Question 11 (Answer: **A**)

- Polar groups on the outside of a protein are what let it dissolve in the watery cytoplasm.
- Replacing them with non-polar groups removes those interactions with water.
- The haemoglobin therefore becomes less soluble – which is what makes sickle cells form.

Question 10 (Answer: **C**)

- The secondary structure (α-helix and β-pleated sheet) is held by hydrogen bonds.
- Hydrogen bonds also help hold the tertiary structure, alongside ionic and disulfide bonds.
- Peptide bonds hold the primary sequence, and disulfide bonds appear only in the tertiary structure.

Question 11 (Answer: **D**)

- Peptidyl transferase catalyses condensation between amino acids on the ribosome.
- So it builds the primary structure of the polypeptide.
- The elasticity of resilin comes from its later folding, not from this enzyme.

Question 12 (Answer: **C**)

- Collagen is three polypeptides wound into a triple helix.
- Glycine is the smallest amino acid, and having it at every third position lets the chains pack tightly.
- Cross-links between the chains, and staggered ends between molecules, give the fibre its strength.

Question 11 (Answer: **D**)

- More charged and hydrophobic amino acids means more ionic bonds and more hydrophobic interactions.
- Those extra interactions hold the tertiary structure together more firmly.
- So a higher temperature is needed before the enzyme denatures.

Question 12 (Answer: **D**)

- Glycine is the smallest amino acid, so having it at every third position lets three chains wind tightly together.
- The chains form a triple helix held by hydrogen bonds.
- Covalent cross-links between neighbouring molecules, staggered along the fibre, give the strength.

2(a)(i)	*any **two** from* each polypeptide is a (left-handed), helix / helical shape **;** **R** alpha helix (three) polypeptides are tightly, coiled / wound (around each other) / AW **;** (three polypeptides form a) triple helix **;** **I** bonding
2(a)(ii)	*any **three** from* *collagen molecules arranged* **1** in parallel **;** **2** staggered / ends are not aligned / AW **;** *molecules held together by – max 2* **3** covalent, bonds / links **; I** hydrogen bonds **R** if part of a list that includes other bonds in proteins **4** between R-groups of amino acids on different molecules **; A** side chains **5** AVP **;** e.g. covalent bonds between lysine / hydroxylysine (residues)
2(b)(i)	provides (high tensile) strength to, help keep trachea open / support trachea **;** **A** provides strength to prevent trachea collapsing allows flexibility for, breathing / change of diameter of trachea / bending of trachea / AW **;**
2(b)(ii)	*any **one** from:* (inhalation) allow, stretching / expansion, without, rupture / AW **; A** prevent overstretching elastic fibres recoil to help, expel air / exhalation / expiration **; R** to empty
2(c)(i)	(gly)-pro-met-gly-pro-arg-gly-pro-pro-gly ;
2(c)(ii)	*any **three** from:* *allow gly for glycine* **1** glycine is every third amino acid **;** **2** glycine, allows tight folding for the polypeptides / makes it easy for polypeptides to fit closely together / AW **;** **A** compactness **A** glycine allows the turning points (of the polypeptide) **3** glycine has smallest R-group **;** **A** glycine is the smallest (amino acid) / glycine has H as R-group *or* side chain **4** NH in glycine can form hydrogen bonds (with carboxyl group on another amino acid residue) **5** (so) allows many hydrogen bonds between polypeptide**s ;** **6** AVP **;** ala / pro, also has a small R-group / AW
2(c)(iii)	**P** *deletion of first nucleotide pair* changes the, sequence / order, of amino acids (in primary structure) **; I** shorter **A** (GTC CAA TGG GTC CCC GAG GTC CCC CAG GT_) val gln trp val pro glu val pro gln (val) **Q** *substitution in first triplet* (GGT to TGT in non-transcribed strand) cys (instead of gly) is first amino acid, and no change to the rest (of, sequence / order, of amino acids) **;** **A** only first amino acid is different