

KEY WORDS insulin

Objective

Predict fuel use across the fed-fasting timeline and read diabetes as a jammed switch.

1 Key knowledge and worked examples

- The switch

Insulin: all organs store. Glucagon: liver releases. Timeline: glycogen (hours) $\rightarrow$ gluconeogenesis (days) $\rightarrow$ ketones (brain $\sim$ 2/3 by day 3). HbA1c $\geq$ 6.5 % integrates $\sim$ 120 days of glucose.

- **Worked example:** the timeline of a fast

Hours 0–4 absorbed fuel; 4–12 glycogen drains; 12–24 gluconeogenesis; day 3+ ketosis with protein sparing ✓.

2 Practice

2.1 Name the hormone high in the fed state and one hepatic action it drives. [3]

2.2 What changes in the brain's fuel mix by day 3 of fasting? [3]

2.3 What does HbA1c measure, and over what window? [3]

3 Exam-style questions

3.1 Map the fasting timeline for liver, fat and muscle.

For each of hours 6, 18 and day 4, state the dominant fuel source of each organ. Justify the switch points with the glycogen budget (100 g vs 480 kcal/day brain). Explain protein sparing quantitatively (ketone substitution). [8]

3.2 (Fictional) type 1 diabetic with ketoacidosis.

Explain how absent insulin makes cells read “fasting” despite hyperglycaemia. Trace four symptoms to the switch (ketoacidosis, Kussmaul breathing, osmotic diuresis, weight loss). Contrast the type 2 picture in one sentence. [7]