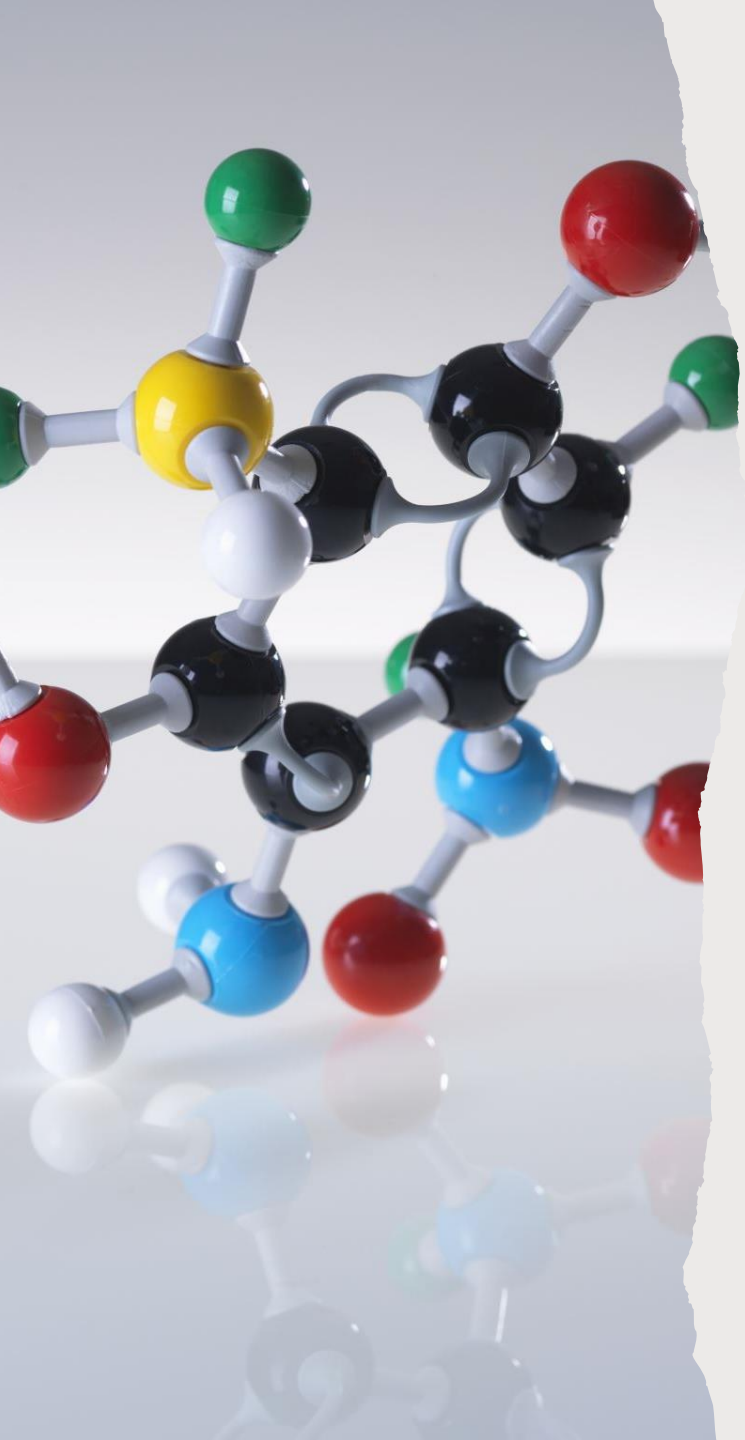


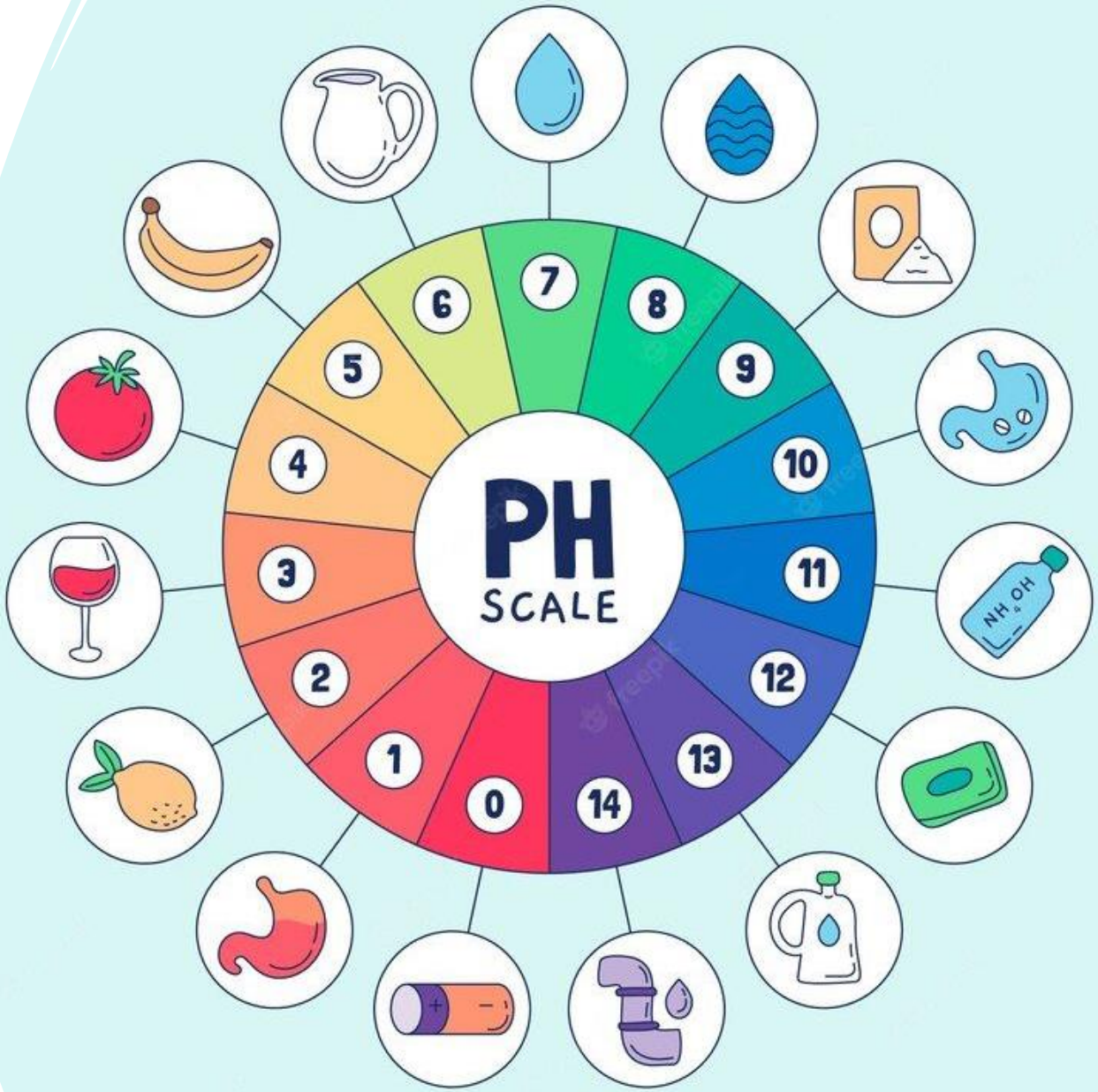
Factors affecting enzyme action

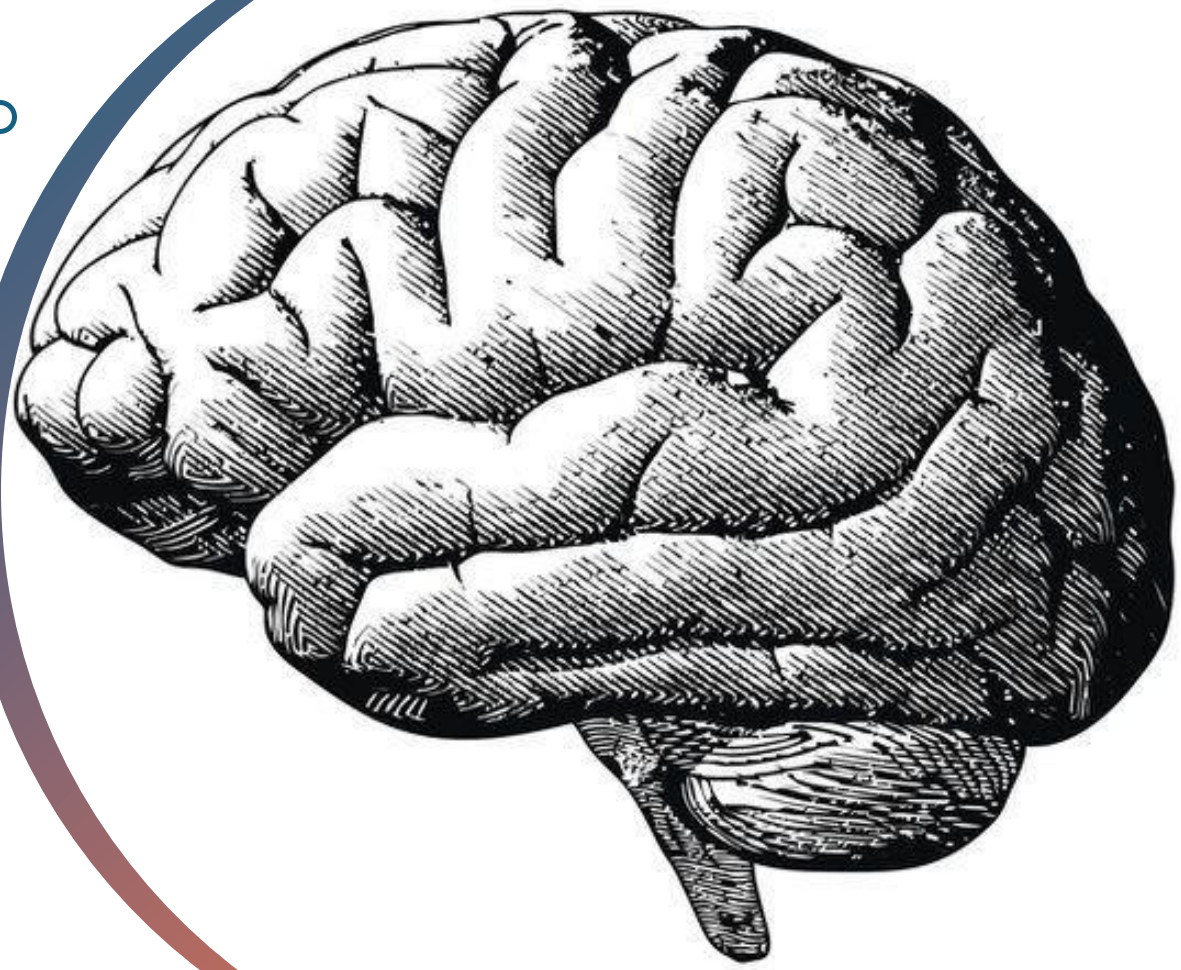
1/5/2026

Objectives

- Understand what an enzyme is
- Know how enzymes work in digestion
- Explain how temperature, pH, and concentration affect enzymes

Can you explain any of these before we start?





Synoptic links

- A synoptic link is when one topic links back to another topic/subject. What do you think the synoptic link is here?
- Enzymes can link back to digestion, which we looked at last time.
- Can you think of any ways that they might link?
- Can you name any of the enzymes we spoke about before?

What is an enzyme?

Enzymes are **proteins that speed up chemical reactions** (they are often called **biological catalysts**)

In digestion, they break down food

Enzymes are like scissors that cut food into smaller pieces

Amylase → breaks starch into sugar

Protease → breaks protein into amino acids

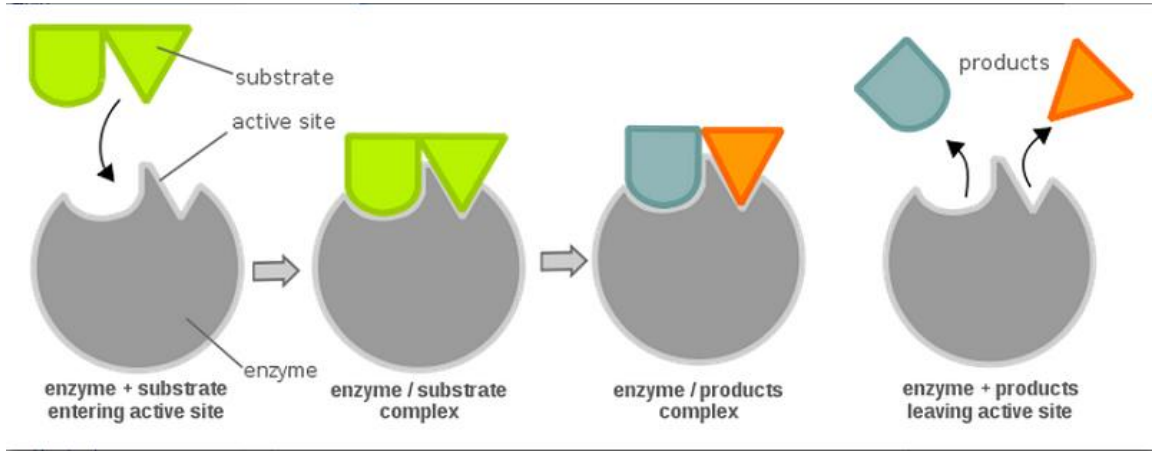
Exam question **(3 marks):**

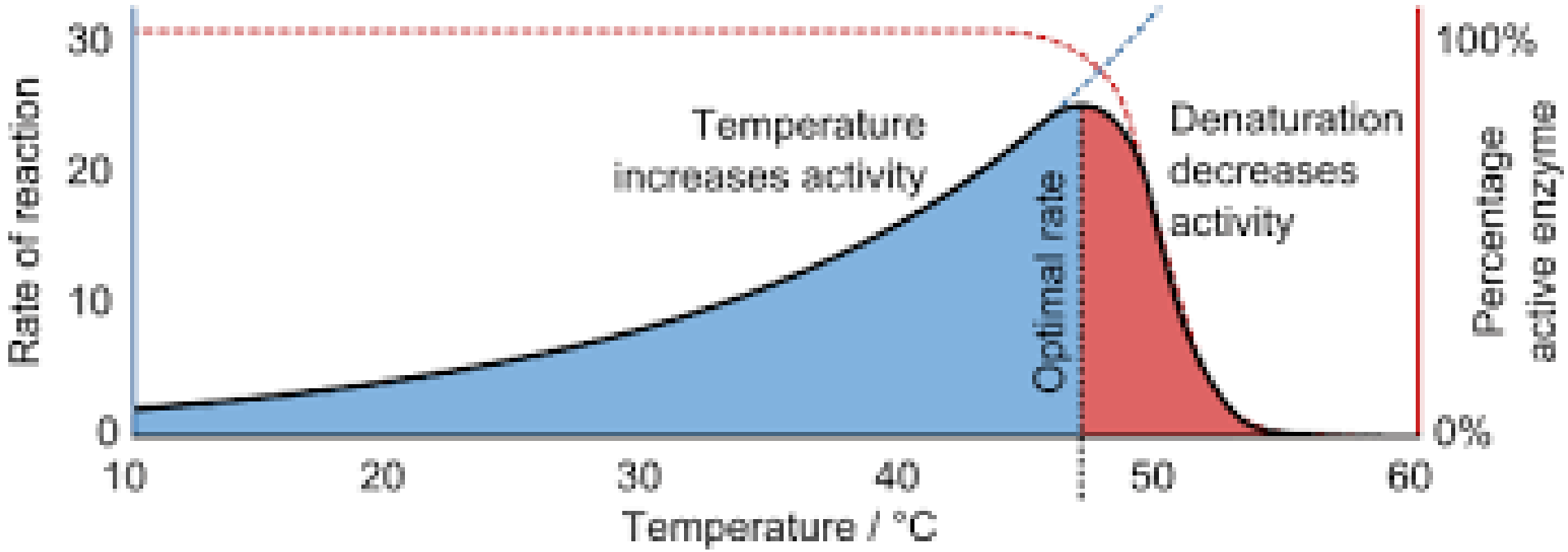
Explain the role of enzymes in digestion.

Enzymes break down large food molecules into smaller soluble molecules. For example, amylase breaks down starch into sugars, and protease breaks down proteins into amino acids so they can be absorbed.

Lock and Key

- Each enzyme has a **specific shape**
- Only one substrate fits (like a key in a lock)
- Mouth → amylase works best
- Stomach → acidic → protease works
- *Why wouldn't amylase work well in the stomach?*





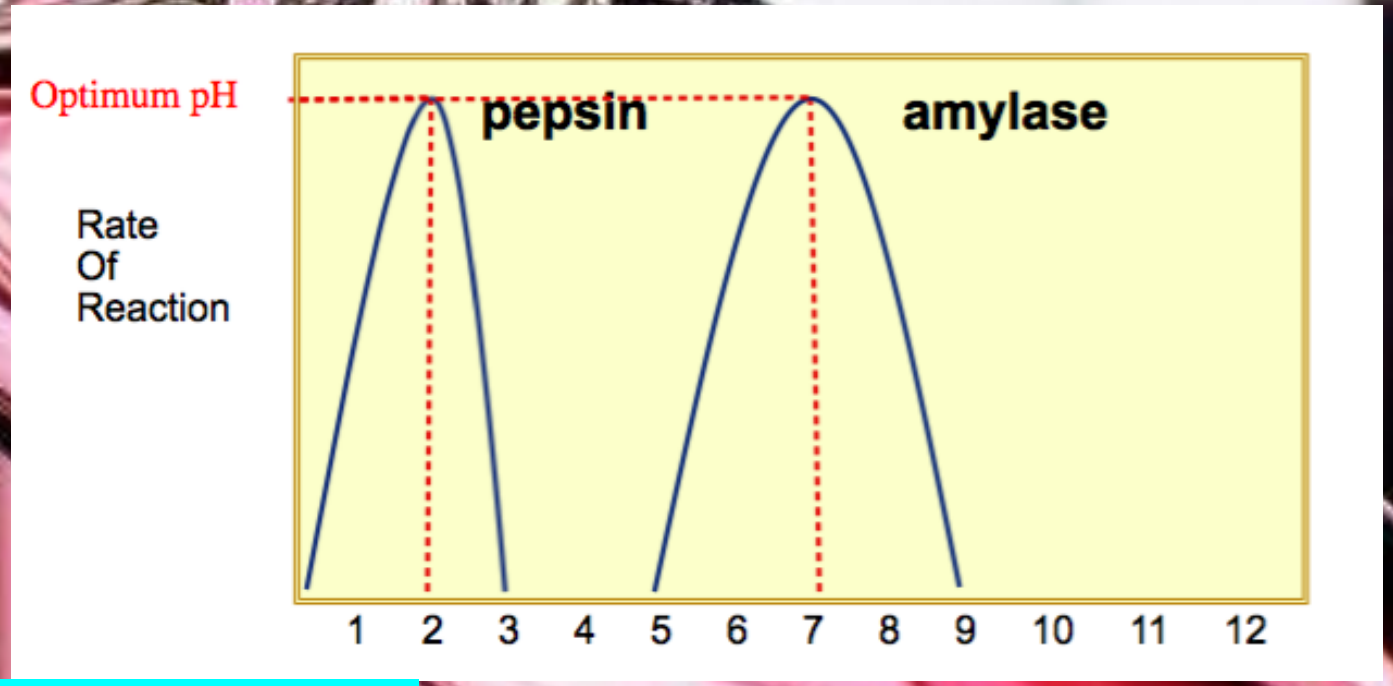
Factor 1: Temperature

- Low temp → slow reaction
- The optimum temperature for most enzymes in humans is 37°C
- Temperature too high denatures the enzyme.
- Think about a fever. Why could they potentially be dangerous for you?

Exam question (4 marks)

- Explain how temperature affects enzyme activity

- At low temperatures, enzymes and substrates have less energy so there are fewer collisions and the reaction is slow. As temperature increases, the rate increases because there are more frequent successful collisions. At the optimum temperature (around 37°C in humans), the rate is highest. Above this temperature, the enzyme denatures and the active site changes shape, so the substrate can no longer fit.



- Each enzyme has an **optimum pH**
- Amylase → neutral
- Protease (stomach) → acidic
- What would happen to you if you put your hand in acid?

Factor 2: pH

Exam question (3-4 marks)

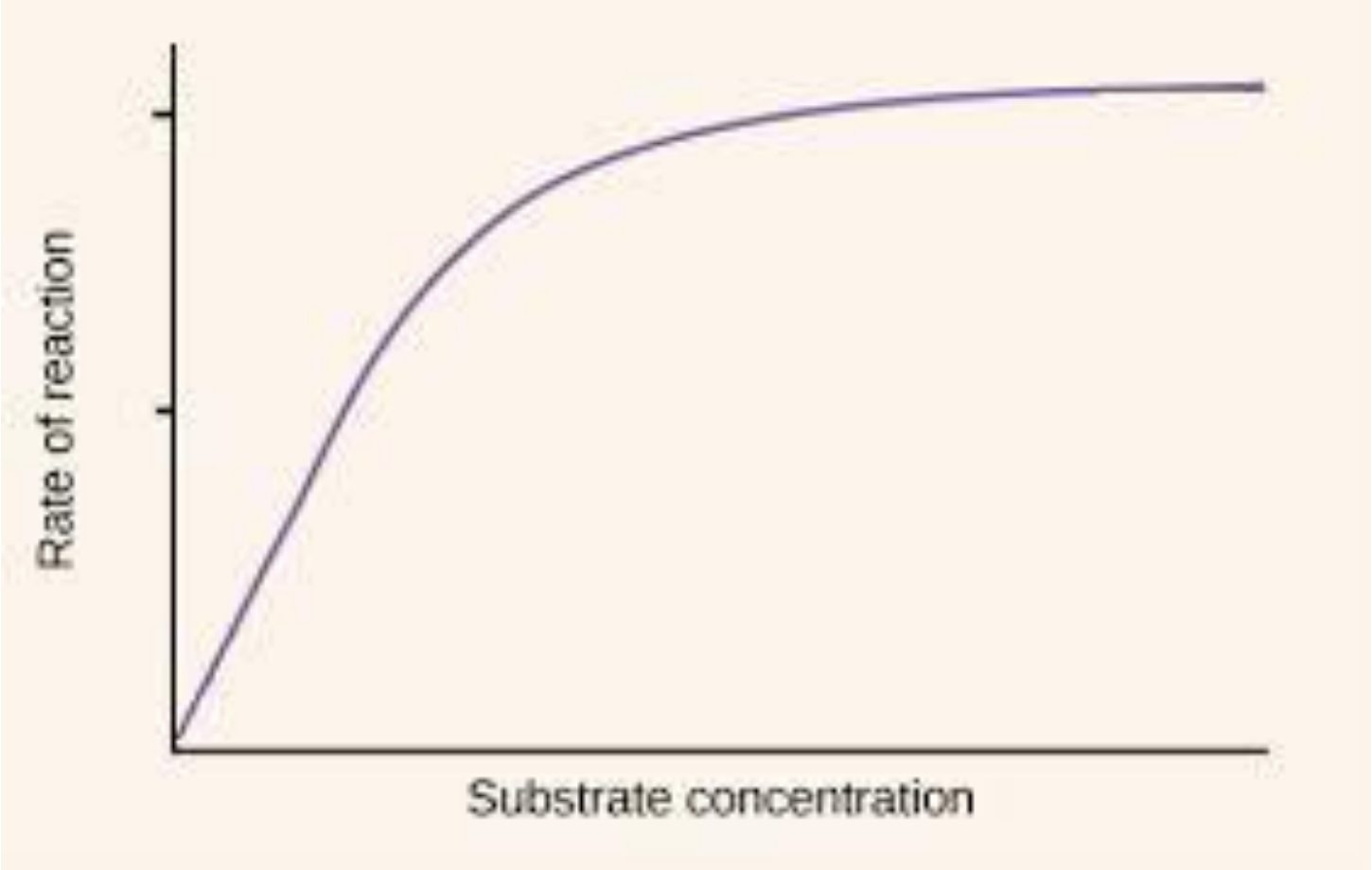
Explain how pH affects enzyme activity.

Each enzyme has an optimum pH at which it works best. If the pH is too high or too low, the enzyme's active site changes shape. This means the substrate can no longer fit, so the reaction slows down or stops.

Can you link this to the stomach?

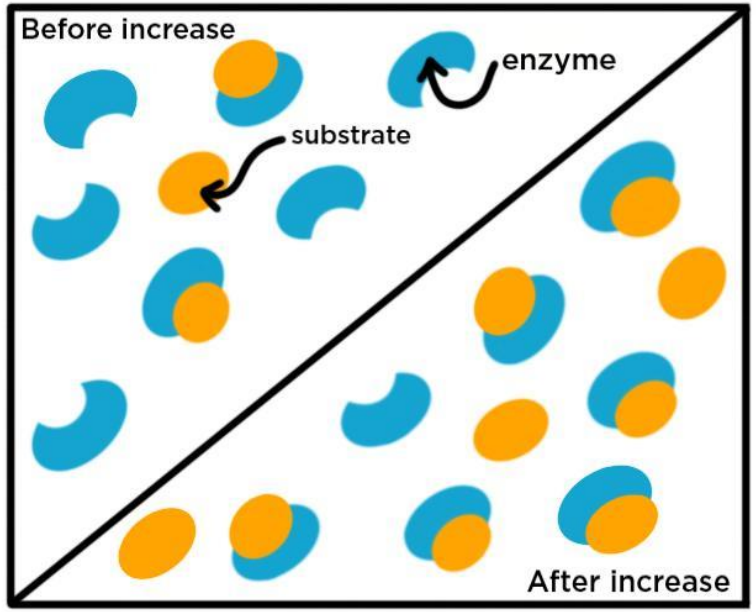
Factor 3: Substrate concentration

- More substrate → more collisions → faster rate
- Eventually levels off
- Why do you think it levels off?



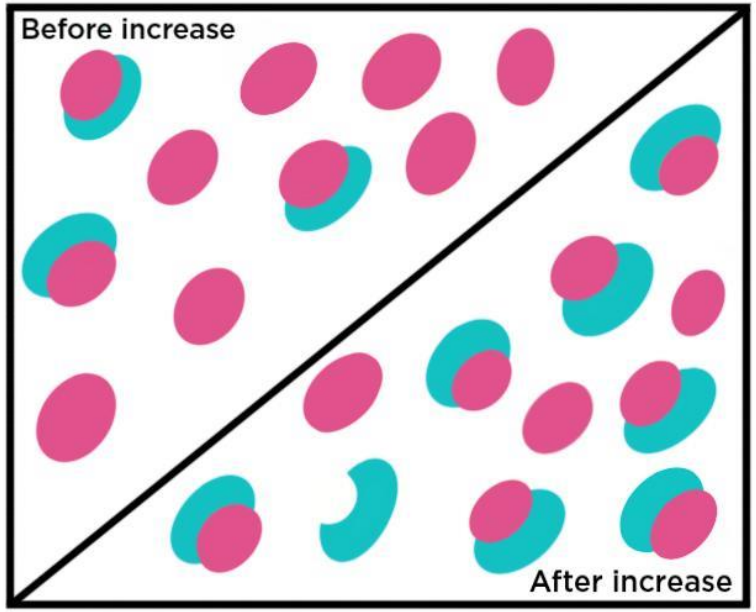
How Does Concentration Affect Enzyme Activity?

When the concentration of substrate increases, the rate of the reaction increases.



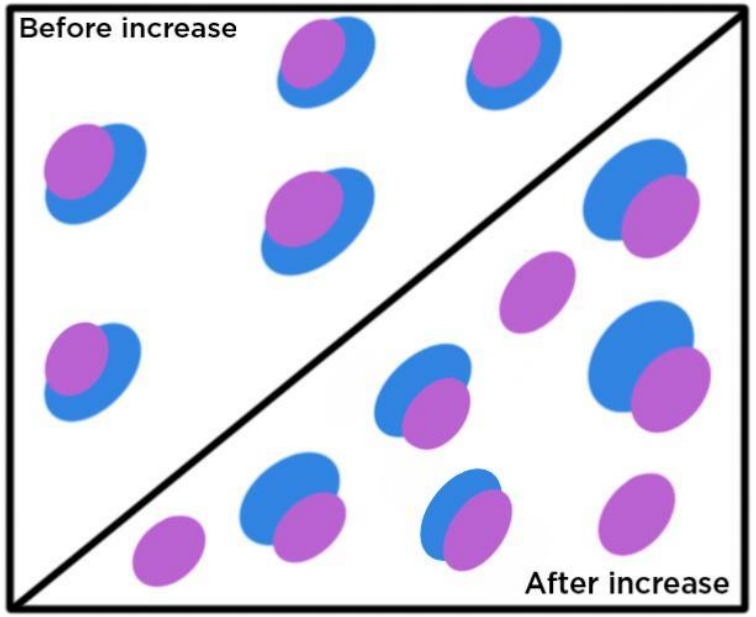
When there are more substrate molecules, more of the enzyme molecules can bind them and speed up the reaction.

When the concentration of the enzyme increases, the rate of the reaction increases.



When there are more enzyme molecules, more of the substrate can be bound to form product.

However, once all of the enzyme molecules are saturated with (bound to) substrate, an increase in the concentration of either one will not alter the rate of reaction.



Quick quiz- true or false

Enzymes get used up during reactions. T/F

A higher temperature is always faster than a lower one. T/F

Enzymes need a specific shape to fit the substrate. T/F

Enzymes kill bacteria. T/F

Amylase works best in the stomach. T/F

Protease breaks down proteins into amino acids. T/F

Fill the blanks

Enzyme activity is affected by _____, _____ and substrate concentration. Each enzyme has an _____ temperature. At low temperatures, the rate is _____ due to fewer _____. At high temperatures, the enzyme _____ and the _____ changes shape.

Each enzyme also has an optimum _____. If the pH is too high or low, the enzyme _____.

Increasing _____ concentration increases the rate due to more _____, until all _____ are full and the rate _____ off.

Word bank: collisions, temperature, levels, active site, optimum, pH, slow, substrate, denatures, active sites

Fill the blanks- answers

Enzyme activity is affected by **temperature, pH, and substrate concentration**. Each enzyme has an **optimum temperature**. At low temperatures, the rate is **slow** due to fewer **collisions**. At high temperatures, the enzyme **denatures** and the **active site** changes shape.

Each enzyme also has an **optimum pH**. If the pH is too high or low, the enzyme **denatures**.

Increasing **substrate concentration** increases the rate due to more **collisions**, until all **active sites** are full and the rate **levels off**.

Homework

Answer in full sentences using key words like *enzyme, active site, substrate, denature, optimum*.

1. What is an enzyme? (2 marks)

2. Explain why enzymes are specific. (2 marks)

3. Explain how temperature affects enzyme activity. (4 marks)

4. Explain what happens to an enzyme at high temperatures. (2 marks)

5. Explain why amylase works in the mouth but not in the stomach. (3 marks)

6. A student says: “Higher temperature always increases enzyme activity.”
Do you agree? Explain your answer. (3 marks)