Enzymes

Cell Biology

Enzymes

Recap

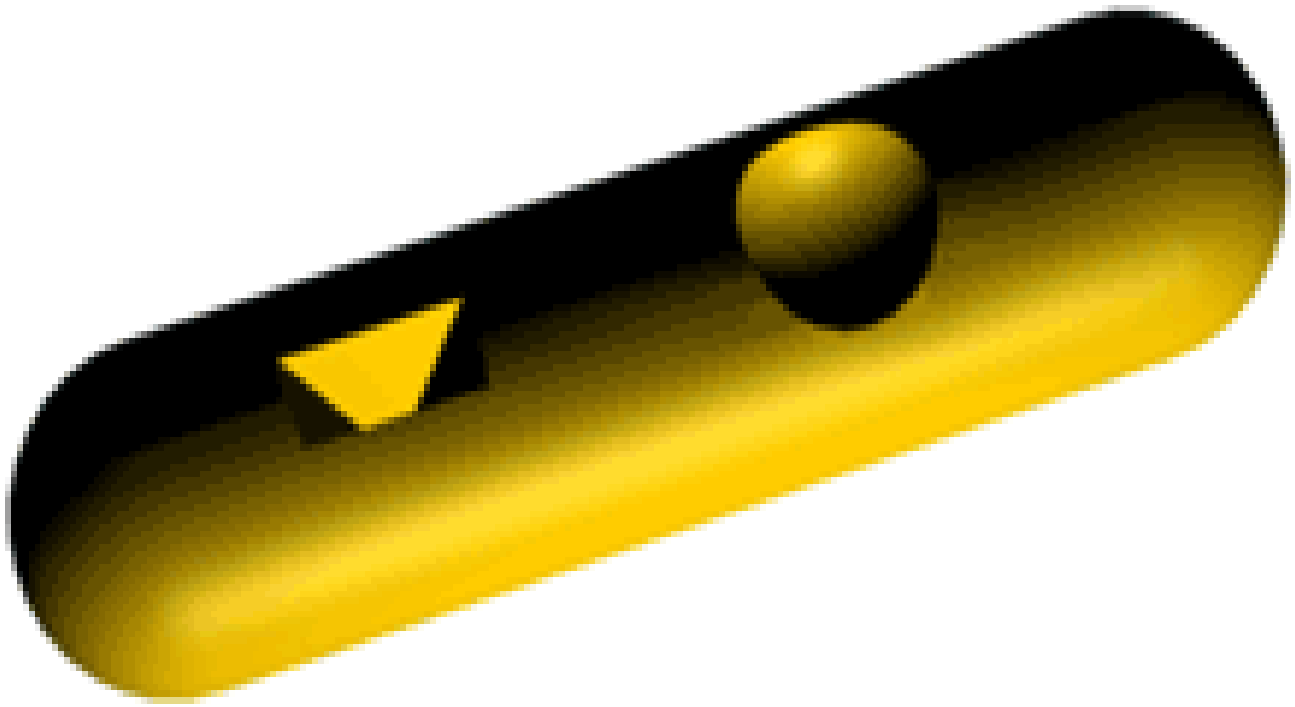
Watch Me

Enzymes are specific:

- They only act with one substrate.

Type of Reaction	Substrate	Enzyme	Product
Degradation	Starch	Amylase	Maltose
Degradation	Protein	Pepsin	Peptides
Degradation	Fat	Lipase	Fatty acids and glycerol
Degradation	Hydrogen peroxide	Catalase	Oxygen and water
Synthesis	Glucose-1-phosphate	Phosphorylase	Starch

enzyme molecule showing the active site



this is a diagrammatic representation

Activity

- Collect 2 colours of Play Do and make an enzyme(including active site) with one of the colours and its substrate using the second colour.

Catalase Demo

- Enzymes are biological **catalysts**
- Catalysts **speed up** reactions

Optimum Conditions

Learning Outcomes:

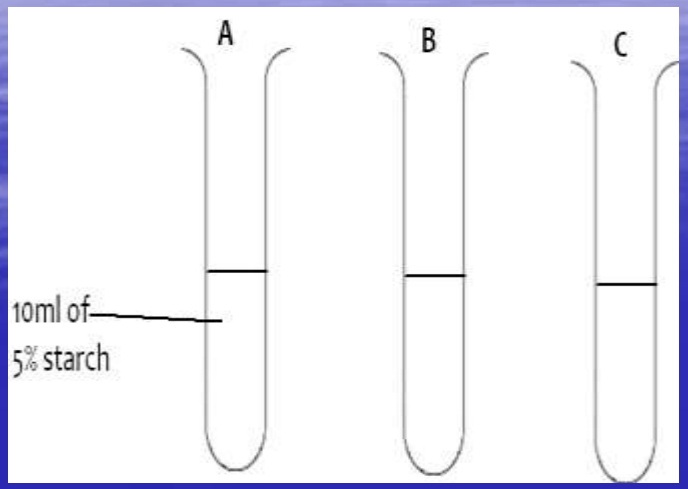
- The conditions in which an enzyme will work best is called its optimum;
- Two conditions which must be at an optimum for an enzyme to work are temperature and pH;
- If an enzyme is not at its optimum it can result in a change of shape until the enzyme is permanently damaged;
- An enzyme which is damaged and unable to work is said to be denatured

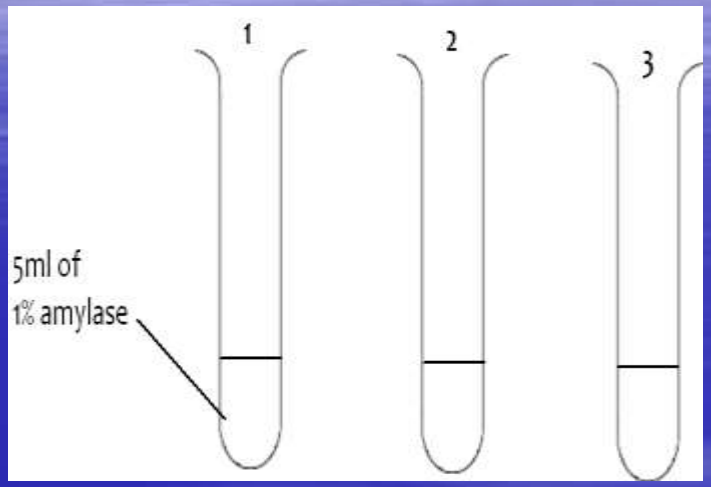
Factors Affecting Enzyme Activity

- For enzymes to function efficiently=

1. Temperature;
2. pH;

The set up





1. Set the boiling tubes up as shown above.
2. Place Tubes A and 1 into the trough filled with ice for 10 minutes.
3. Place tubes B and 2 into the 37°C water bath for 10 minutes.
4. Place tubes C and 3 into the 90°C water bath for 10 minutes.
5. Combine the contents of tubes A&1, B&2, C&3
6. Leave in the correct conditions for 20 minutes
7. Test each solution for reducing sugars

Results

Temperature (˚C)	Sugar present (lots/some/none)
0	
37	
90	

Conclusion –

At 0 ◦C, it was too _____ for the enzymes to work properly. The enzymes were not damaged.

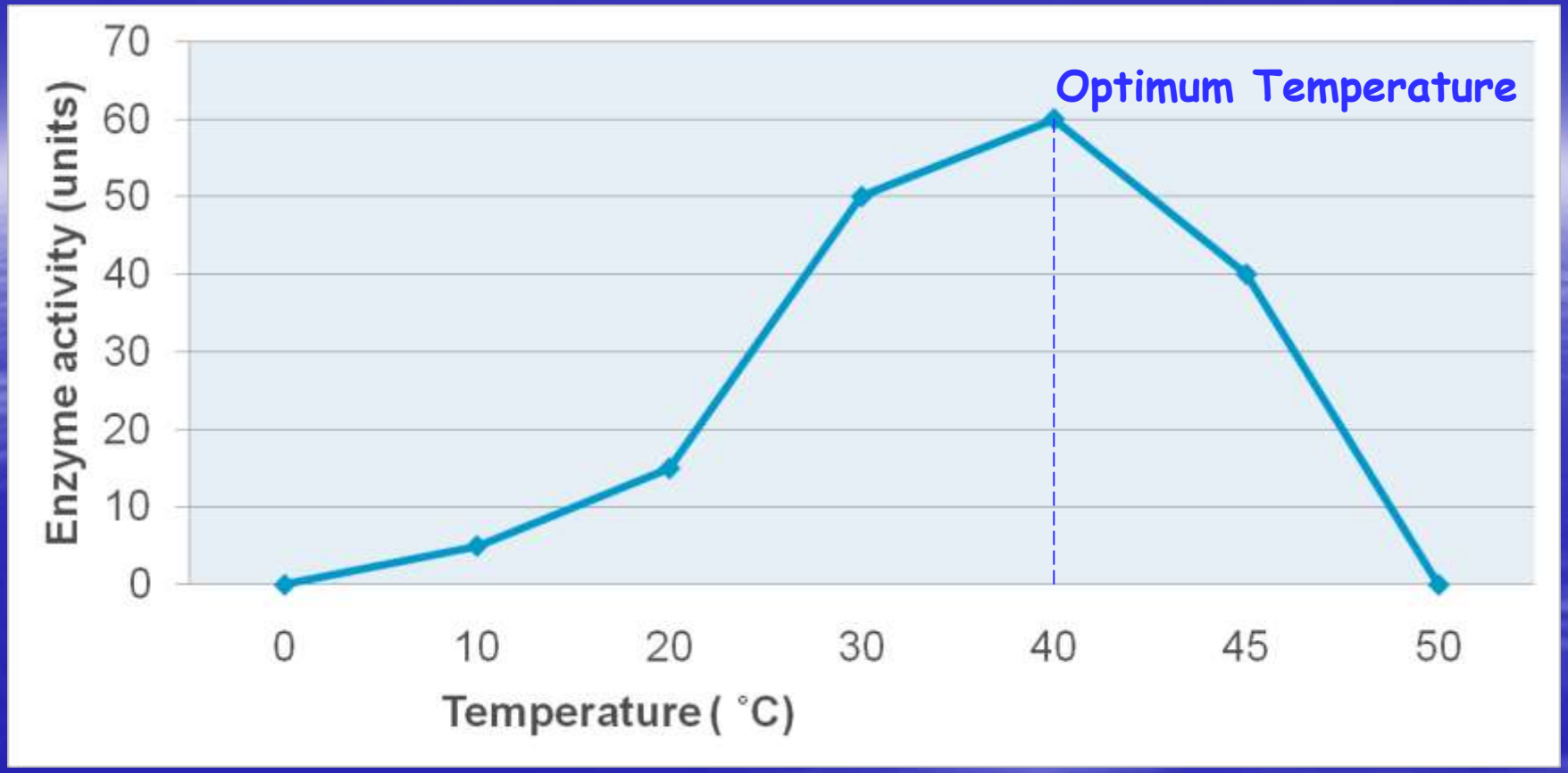
At 37 ◦C, it was the optimum temperature for the enzyme to work. Lots of sugar was produced as the enzyme _____ broke down the _____.

At temperatures above the o_____, the enzyme became d_____ and could no longer b_____ d_____ the sugar so there was no sugar produced.

Line graph Practice

Temperature (˚C)	Enzyme Activity (units)
0	0
10	5
20	15
30	50
40	60
45	40
50	0

1. Plot a line graph of these results to show the effect temperature has on enzyme activity
2. Describe what happens to the enzyme activity between **0 – 20 ˚C**
3. Describe what happens to enzyme activity between **20 – 40 ˚C**
4. Describe what happens to the enzyme activity between **40 – 50 ˚C**



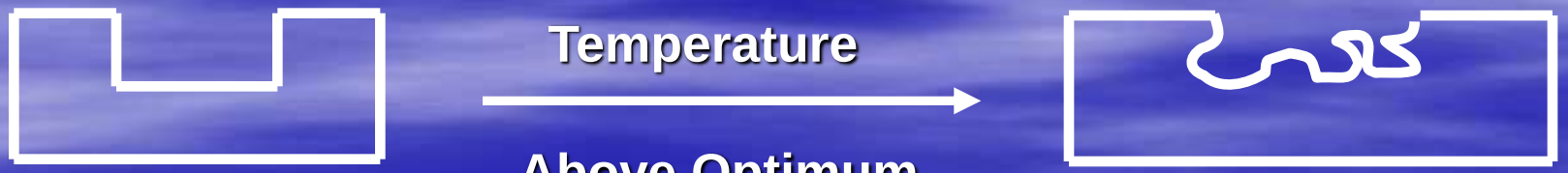
- Optimum – conditions where enzymes work best.

Denaturing

- At temperatures above an enzyme's optimum the enzyme becomes denatured:

Why does this happen?

Active site shape is permanently changed so the substrate no longer fits.



(Normal enzyme)

(Denatured enzyme)

Factors Affecting Enzyme Activity

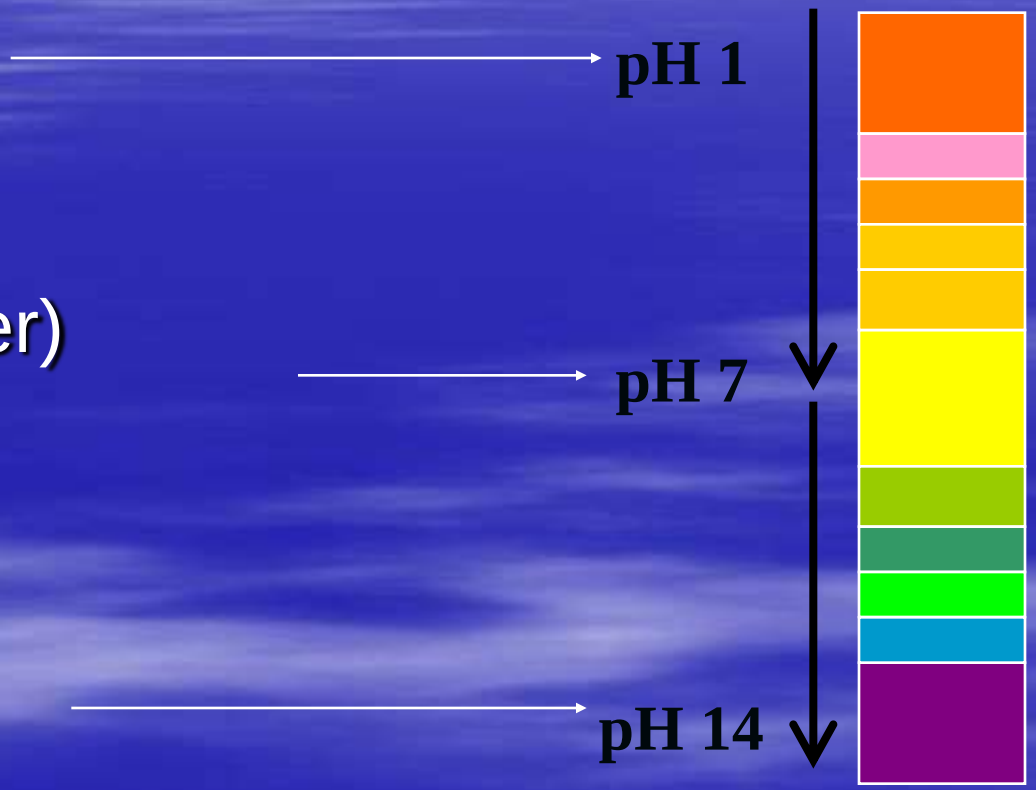
- For enzymes to function efficiently=

1. Temperature;

2. pH;

pH - Testing you knowledge

- Acidic
- Neutral (water)
- Alkaline



2. The Effect of pH

- pH of the enzyme's surrounding is very important
- Each enzyme has a pH level they work best at
- E.g. Pepsin works best in a pH of 0.5 – 5.5

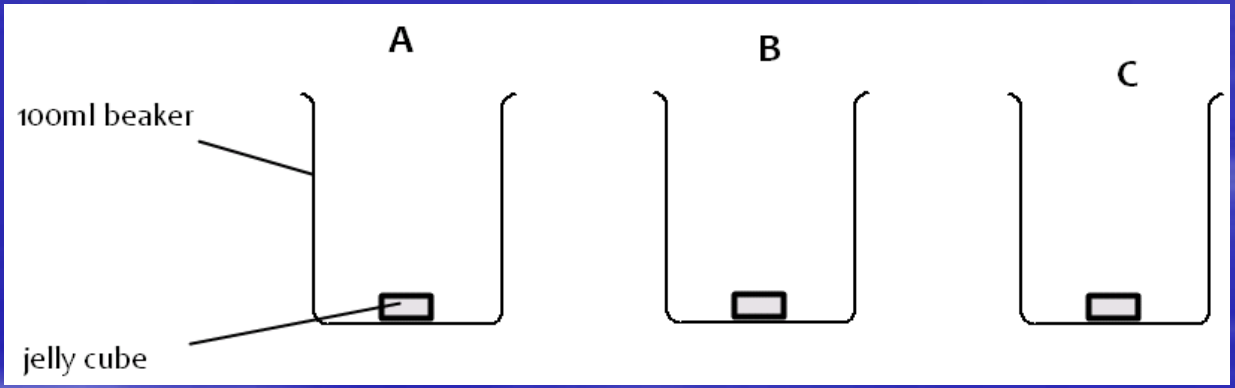
  Most enzymes work best at a pH of 4 – 10

Working Range

The Effect of pH on Enzyme activity

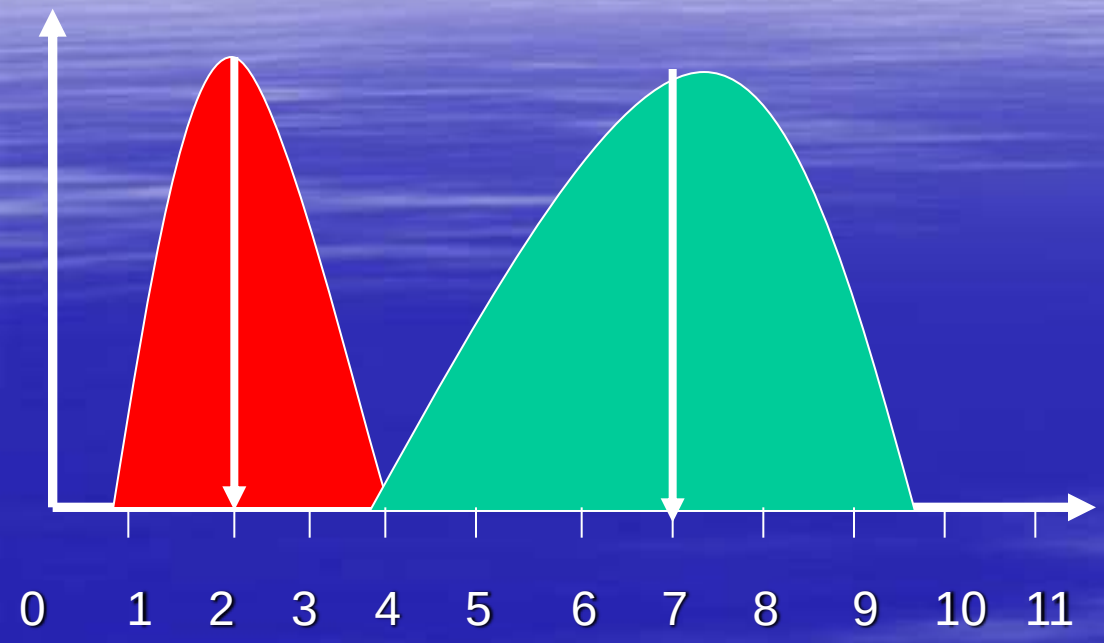
Aim: To investigate the effect different pH solutions have on the activity of the enzyme pepsin

Method:



1. Set up the apparatus as shown above
2. Using a dropper add 2ml of pH2 pepsin to beaker A
3. Using a dropper add 2ml of pH7 pepsin to beaker B
4. Using a dropper add 2ml of pH14 pepsin to beaker C
5. Leave overnight and observe any changes in appearance.

Working Range

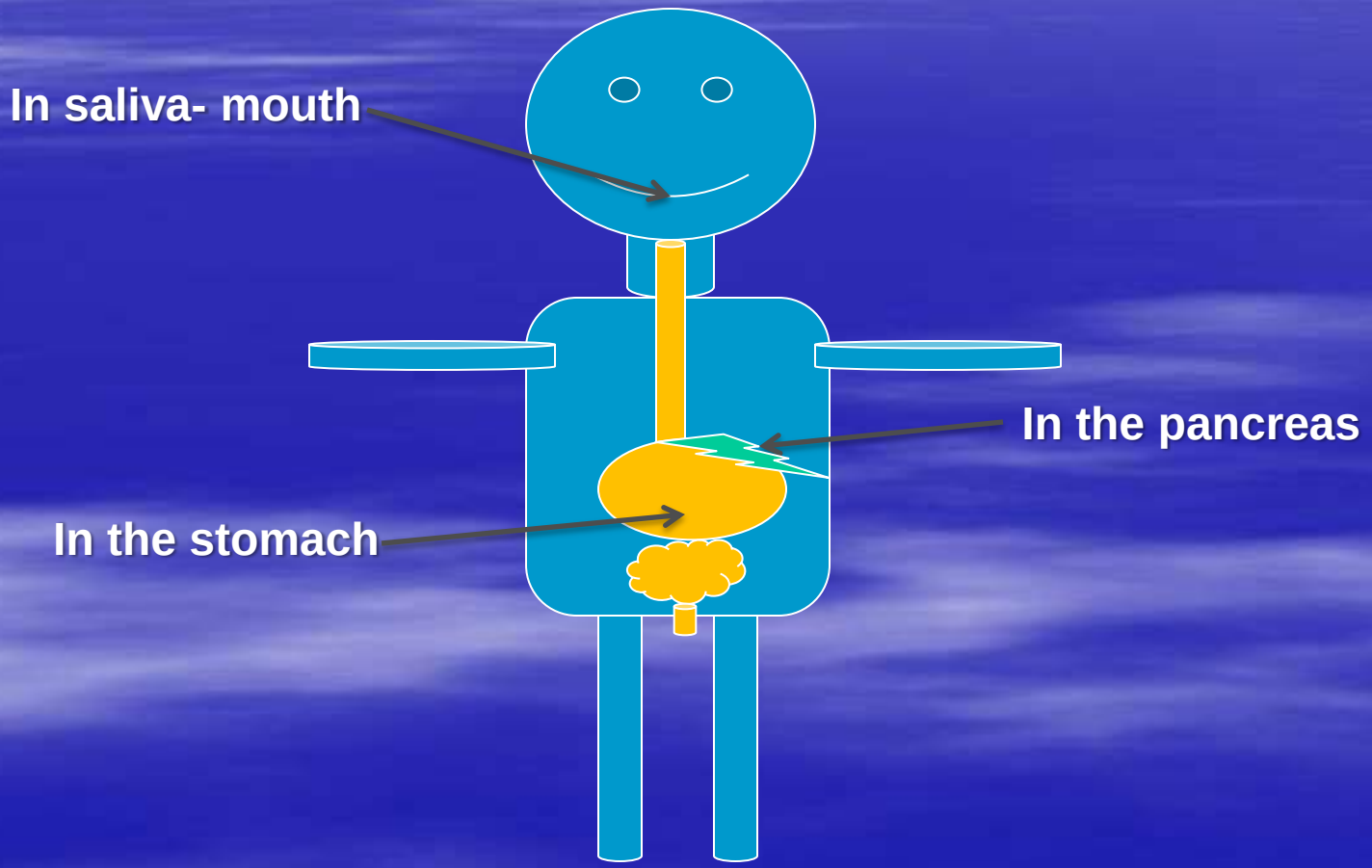


Pepsin

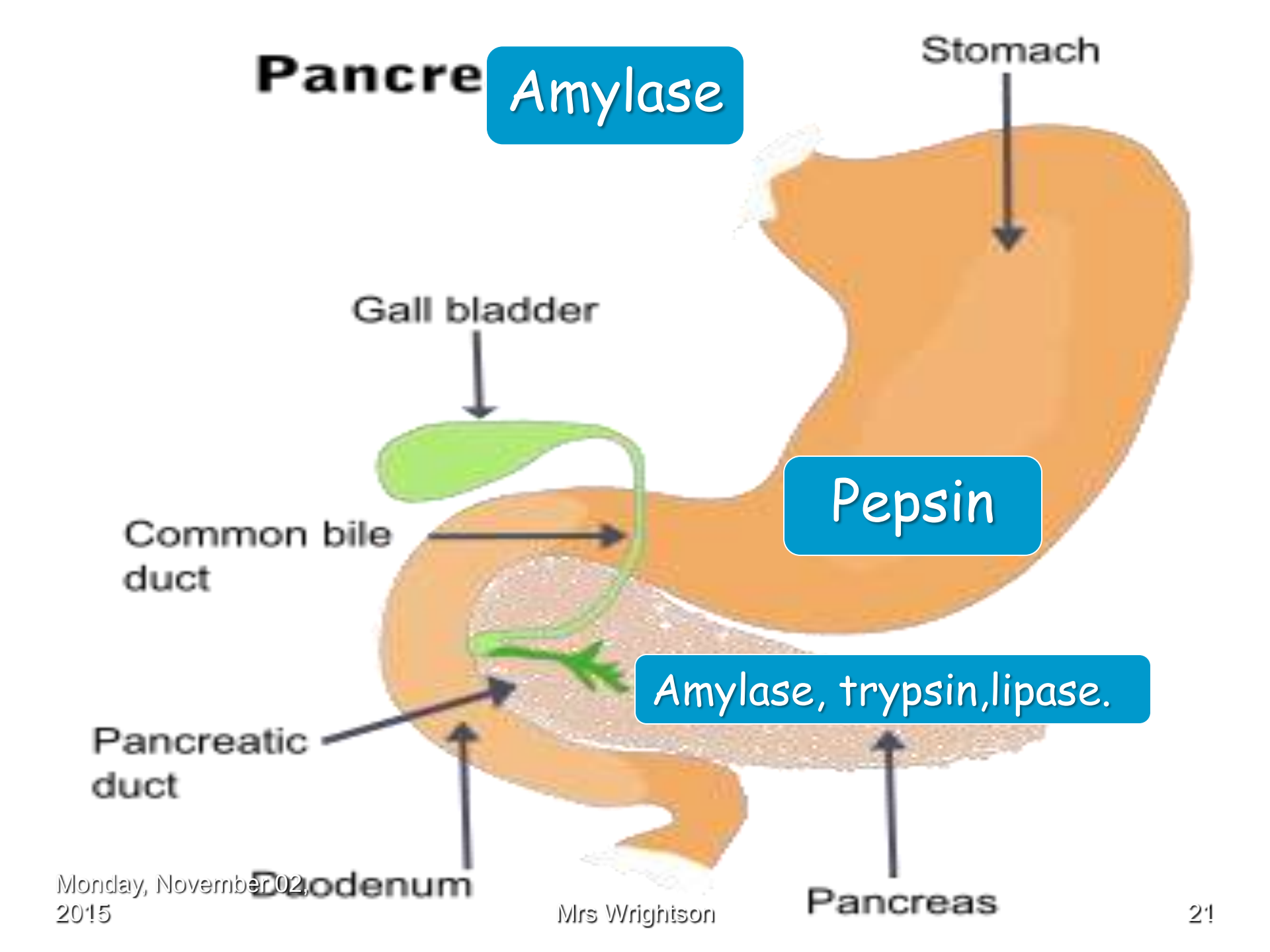
Most enzymes

- Pepsin's working range is 1 - 4. Optimum = 2.5
- Most enzymes working range is 4 – 10. Optimum pH = 7

Where are the digestive enzymes made in the body?



Where enzyme is found and pH	Name of enzyme	Substrate
Mouth **pH 6.8**	Salivary Amylase	Starch
Stomach **pH 2-3**	Pepsin	Protein
Small intestine **pH 8**	Pancreatic Amylase Pancreatic Lipase Pancreatic Trypsin	Starch Fats Proteins


Pancre
Amylase
Stomach
Gall bladder
Pepsin
Common bile duct
Amylase, trypsin,lipase.
Pancreatic duct
Duodenum
Pancreas