Solutions

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

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

2.1

unwinds / separates the DNA strands; joins RNA nucleotides complementary to the template strand to make mRNA

2.2

mRNA: AUG GGC UAA; Met–Gly; UAA is a stop codon, so translation ends and the polypeptide is released

2.3

each tRNA carries a specific amino acid and has an anticodon; the anticodon pairs with a complementary mRNA codon in the ribosome; the ribosome joins the amino acids with peptide bonds and moves along the mRNA

2.4

the gene has exons and introns; introns are removed from the RNA; alternative splicing joins different combinations of exons, giving different mRNAs and proteins

2.5

several ribosomes translating the same mRNA at the same time; many copies of the protein are made quickly

3.1

(a) GUG

(b) the base substitution changes one codon in the mRNA; a tRNA brings valine instead of glutamic acid; the haemoglobin has a different shape / sticks together, making cells sickle-shaped

(c) the code is degenerate: several codons code for the same amino acid; so the new codon may still code for the same amino acid

3.2

(a) the genetic code is universal; so the bacterial ribosomes and tRNAs read the codons as the same amino acids

(b) transcription: nucleus; translation: ribosomes in the cytoplasm / on the rough ER

(c) $4^3 = 64$ combinations of three bases; most amino acids have more than one codon / some codons are stop signals