2025 Bi H1 Q4

Section: DNA and the Genome

Topic: Mutations

Question Summary:

Proteins X, Y and Z are produced from an unmutated gene, a missense mutation and a nonsense mutation. A gel is used to compare protein sizes: smaller proteins travel further. You are asked which gel diagram correctly shows the positions of X, Y and Z.

Worked Solution:

- The **unmutated** sequence produces protein X — this is the full-length protein.
- A **missense mutation** changes one amino acid but does not introduce a stop codon. Protein Y will be almost the same size as X, so will travel almost the same distance.
- A **nonsense mutation** introduces a premature stop codon. Protein Z will be **much shorter** and therefore travel **much further** in the gel.

So the correct pattern is:
- X (largest) → shortest distance
- Y (almost same size as X) → slightly further or same distance
- Z (smallest) → furthest distance

Among the options, only diagram **A** shows X nearest the well, Y close to X, and Z furthest down the gel.

Final Answer: A

Revision Tips:

- Missense mutation → one amino acid change → protein length stays almost the same.
- Nonsense mutation → early stop → much shorter protein.

- In gel electrophoresis of proteins, **smaller proteins travel further** through the gel matrix.
- Always link mutation type to effect on protein length first, then interpret the gel pattern.