Model Answers: Easy

1

The correct answer is **D** because:

- Statement **1** is incorrect as, although the majority of enzymes in humans function best at this temperature, those found in other organisms may have different optimum temperatures (this rules out **A**)
- Statement **3** is incorrect as enzymes will still continue to function past their optimum temperature, just at a lower rate (this rules out **B** and **C**)

Increasing temperature past the optimum will break/alter bonds in the tertiary structure of the enzyme. This is why the rate of reaction starts to slow – the enzyme is becoming denatured

2

The correct answer is **B** because:

- Competitive inhibitors have a similar shape to the substrate of an enzyme and are therefore able to bind to the active site instead of the substrate.   This reduces the rate of reaction
- Enzymes are proteins and, as with all proteins, their primary structure is coded for by mRNA (which was originally transcribed from the DNA)
- Quite a large proportion of enzymes end up in membranes.   There are particularly large numbers in the inner membranes of mitochondria and chloroplasts
- Having a quaternary structure implies more than one polypeptide chain is involved.   This is the case with many enzymes but not all of them - so the statement is incorrect

3

The correct answer is **C** because:

- Breaking down food molecules in food stains is a **catabolic reaction** (breaking bigger molecules into smaller molecules) and requires water
- A catabolic reaction requiring water is a hydrolysis reaction
- **Proteases** break down **proteins** (proteins are held together by peptide bonds)
- **Carbohydrases** break down **carbohydrates** (carbohydrates are held together by glycosidic bonds)
- **Lipases** break down **lipids** (lipids are held together by ester bonds)

Hydrolysing DNA or RNA molecules to nucleotides involves breaking phosphodiester bonds.

4

The correct answer is **D** because:

- Enzymes can either be **catabolic** (splitting large molecules into smaller ones) or **anabolic** (building larger molecules from smaller ones) –statement 1 describes the second of those processes
- Enzymes cause more frequent **successful** collisions by lowering the activation energy.   However, they don't increase the number of collisions; the kinetic energy of the particles determines this (and therefore increases and decreases with increasing and decreasing temperature)
- Enzymes **lower** the **activation energy** required to start a reaction; this is how they speed up the rate of reaction
- As with all proteins, enzymes are translated from mRNA by a ribosome.   The mRNA was originally transcribed a gene made from DNA

5

The correct answer is **C** because:

Primary, secondary and tertiary structures all apply to proteins made up of a single polypeptide chain.

Only quaternary structure refers to the interaction between distinct polypeptide chains within that protein.

6

The correct answer is **A** because enzymes are globular proteins (spherical molecules generally with hydrophilic amino acids on the outside) and are therefore soluble in water

- Not all enzymes have a quaternary structure (although many do) so **B** is incorrect
- Enzymes can have more than one active site, so **C** is incorrect
- Enzymes can catalyse anabolic or catabolic reaction; therefore, **D** is not correct

7

The correct answer is **B** because butter is predominantly comprised of triglycerides (a type of lipid) and, therefore, butter will be hydrolysed by lipase.

8

The correct answer is **D** as the plant cell walls are made of cellulose.   Cellulose is made up of long chains of β-glucose (so this is what the cellulose is hydrolysed into)

Humans do not have the digestive enzymes to break down cellulose into β glucose.   Herbivorous animals have bacteria in their digestive tract that can produce cellulases - that is why they can obtain significantly more nutrition by eating vegetation.   α glucose is the monomer for starch in a plant.   Humans can break down starch into α glucose, therefore we favour starchy plants as food sources

9

The correct answer is **B** because:

- To get from $cm^3\ sec^{-1}$ to $dm^3\ min^{-1}$ we need to divide by 1000, then times by 60.   If there is 250 cm^3 oxygen produced in five seconds, then this has an average rate of production of 50 $cm^3\ sec^{-1}$.
- 50 / 1000 = 0.05 $dm^3\ sec^{-1}$
- 0.05 x 60 = 3 $dm^3\ min^{-1}$

10

The correct answer is **C** as enzymes work by decreasing activation energy (which rules out answers **A** and **B**).   Although they lower the activation energy, they do not affect the energy yield.   A reaction will still be just as endothermic (or exothermic) as it would without an enzyme - it will just occur at a faster rate with the enzyme.