Solutions

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

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

2.1

pairs A–U, T–A, G–C, C–G

`5′-AUGCCUUCA-3′`

2.2

AUG, CCU, UCA

Met–Pro–Ser

2.3

$4^2 = 16 < 20$ amino acids

$4^3 = 64$ codons, 61 of them for 20 amino acids

so about 3 codons each: the code is degenerate, mostly at the third base

2.4

CCU → CCC: silent (still Pro)

UCA → UAA: nonsense (stop)

one base inserted: frameshift, every later codon changes

3.1

(a) $500/20 =$ **25** s; $110/3 \approx$ **37** s

(b) making new insulin, then processing and packing it, takes much longer than the time needed; stored granules can be released at once when glucose rises

(c) each ribosome finishes one chain every 37 s; $60/37 \approx 1.6$ chains per ribosome each minute; $20 \times 1.6 \approx$ **32** chains a minute

3.2

(a) it removes the introns from the pre-mRNA and joins the exons in order

(b) the splicing machinery uses the new site, so part of the intron stays in the mRNA; the extra bases shift the reading frame, and a stop codon soon appears

(c) an mRNA with an early stop is broken down by the cell, and any short protein made is unstable

3.3

(a) bacterial 70S ribosomes differ in shape from human 80S ones, so the drug binds them much more strongly

(b) $200/2 =$ **100**; the blood level 10 mg/L is **20** times below 200

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(c) mitochondrial ribosomes resemble bacterial ones, so over weeks or at high levels mitochondrial proteins are made less, and cells such as marrow or nerve cells suffer

(d) use the normal dose for the shortest course that works; for long courses, check blood counts and symptoms regularly and stop if side effects appear