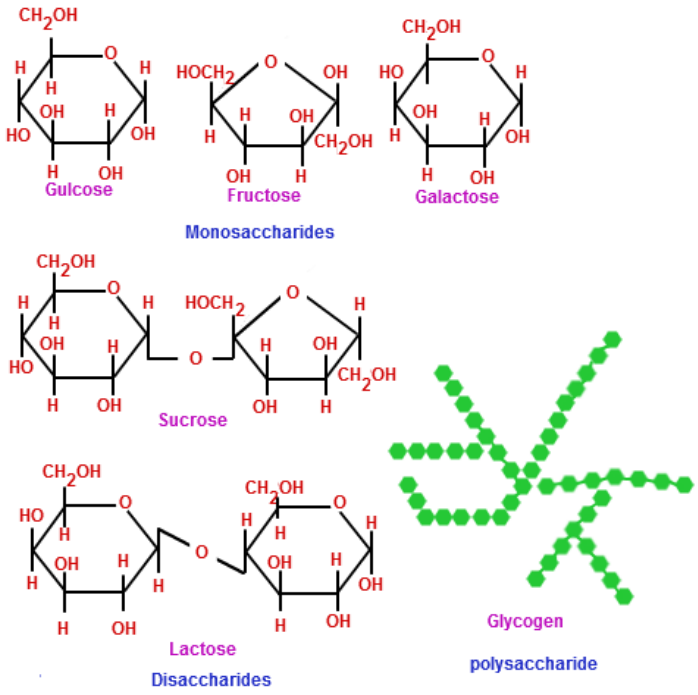
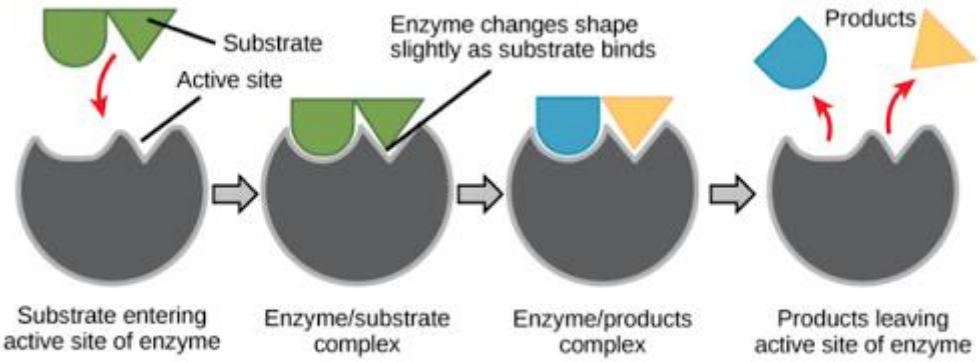
WJEC Medical Science

Summer Independent Learning





Medical Science Summer Independent Learning Activity.

Welcome to Medical Science, please complete **ALL** of the following tasks ready for your first day at New College.

You can print the booklet, write on the PDF file or answer the questions on paper.

Part 1: Structure of Carbohydrates, Lipids and Proteins

Task 1: Carbohydrate Structure

Task 2: Lipid Structure

Task 3: Protein Structure

Part 2: Enzymes

Task 4: Enzyme definitions.

Task 5: Interpreting enzyme graphs.

Task 6: Enzyme inhibition.

Part 3: Maths

Task 7: Calculating percentage change.

Task 8: Calculating ratios.

Task 9: Standard form

Part 4: Highly recommended additional content – the digestive system

Task 10: Structure of the digestive system

Task 11: Digestive enzymes

Part 5: Self-reflection.

Please be aware that you will have **an assessment** on these topics (excluding the digestive system) shortly after beginning the Medical Science course and the knowledge covered is essential to understanding the subsequent content. Many of the following tasks are GCSE

revision, but you will need to use specific A Level resources for some of the tasks. The following resources will be useful:

- www.youtube type in NCP Biology for our department's channel.
- GCSE notes and revision guides
- SENECA learning – sign up, enrol onto the Biology A level AQA course, within the Unit 1 section, there are sections for all these topics.

There is a mark Scheme to the exam questions at the end of the booklet

Part 1

Task 1: Structure of carbohydrates

Use the following video link to support your answers to this section:

https://www.youtube.com/watch?v=3g-_jgpE8UM

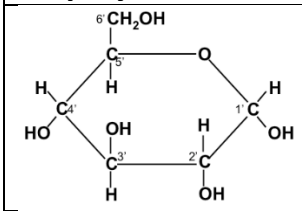
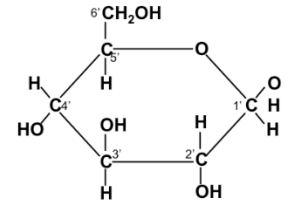
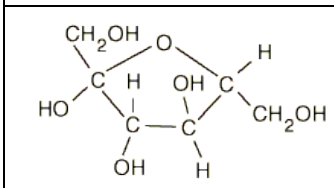
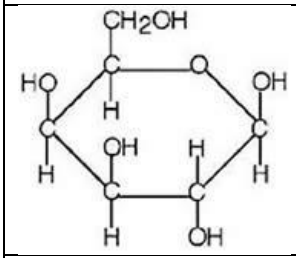
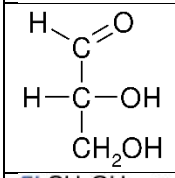
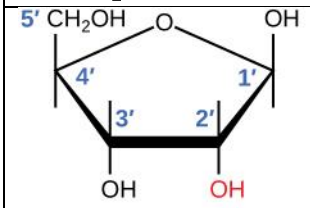
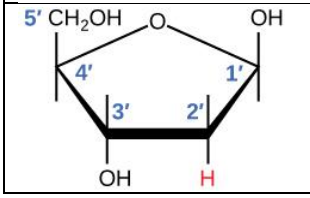
What is a monomer?

What is a polymer?

Describe the condensation reaction

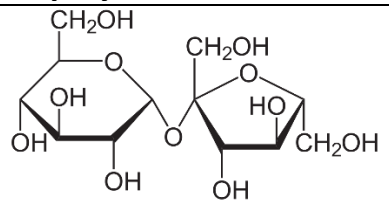
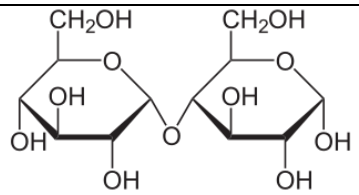
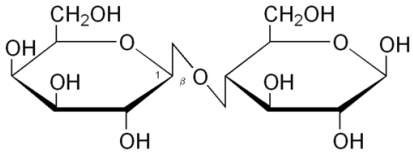
Describe the hydrolysis reaction

These molecules are ……, name the individual molecules:

Display formula	Formula	Name	Type of sugar
			
			
			
			
			
			
			

Describe how a disaccharide is formed:

These molecules are ……, name the individual molecules:

Display formula	Formula	Name	Made from
			
			
			

Draw a diagram to show how a condensation reaction occurs between two monosaccharides to form maltose. Label the bond that forms.

Describe how glycogen is formed. Include the monomer, the reaction and the bond formed.

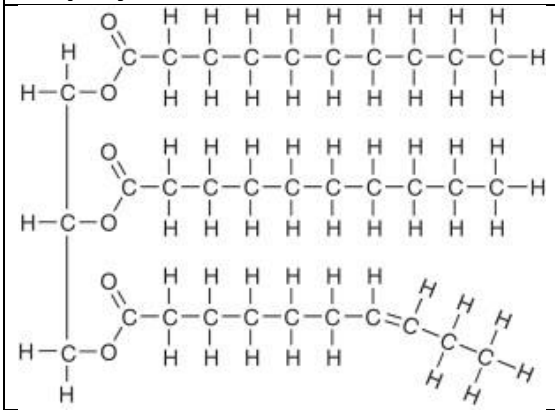
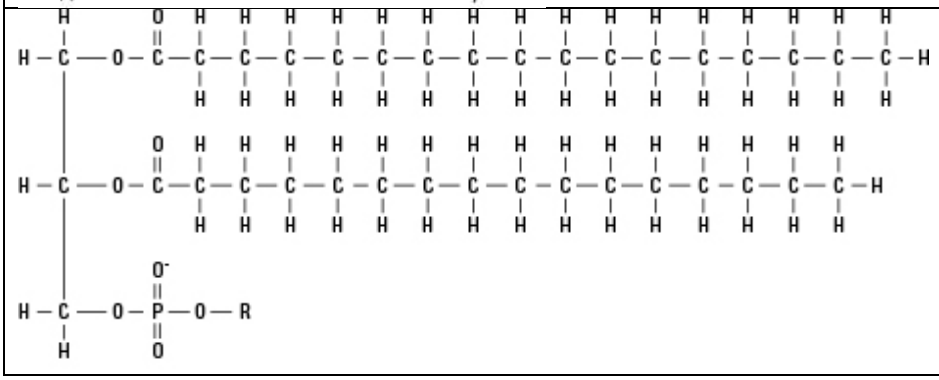
Draw a diagram of glycogen:

Explain what makes it a good storage molecule for glucose, inside cells:

Task 2: Lipid Structure

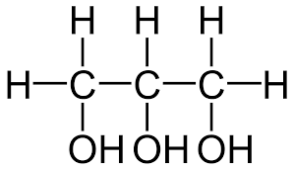
Use the following video link to support your answers to this section:

https://www.youtube.com/watch?v=N6_ajLm4KOo

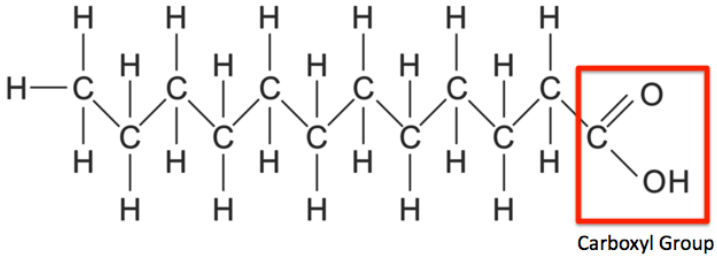
Display formula	Name
	
	

Draw a diagram to represent a triglyceride and a fatty acid.

What is the formula for glycerol?

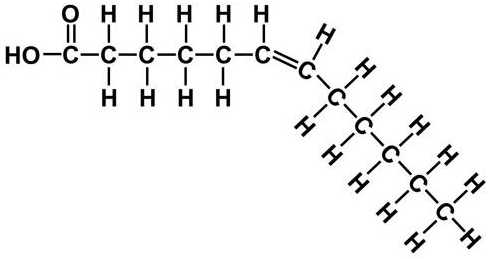


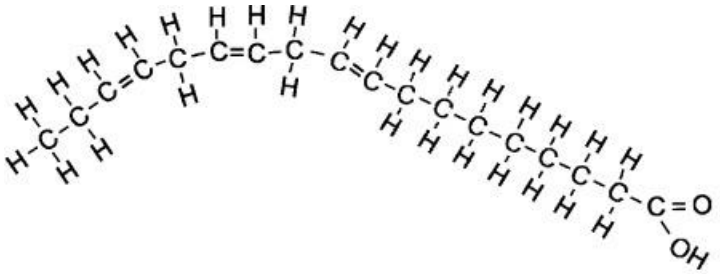
What is the general formula for a saturated fatty acid?



What does the term saturated mean when describing a fatty acid?

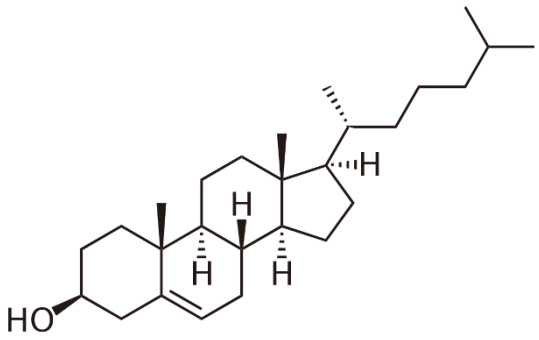
What is the difference between mono-unsaturated fatty acids and poly-unsaturated fatty acids?





	Triglyceride	Phospholipid
Function		
Properties		

Describe the structure of cholesterol:



How can you recognise a steroid hormone from its structure?

Give 2 examples of steroid hormones that are made from cholesterol:

What is cholesterol a vital component of?

Task 3: Protein structure

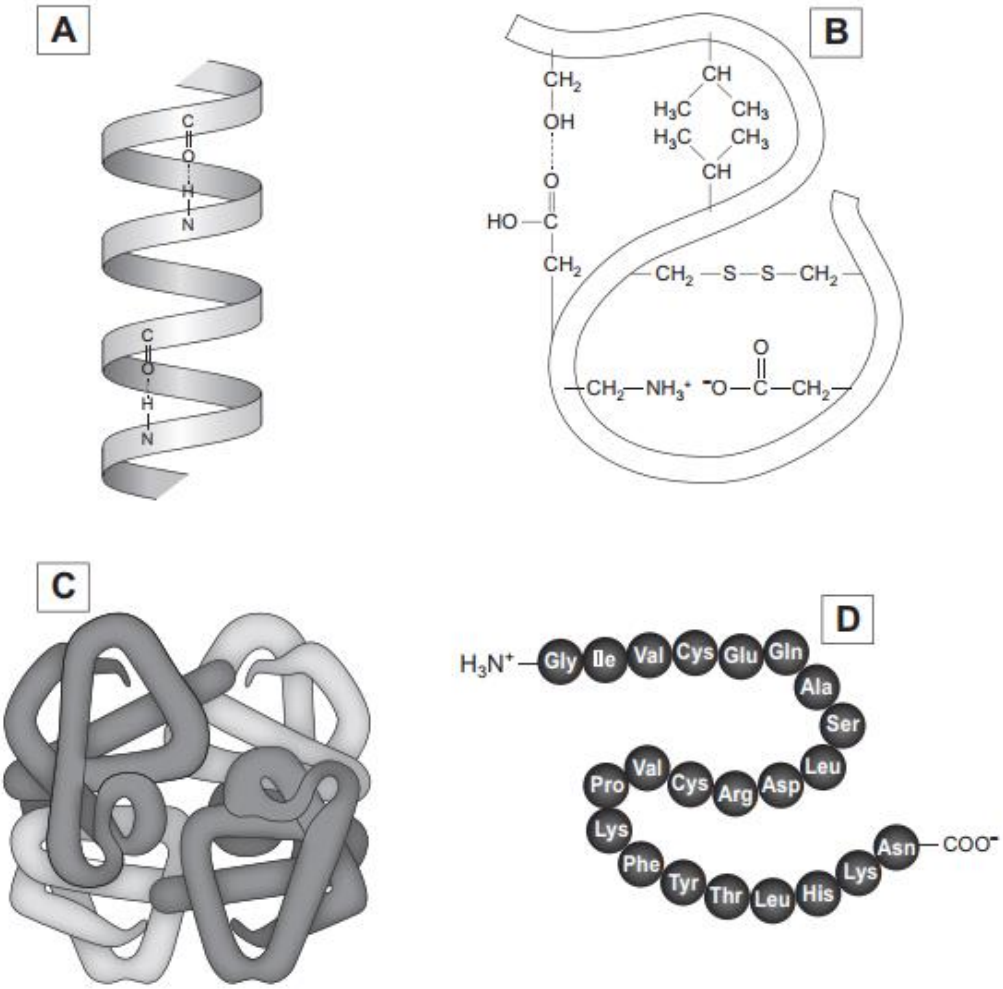
https://youtu.be/g1n4pS25k-c

Draw and label the general structure of an amino acid:

How do 2 amino acids differ?

How many different amino acids are coded for in proteins?

Label the structures within a protein and any bonds that are shown in the diagrams.



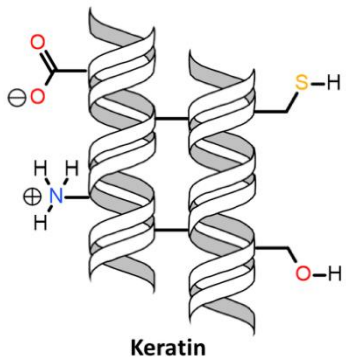
Describe the following protein structures, including the bonds that hold them together:

Primary Structure

Secondary Structure

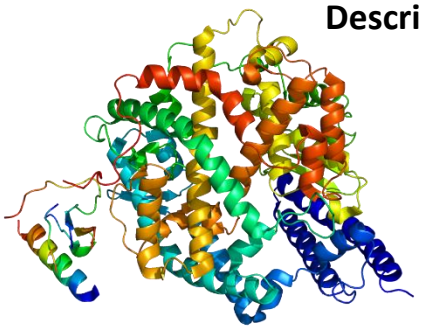
Tertiary Structure

Quaternary



Keratin

Describe how the structure of keratin affects its function:



Describe how the structure of an enzyme affects its function:

Part 2: Enzymes

Task 4: Enzyme definitions.

This section revises many of the key terms for GCSE to do with enzyme structure and function. A GCSE level question follows to assess your understanding. Whilst most of the definitions are from the GCSE specification you may find that some are unfamiliar to you.

https://www.youtube.com/watch?v=yoRcqcMEiVQ

Define these key words.

Enzyme:

Active site:

Substrate:

Activation energy:

Denature:

Q1. (a) Enzymes are used in body cells.

(i) What is an enzyme?

Draw a ring around the correct answer.

antibody	**biological catalyst**	**hormone**

(1)

(ii) All enzymes are made of the same type of substance.
What is this substance?
Draw a ring around the correct answer.

carbohydrate	**fat**	**protein**

(1)

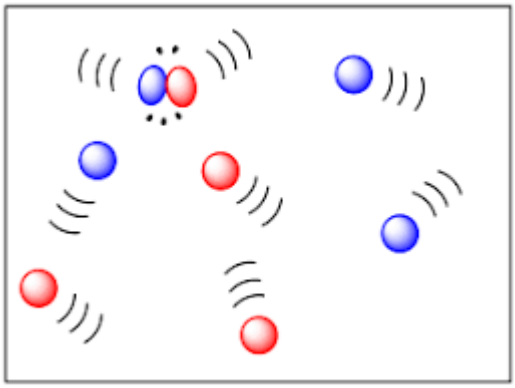
(iii) Where is the enzyme amylase produced in the human body?
Draw a ring around the correct answer.

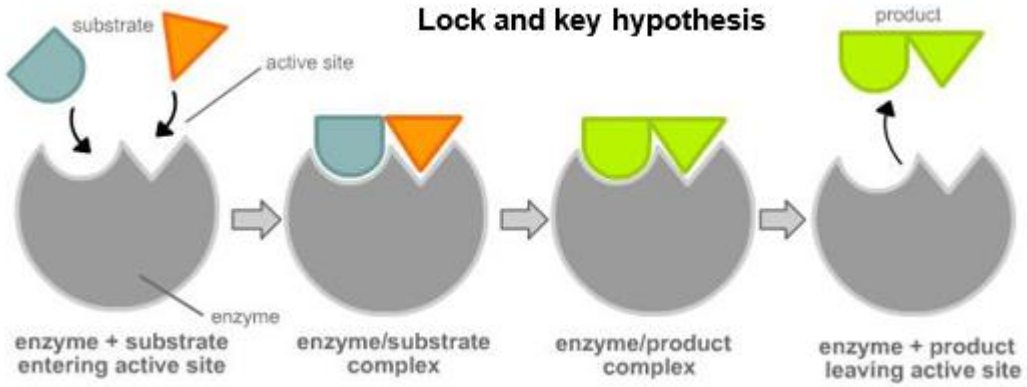
liver	**salivary glands**	**stomach**

(1)

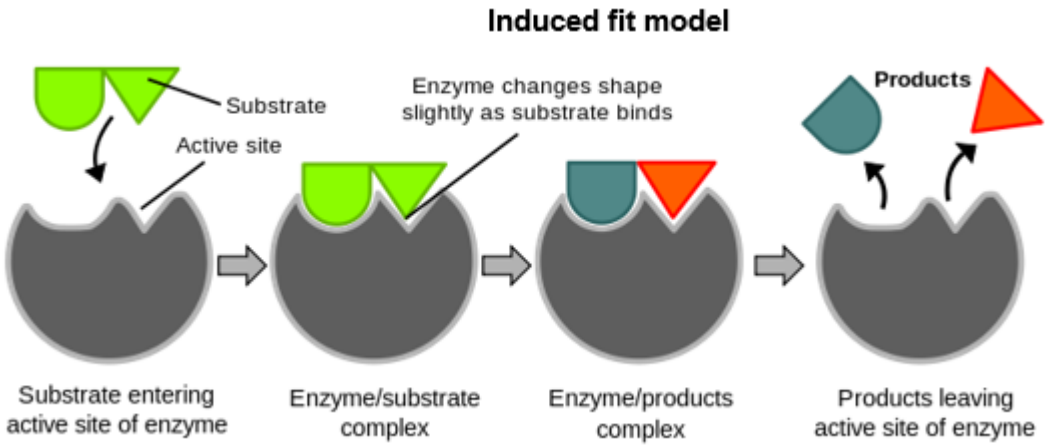
Enzyme reactions:

Use the diagram to describe how collision theory is involved in enzyme controlled reactions.





Use the diagram to describe the lock and key model of enzyme controlled reactions.



Use the diagram to describe the induced fit model of enzyme controlled reactions.

Task 5: Interpreting enzyme graphs.

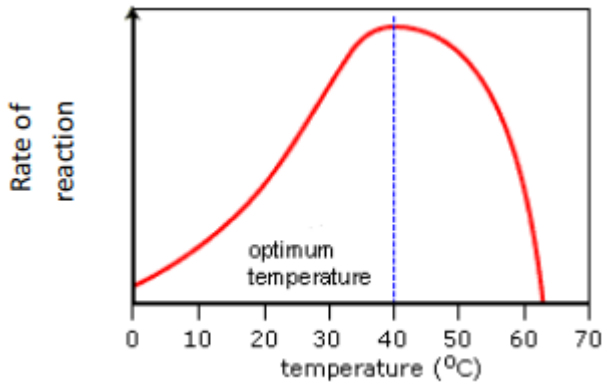
This section requires you to explain how different conditions affect enzyme activity.

Using the following link from our YouTube channel, watch the video and annotate each of the graphs.

You need to ***explain*** the shape of each graph in terms of enzyme activity.

https://www.youtube.com/watch?v=Pk3Lb2UHVcA&list=PL0Mjub5NT755dp8xUfC-yoXlbPTcjVM1i&index=9&t=0s

Q1. Change in temperature.



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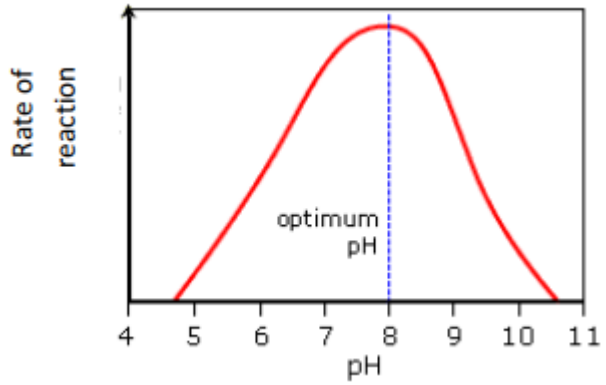
Q2. Change in pH.



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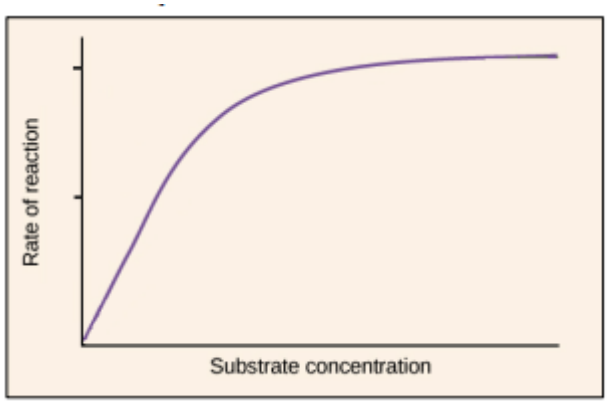
Q3. Change substrate concentration.



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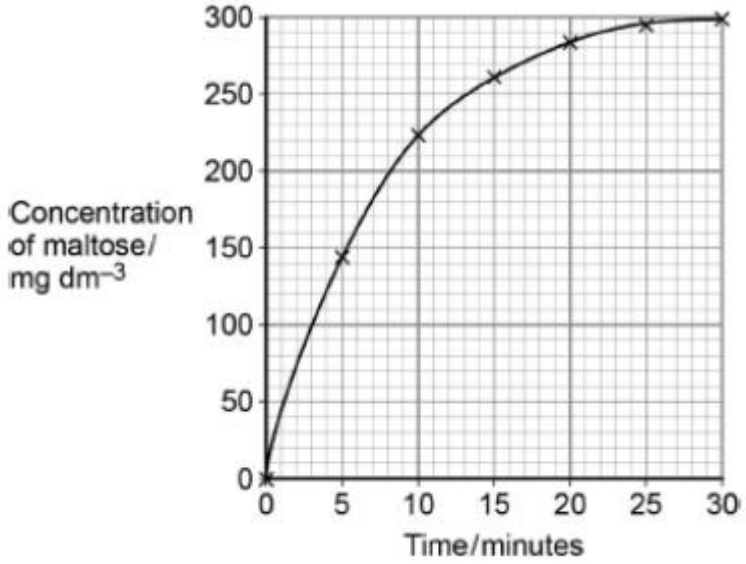
Q4. A scientist investigated the hydrolysis of starch. He added amylase to a suspension of starch and measured the concentration of maltose in the reaction mixture at regular intervals.

His results are shown in the graph below.



Explain the results shown in the graph.

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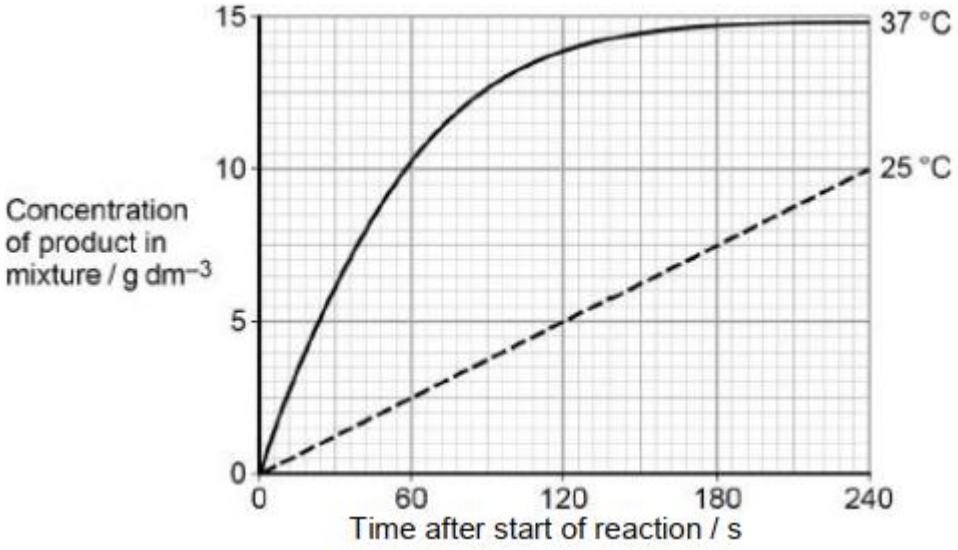
(2)

Q2. A technician investigated the effect of temperature on the rate of an enzyme-controlled reaction. At each temperature, he started the reaction using the same volume of substrate solution and the same volume of enzyme solution.

The figure below shows his results.



(a) Describe and explain the differences between the two curves.

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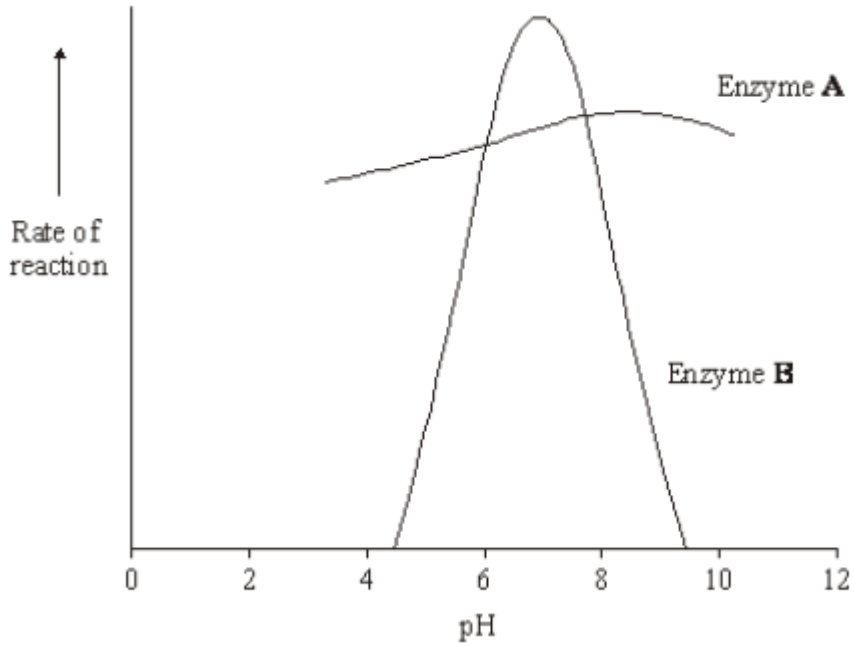
(5)

Q3. Enzymes **A** and **B** digest protein. The graph shows the effect of pH on the rates of reaction of these enzymes.



(a) Pepsin is a protein-digesting enzyme found in the stomach. It has an optimum pH of 2 and is fully denatured at pH 6. Sketch a curve on the graph to show the effect of pH on the rate of reaction of pepsin.

(1)

(b) Explain why the rate of reaction of enzyme **B** is low at pH 5.

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(3)

Task 6: Enzyme inhibition.

This section requires you to explain how different inhibitor molecules affect enzyme activity, together with how you can identify which type of inhibition is present.

A Level exam questions follow to assess your understanding.

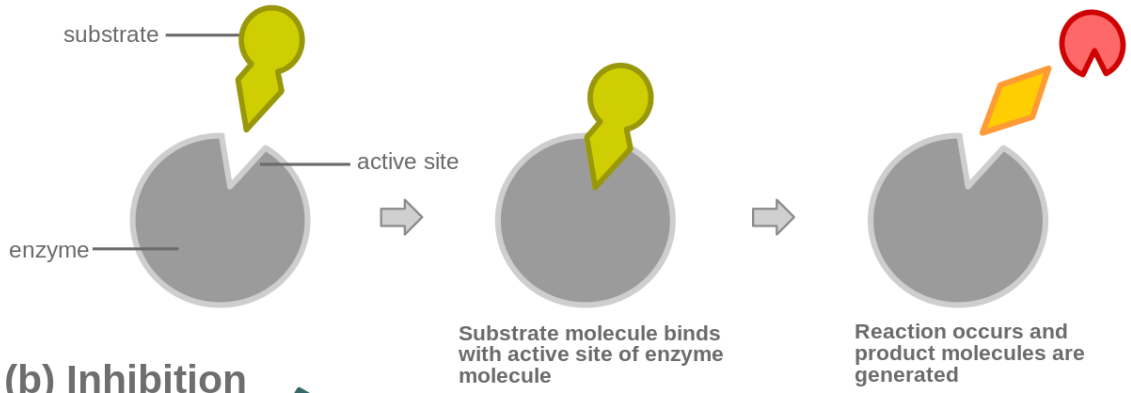
Using the following link watch the video and annotate each of the diagrams.

You need to ***explain*** how each inhibitor affects enzyme activity.

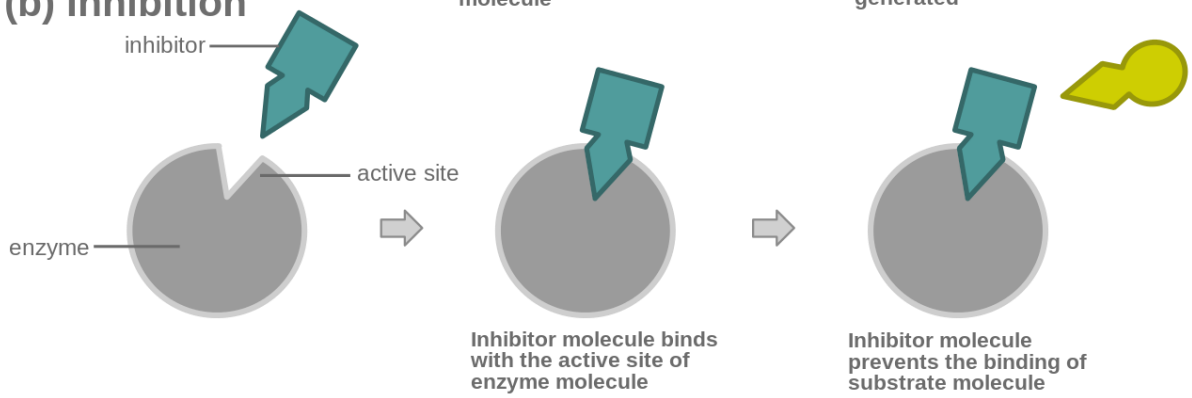
https://www.youtube.com/watch?v=aJF6yIYahAQ

Competitive inhibition

(a) Reaction



(b) Inhibition



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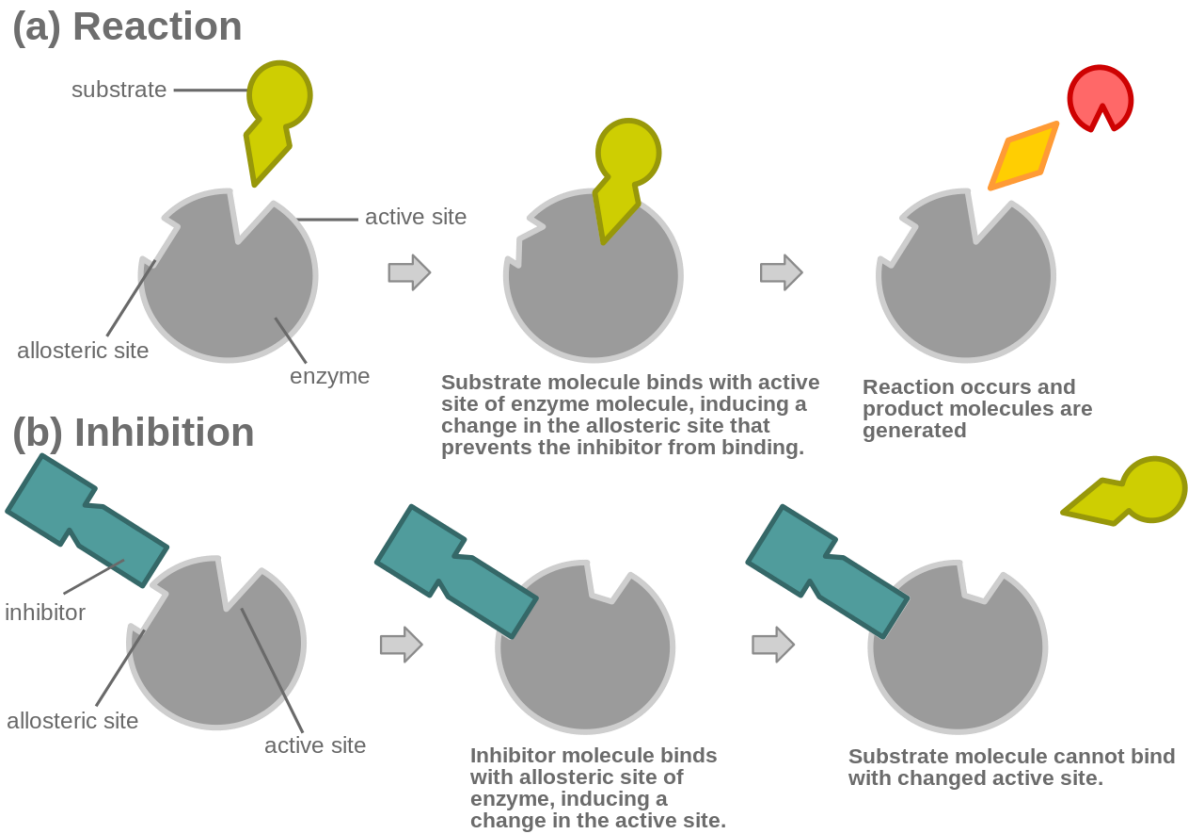
Non-competitive inhibition.



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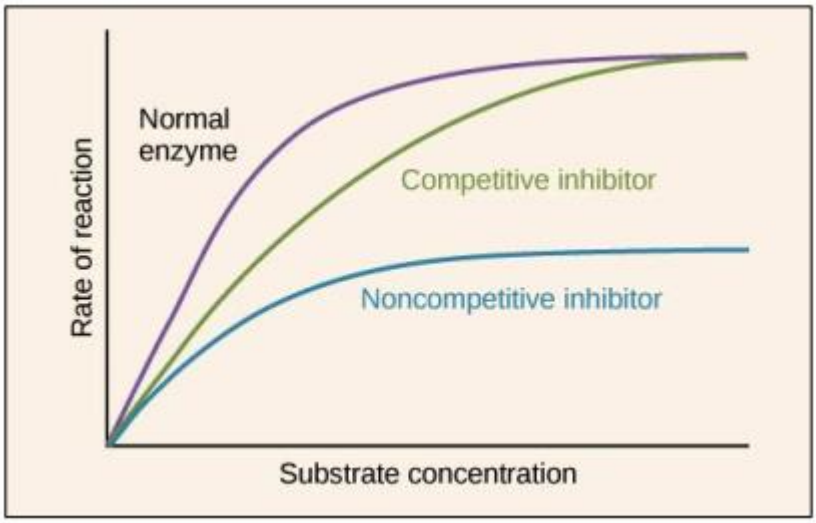
Explain the shape of both inhibitor lines, including how you can identify the type of inhibition.



Competitive inhibitor:

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Non-competitive inhibitor:

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Q1. Scientists have investigated the effects of competitive and noncompetitive inhibitors of the enzyme maltase.

Describe competitive and non-competitive inhibition of an enzyme.

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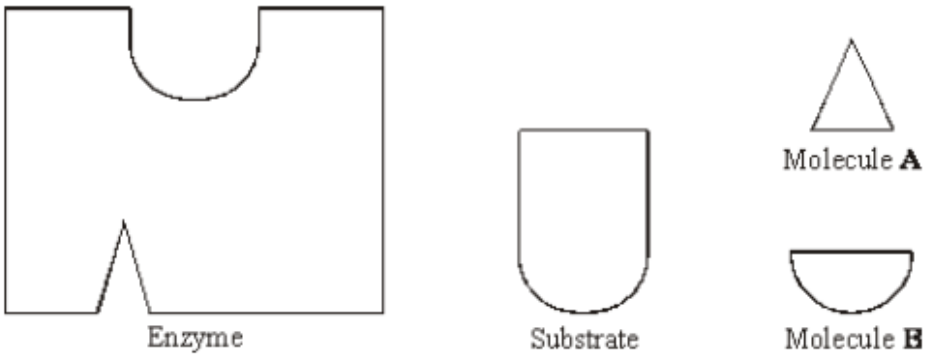
(5)

Q2. The diagrams represent an enzyme, its substrate and two other molecules, **A** and **B**.



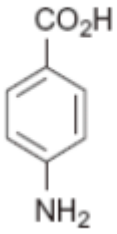
The addition of a non-competitive inhibitor will prevent the formation of an enzyme-substrate complex. Draw a labelled diagram based on relevant molecules selected from the diagram above to explain how this occurs.

(2)

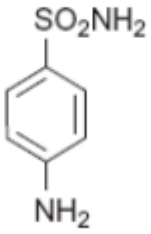
Q3. Folic acid is a substance required by bacteria for cell growth. Bacteria produce folic acid by the following reaction.

The diagram shows the structure of a molecule of PABA. It also shows the structure of a molecule of a drug called sulfanilamide, which can be used to treat bacterial infections. Sulfanilamide prevents bacteria producing folic acid.

PABA



sulfanilamide



Use the diagram and your knowledge of enzymes to explain how sulphanilamide prevents bacteria producing folic acid.

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(Total 3 marks)

Part 3: Maths

Task 7: Calculating percentage change.

This section requires you to understand how to calculate percentage change from given data. This is a common skill required in exams. Read the worked examples and complete the questions.

You **MUST** show your working.

https://www.youtube.com/watch?v=CbfxFBfB7kk&list=PL0Mjub5NT756MyHewhXhdRSIygaF_woF3&index=4&t=0s **from 2:10** on the NCP Biology You tube channel in order to help you with the follow section.

$$\text{Percentage change} = \frac{\text{Change}}{\text{Original}} \times 100$$

Worked example.

The mean height of some seedlings is 12mm at day 6 and 18mm at day 12.
What is the % change in height?

$$\%\ \text{change} = \frac{(18-12)}{12} \times 100 = 50\%$$

1. The table shows how environmental temperature affects the food intake, water intake and milk production of cows in a fixed period of time.

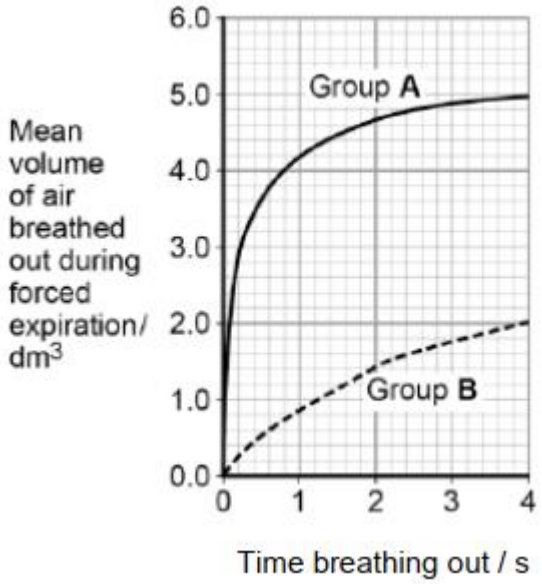
Environmental temperature / °C	**Food intake / kg**	**Water intake / dm3**	**Milk production / dm3**
20	18.2	81.8	27.0
25	17.7	88.6	25.0
30	17.0	95.0	22.9
35	16.7	144.1	18.0

Calculate the percentage decrease in milk production between the temperatures of 30 °C and 35 °C. Show your working. Answer

..... %

Q2. Forced expiration volume (FEV) is the volume of air a person can breathe out in 1 second.

Using data from the first second of forced expiration, calculate the percentage decrease in the FEV for group **B** compared with group **A**.



..... %

Task 8: Calculating ratios.
This section requires you to understand how to calculate ratios from given data.

This is a common skill required in exams. Read the worked examples and complete the questions.
You **MUST** show your working.

You may wish to watch the https://www.youtube.com/watch?v=CbfxFBfB7kk&list=PL0Mjub5NT756MyHewhXhdRSIygaF_woF3&index=4&t=0s **from 0:30** video on the NCP Biology You tube channel in order to help you with the follow section

A ratio is a way to compare amounts of something. Recipes, for example, are sometimes given as ratios. To make pastry you may need to mix 2 parts flour to 1 part fat. This means the ratio of flour to fat is 2:1

When calculating a ratio divide the first value by the second value then divide the second value by itself.

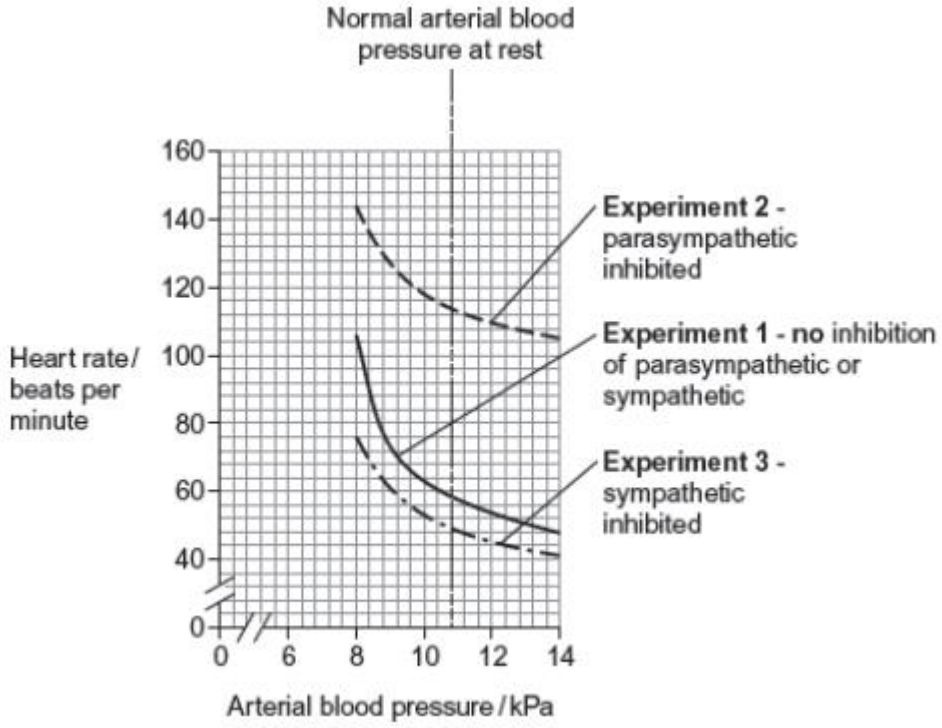
Worked example.
A zoo has a population of monkeys. 56 are female and 19 are male. What is the ratio of females to males?

$\frac{56}{19} = 1.3$ $\frac{19}{19} = 1$ *the ratio is 1.3:1*

It is important that the number are presented in the same order as the question. In this case it is female's first them males.

Q2. Doctors investigated the relationship between heart rate and arterial blood pressure. They recruited healthy volunteers. For each volunteer, they recorded their normal arterial blood pressure at rest. With each volunteer, they then carried out the following experiments.

The graph shows the results for one volunteer.



Calculate the ratio of heart rate in **experiment 2** to heart rate in **experiment 3** at an arterial blood pressure of 10 kPa.
Show your working.

Answer = ...
(2)

Q3. Researchers investigated some characteristics of people from different parts of England. In the north of England they selected 200 people and recorded their phenotypes for three different characteristics.
Their results are shown in the figure below.

Phenotype produced by dominant allele	**Number of people**	**Phenotype produced by recessive allele**	**Number of people**
Tongue roller	131	Non-tongue roller	58
Right-handed	182	Left-handed	14
Straight thumb	142	Hitch-hiker thumb	50

Calculate the ratio of straight thumb to hitch-hiker thumb in this study.

Ratio = ... **(1)**

Task 9: Standard Form

The Rules of Standard Form Calculation

Multiplying numbers in standard form

Multiply the main numbers first then add the powers together.

Dividing numbers in standard form

Divide the main numbers first then subtract the second power from the first.

The Rules of Working with Negative and Positive numbers

Adding a negative number is the same as subtracting:

eg 7 + (−3) is the same as 7 − 3 = 4

Subtracting a negative number is the same as adding:

eg (−5) − (−2) is the same as (−5) + 2 = −3

- Positive × positive = **positive**
- Positive × negative = **negative**
- Negative × positive = **negative**
- Negative × negative = **positive**

If the signs are the **same**, the answer is **positive**. If the signs are **different**, the answer is **negative**.

Note - you can use a scientific calculator in all exams so make sure you can carry out calculations involving standard form on a calculator.

CONVERTING SCIENTIFIC NOTATION TO STANDARD FORM:

2.4×10^9

1. THIS NUMBER IS WRITTEN IN SCIENTIFIC NOTATION.
2. TO CHANGE IT TO STANDARD FORM, SIMPLY MOVE THE DECIMAL 9 PLACES TO THE RIGHT BECAUSE THE EXPONENT OR POWER OF 10 IS 9.

0.0000000024

0.0050 mol dm–3

is equivalent to

5.0 × 10–3 mol dm–3

E.g. $0.56 = 5.6 \times 10^{-1}$

$0.0564 = 5.64 \times 10^{-2}$

$0.005648 = 5.648 \times 10^{-3}$

$0.00231 = 2.31 \times 10^{-3}$

Standard Form Worksheet

[C] indicates a calculator can be used

1. Write these ordinary numbers in Standard Index Form

a. 30000 b. 420000 c. 545000 d. 26750.7 e. 105000000

f. 0.0078 g. 0.00000672 h. 780.5 i. 0.0603 j. 0.00000901

2. Write these numbers that are in Index Form as an ordinary number

a. 3×10^4 b. 6.5×10^7 c. 12.6×10^6 d. 0.6×10^2 e. 6.251×10^8

f. 4×10^{-5} g. 7.21×10^{-4} h. 0.03×10^{-3} i. 9.887×10^{-6} j. 12.999×10^{-6}

3. Work out the following giving your answer in Standard Index Form **[C]**

a. $3.4 \times 10^5 \times 2.5 \times 10^7$ b. $8.4 \times 10^3 \times 2.1 \times 10^4$ c. $5.8 \times 10^{-3} \times 0.25 \times 10^7$

d. $0.034 \times 10^4 \times 7.1 \times 10^9$ e. $13.4 \times 10^5 \times 3.1 \times 10^7 \times 3$

4. Work out the following giving your answer in Standard Index Form

a. $\dfrac{8\times10^7}{2\times10^3}$ b. $\dfrac{6.2\times10^7}{3.1\times10^{-2}}$ c. $\dfrac{26\times10^{-6}}{2\times10^{-3}}$ d. $\dfrac{10\times10^{10}}{0.01\times10^{-4}}$

5. If $p = 3.41 \times 10^6$ and $q = 12.1 \times 10^{-2}$. Find in standard Index Form **[C]**

a. $p \times q$ b. $p \div q$ c. $2p \times 6q$ d. $p^2 \div q$

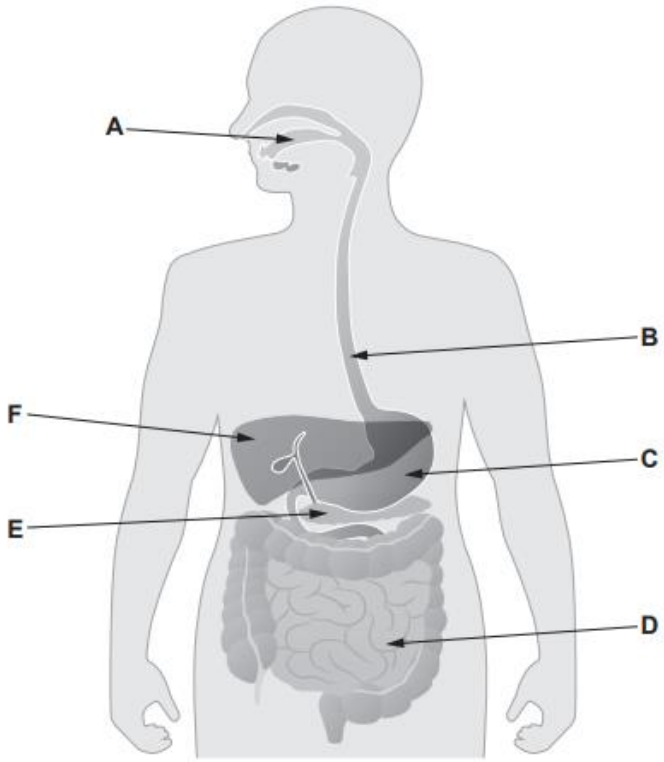
Highly Recommended Additional content:

The digestive system

https://www.youtube.com/watch?v=ZTKkTitquuM

Task 10: Structure of the digestive system

The diagram shows the human digestive system. Add labels to parts A-F.



Complete the table:

Name of organ	Function in digestion	Secretions produced
A		
B		
C		
D		
E		
F		

Describe the role of the following secretions in the digestive system:

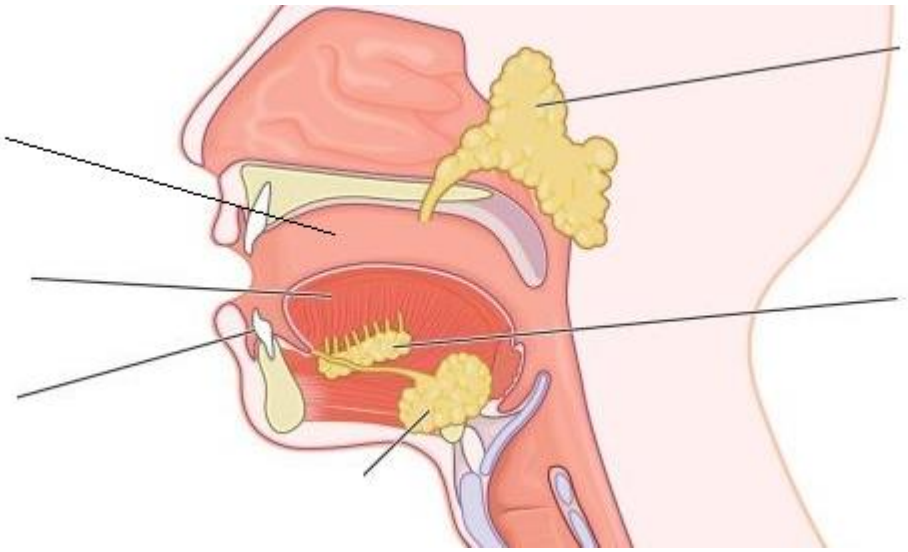
Hydrochloric acid:

Mucus:

Saliva:

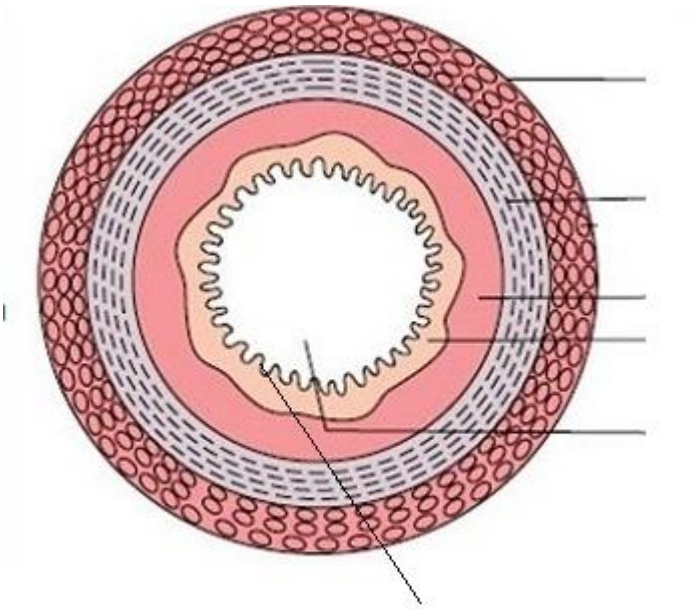
Bile:

Label the diagram of the mouth:



Give the functions of the different parts of the mouth:

Label the diagram of the gut wall:



Complete the table to give the function of each layer of the gut wall

Name of layer	Function
Epithelium	
Mucosa	
Submucosa	
Muscle Layers	
Serosa	

Task 11: Digestive enzymes

Complete the table to show your understanding of digestive enzymes:

Enzyme(s)	Site of enzyme production	Biological molecules broken down	Product(s) of digestion
pepsinogen	gastric glands	peptides	amino acids
trypsinogen	.....	.....	amino acids
lactase	small intestine	lactose	.....
.....	small intestine	.....	fructose, α glucose
.....	small intestine	maltose	α glucose

Task 12: Self-reflection

Having completed all of the tasks please complete the self-reflection table below. This both you and us to identify your individual areas of strength and those that require improvement.

1= very confident/fully covered at GCSE

10= Not at all confident/not at all covered at GCSE

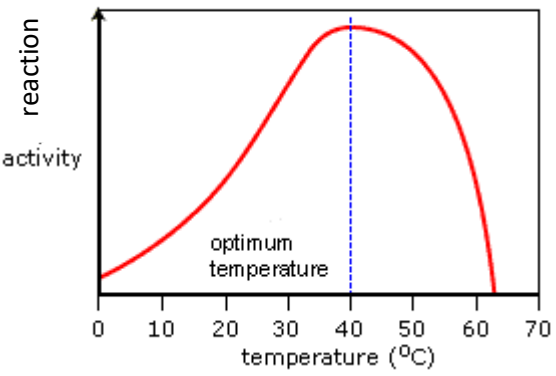
Have a good summer and we will see you in September!

Task number	**How confident you were with it (1-10)**	**How much you had covered at GCSE (1-10)**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

Any Comments and/or questions:

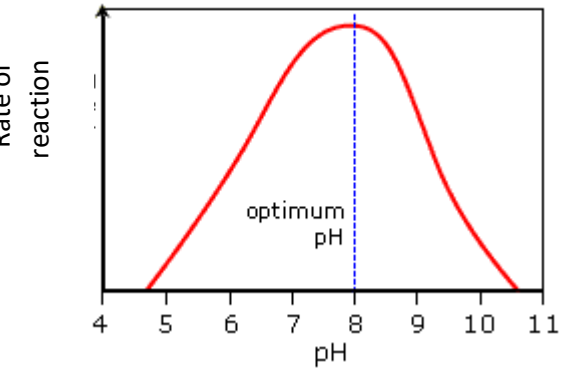
Mark Scheme
Task 5: Interpreting enzyme graphs.

Q1.



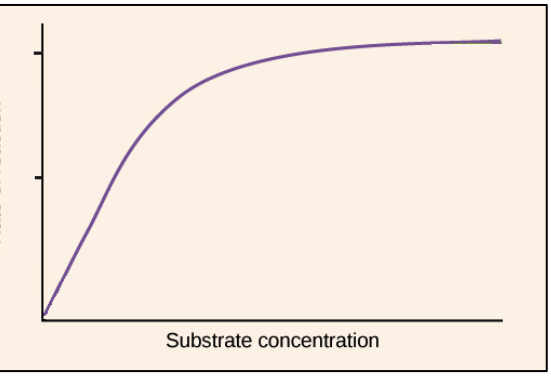
Change in temperature.
As temperature increase the enzyme & substrate gain more kinetic energy. There are more frequent successful collision, this increases the rate of reaction to its optimum at 400C. After this the increase in temperature causes H bonds to break. This means both the secondary and tertiary structures are lost and the enzymes active site is no longer complimentary to the substrate. The enzyme is denatured and the rate of reaction drops. No Enzyme substrate complexes can form.

Q2.



Change in pH.
Any change in pH causes H bonds to break. This means both the secondary and tertiary structures are lost and the enzymes active site is no longer complimentary to the substrate. The enzyme is denatured and the rate of reaction drops. No Enzyme substrate complexes can form.

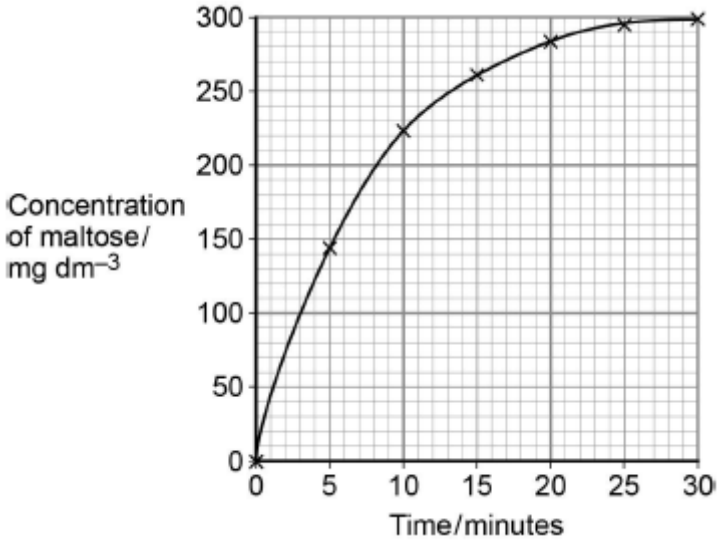
Q3.



Change substrate concentration.
An increase in substrate increases rate of reaction as there is an increased chance in enzymes substrate complexes forming. At a certain substrate concentration the rate of reaction plateaus. This is due to the enzymes actives sites becoming saturated with substrate.

Q1. A scientist investigated the hydrolysis of starch. He added amylase to a suspension of starch and measured the concentration of maltose in the reaction mixture at regular intervals.

His results are shown in the graph below.



Explain the results shown in the graph.

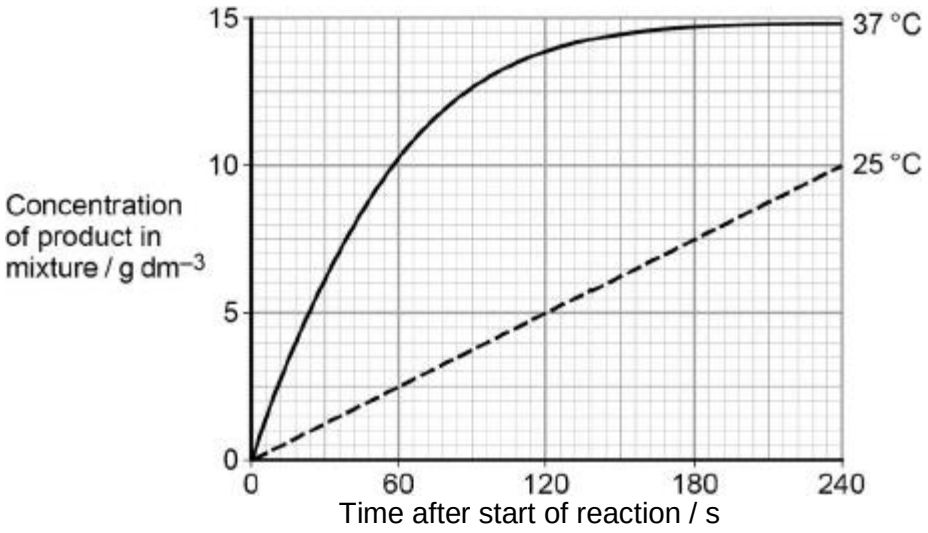
1. (Rate of) increase in concentration of maltose slows as substrate/starch is used up
   OR
   High initial rate as plenty of starch/substrate/more E-S complexes;
   Reject ref. to amylase being used up

2. No increase after 25 minutes/at end/levels off because no substrate/starch left;
   Accept 'little'
   Ignore references to substrate a limiting factor

(2)

Q2. A technician investigated the effect of temperature on the rate of an enzyme-controlled reaction. At each temperature, he started the reaction using the same volume of substrate solution and the same volume of enzyme solution.

The figure below shows his results.



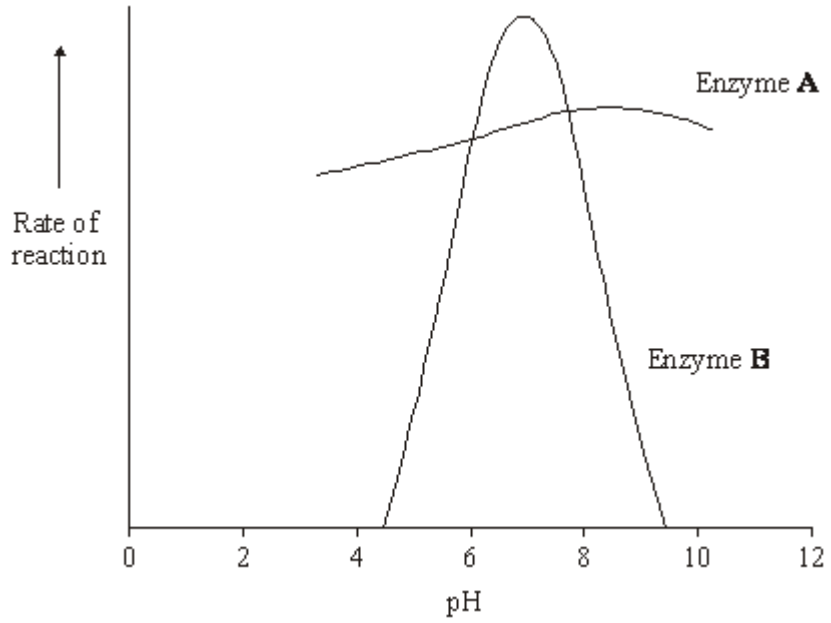
(a) Describe and explain the differences between the two curves.

1. Initial rate of reaction faster at 37 °C;
2. Because more kinetic energy;
3. So more E–S collisions / more E–S complexes formed;
4. Graph reaches plateau at 37 °C;
5. Because all substrate used up.

Allow converse for correct descriptions and explanations for curve at 25 °C

(5)

Q3. Enzymes **A** and **B** digest protein. The graph shows the effect of pH on the rates of reaction of these enzymes.



(a) Pepsin is a protein-digesting enzyme found in the stomach. It has an optimum pH of 2 and is fully denatured at pH 6. Sketch a curve on the graph to show the effect of pH on the rate of reaction of pepsin.

curve rising to peak at pH 2 and falling to zero by pH 6;

(1)

(b) Explain why the rate of reaction of enzyme **B** is low at pH 5.

(change in pH) leads to breaking of bonds holding tertiary structure / changes charge on amino acids; enzyme / protein / active site loses shape / denatured; substrate will not bind with / fit active site / fewer / no ES complexes formed;

(3)

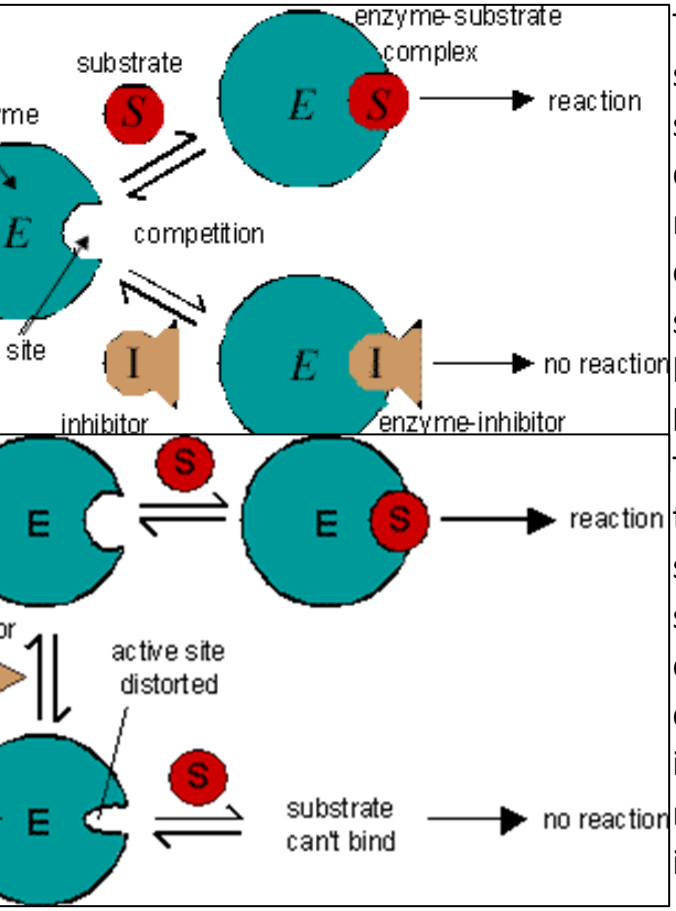
Task 6: Enzyme inhibition.

This section requires you to explain how different inhibitor molecules affect enzyme activity, together with how you can identify which type of inhibition is present.

A Level exam questions follow to assess your understanding.

Using the following link watch the video and annotate each of the diagrams. You need to ***explain*** how each inhibitor affects enzyme activity.

https://www.youtube.com/watch?v=aJF6yIYahAQ



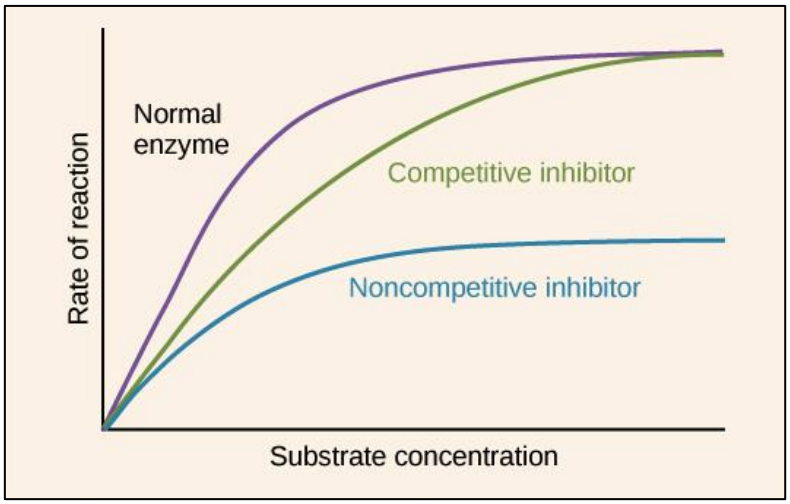
Competitive inhibition

The inhibitor molecule is a SIMMILAR shape to the substrate. It binds to the active site meaning enzyme substrate complexes are unable to form. This decreases the rate of reaction. This is a reversible reaction. Adding more substrate will increase the rate of reaction as there is more chance of enzyme substrate complexes forming rather than the inhibitor binding to the active site.

Non-competitive inhibition.

The inhibitor molecule binds to the inhibitor site on the enzyme. This changes the shape of the active site so that it is no longer complementary to the substrate. The substrate is unable to bind with the enzymes active site and no enzyme substrate complexes form. The rate of reaction decreases. This is a reversible reaction. Adding more substrate will not increase the rate of reaction as the chance of the inhibitor binding to the inhibitor site is not affected.

Explain the shape of both inhibitor lines, including how you can identify the type of inhibition.



Competitive inhibitor:
The rate or reaction is lower than an enzyme without an inhibitor. This is because. The inhibitor molecule is a SIMMILAR shape to the substrate. It binds to the active site meaning enzyme substrate complexes are unable to form. This decreases the rate of reaction. The inhibitor can be identified because adding more substrate will increase the rate of reaction as there is more chance of enzyme substrate complexes forming rather than the inhibitor binding to the active site.

Non-competitive inhibitor:
The rate of reaction is lower than both normal and competitive inhibitor lines. This is because the inhibitor molecule binds to the inhibitor site on the enzyme. This changes the shape of the active site so that it is no longer complementary to the substrate. The substrate is unable to bind with the enzymes active site and no enzyme substrate complexes form. The rate of reaction is lower. Adding more substrate will not increase the rate of reaction because the chance of the inhibitor binding to the inhibitor site is not affected be the concentration of substrate

Q1. Scientists have investigated the effects of competitive and non-competitive inhibitors of the enzyme maltase.

Describe competitive and non-competitive inhibition of an enzyme.

1. Inhibitors reduce binding of enzyme to substrate / prevent formation of ES complex;

Max 3 if only one type of inhibition dealt with. Accept maltase and maltose as examples of enzyme and substrate (and others)

Only once, for either inhibitor

(Competitive inhibition),

2. Inhibitor similar shape (idea) to substrate;

3. (Binds) in to active site (of enzyme);

Accept allows max rate of reaction to be reached / max product will eventually be formed

Accept complementary to active site

4. (Inhibition) can be overcome by more substrate;

(Non-competitive inhibition),

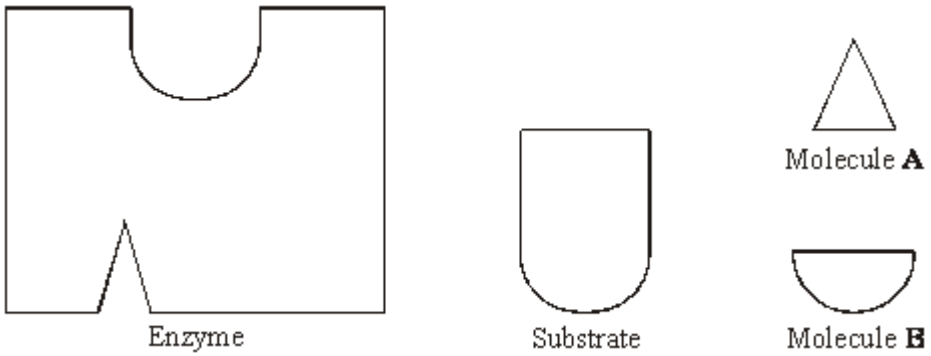
5. Inhibitor binds to site on enzyme other than active site;

6. Prevents formation of active site / changes (shape of) active site;

Accept does not allow max rate of reaction to be reached / max product will not be formed

7. Cannot be overcome by adding more substrate; **(5)**

Q2. The diagrams represent an enzyme, its substrate and two other molecules, **A** and **B**.

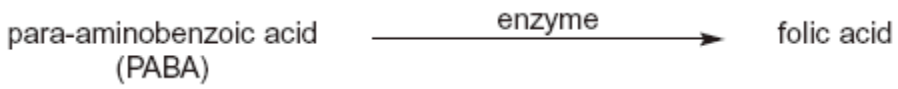


The addition of a non-competitive inhibitor will prevent the formation of an enzyme-substrate complex. Draw a labelled diagram based on relevant molecules selected from the diagram above to explain how this occurs.

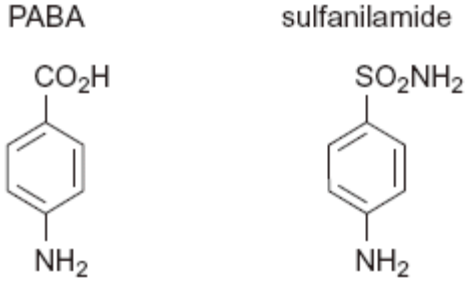
diagram showing molecule **A** fitting in inhibition site; distortion of active site;

(2)

Q3. Folic acid is a substance required by bacteria for cell growth. Bacteria produce folic acid by the following reaction.



The diagram shows the structure of a molecule of PABA. It also shows the structure of a molecule of a drug called sulfanilamide, which can be used to treat bacterial infections. Sulfanilamide prevents bacteria producing folic acid.



Use the diagram and your knowledge of enzymes to explain how sulphanilamide prevents bacteria producing folic acid.

Similar structure / shape (to PABA) / both complementary;

Competes for / binds to active site / competitive inhibitor;

Less PABA binds / less E-S complexes;

OR

Specific reference to different structure / shape (to PABA) using the diagram;

Binds to position other than active site / binds to allosteric site / binds to inhibitor site / non-competitive inhibitor;

Changes the active site so substrate cannot bind / less PABA binds / less E-S complexes **(Total 3 marks)**

Task 7: Calculating percentage change.

This section requires you to understand how to calculate percentage change from given data. This is a common skill required in A Level Biology exams. Read the worked examples and complete the questions.

You **MUST** show your working.

You may wish to watch the **"General maths you need to know"** video on the NCP Biology You tube channel in order to help you with the follow section.

$$\text{Percentage change} = \frac{\text{Change}}{\text{Original}} \times 100$$

Worked example.

The mean heigh of some seedlings is 12mm at day 6 and 18mm at day 12. What is the % change in height?

$$\%\ \text{change} = \frac{(18-12)}{12} \times 100 = 50\%$$

1. The table shows how environmental temperature affects the food intake, water intake and milk production of cows in a fixed period of time.

Environmental temperature / °C	Food intake / kg	Water intake / dm^3	Milk production / dm^3
20	18.2	81.8	27.0
25	17.7	88.6	25.0
30	17.0	95.0	22.9
35	16.7	144.1	18.0

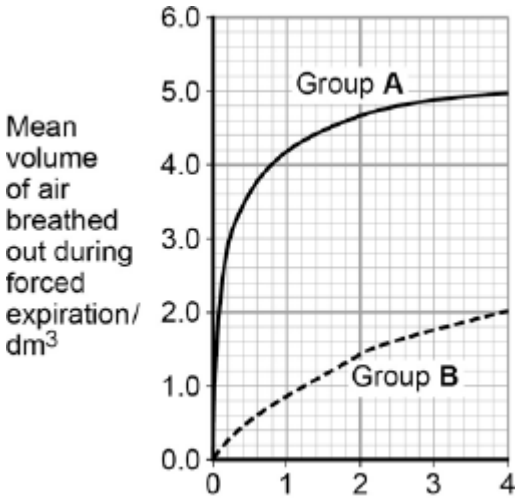
Calculate the percentage decrease in milk production between the temperatures of 30 °C and 35 °C. Show your working.

$$\frac{18-22.9}{22.9} \times 100 = 21.4\%$$

Answer ..... %

Q2. Forced expiration volume (FEV) is the volume of air a person can breathe out in 1 second.

Using data from the first second of forced expiration, calculate the percentage decrease in the FEV for group **B** compared with group **A**.



<u>0.8-4.2</u>

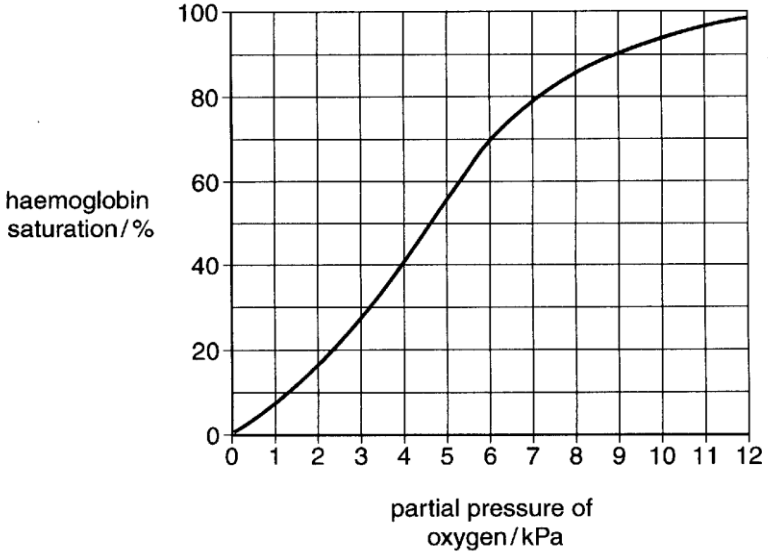
4.2 x100 = 80%

Answer ..... %

Q3. What is the **percentage change** in the saturation of haemoglobin between 4 and 9 kPa O_2?

90-40 = 50%

Answer ..... %



Task 8: Calculating ratios.

This section requires you to understand how to calculate ratios from given data. This is a common skill required in A Level Biology exams. Read the worked examples and complete the questions.

You **MUST** show your working.

You may wish to watch the **"General maths you need to know"** video on the NCP Biology You tube channel in order to help you with the follow section

A ratio is a way to compare amounts of something. Recipes, for example, are sometimes given as ratios. To make pastry you may need to mix 2 parts flour to 1 part fat. This means the ratio of flour to fat is 2:1

When calculating a ratio divide the first value by the second value then divide the second value by itself.

Worked example.

A zoo has a population of monkeys. 56 are female and 19 are male. What is the ratio of females to males?

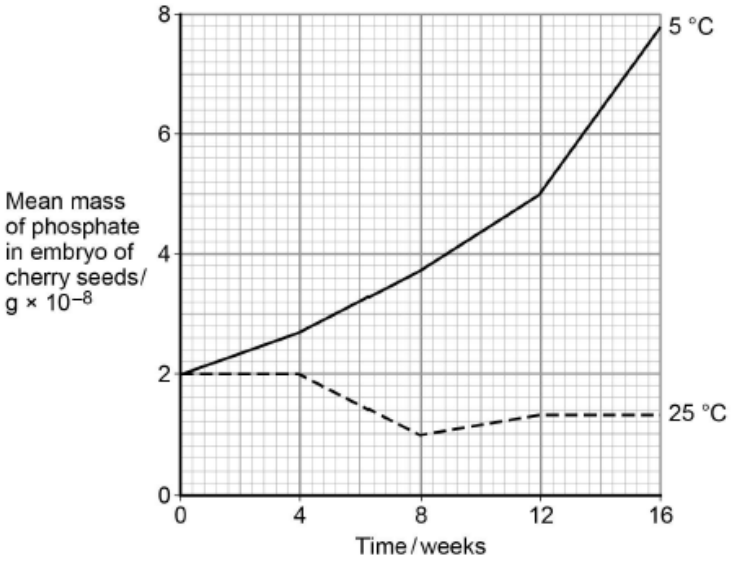
$\frac{56}{19} = 1.3$ $\quad\quad$ $\frac{19}{19} = 1$ *the ratio is 1.3:1*

It is important that the number are presented in the same order as the question. In this case it is female's first them males.

Q1. The seeds of some plant species require chilling (exposure to low temperatures) before the embryos they contain grow into plants. During chilling, storage molecules in the seed that contain phosphate are broken down and phosphates are transported to the embryo.

Scientists investigated the change in the mass of phosphate in the embryos of cherry seeds exposed to two different temperatures for 16 weeks.

The following graph shows their results.



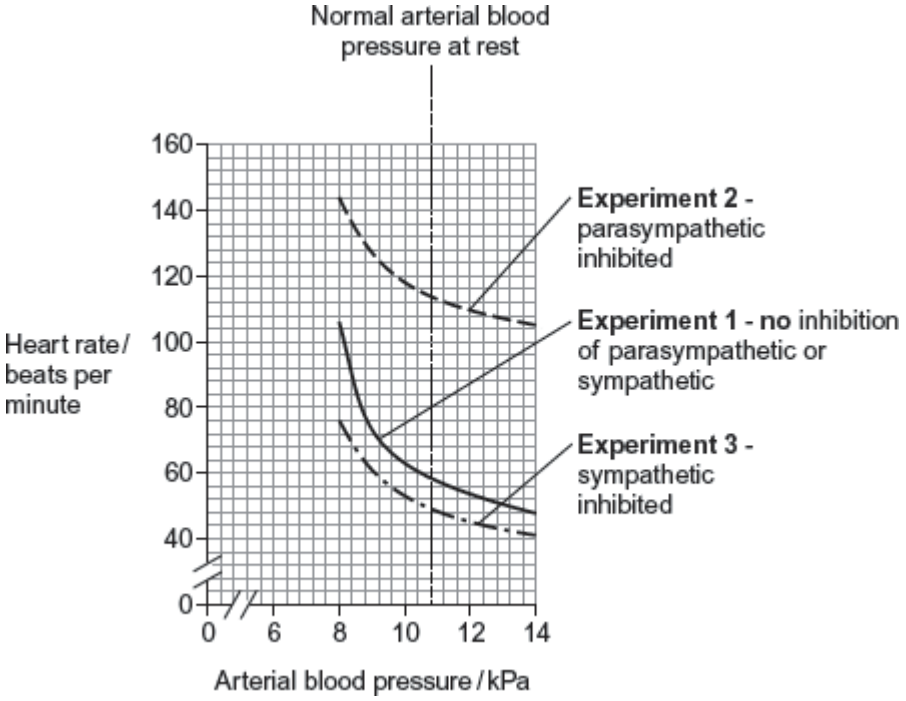
Calculate the ratio of the mean mass of phosphate found at 5 °C to the mean mass of phosphate found at 25 °C after 9 weeks of chilling.

$\frac{4.4}{1.2}$ $\frac{1.2}{1.2}$

Ratio 3.67:1.....**(1)**

Q2. Doctors investigated the relationship between heart rate and arterial blood pressure. They recruited healthy volunteers. For each volunteer, they recorded their normal arterial blood pressure at rest. With each volunteer, they then carried out the following experiments.

The graph shows the results for one volunteer.



Calculate the ratio of heart rate in **experiment 2** to heart rate in **experiment 3** at an arterial blood pressure of 10 kPa.
Show your working.

116 52

52 52

Answer = ...2.23:1.....

(2)

Q3. Researchers investigated some characteristics of people from different parts of England. In the north of England they selected 200 people and recorded their phenotypes for three different characteristics.

Their results are shown in the figure below.

Phenotype produced by dominant allele	Number of people	Phenotype produced by recessive allele	Number of people

Tongue roller	131	Non-tongue roller	58
Right-handed	182	Left-handed	14
Straight thumb	142	Hitch-hiker thumb	50

Calculate the ratio of straight thumb to hitch-hiker thumb in this study.

142:50

Ratio = ..2.84:1..... **(1)**