [8]

3.2 A fictional patient: fluent speech, intact comprehension, repetition destroyed.

Localise (arcuate fasciculus, conduction aphasia) and contrast with Broca and Wernicke lesions on all three axes (fluency, comprehension, repetition). Justify why repetition is the cable's test ✓. [7]

Solutions

2.1

- N3 (slow-wave sleep), delta 0.5–4 Hz ✓.

2.2

- Hippocampus (episodic) and striatum (procedural) ✓.

2.3

- Conduction aphasia – the arcuate fasciculus is cut ✓.

3.1

- N3 front-loaded: cycles 1–2 carry most slow-wave sleep ✓.
- REM lengthens toward morning; ~20–25 % of the night ✓.
- REM features: muscle atonia, vivid dreams ✓.
- Early loss costs N3 (growth hormone); late loss costs REM ✓.

3.2

- Conduction aphasia: arcuate fasciculus (the cable) cut ✓.
- Broca: non-fluent, comprehension intact, repetition impaired ✓.
- Wernicke: fluent-empty, comprehension impaired, repetition impaired ✓.
- Repetition requires the front-to-back cable – only its lesion spares both other axes ✓.