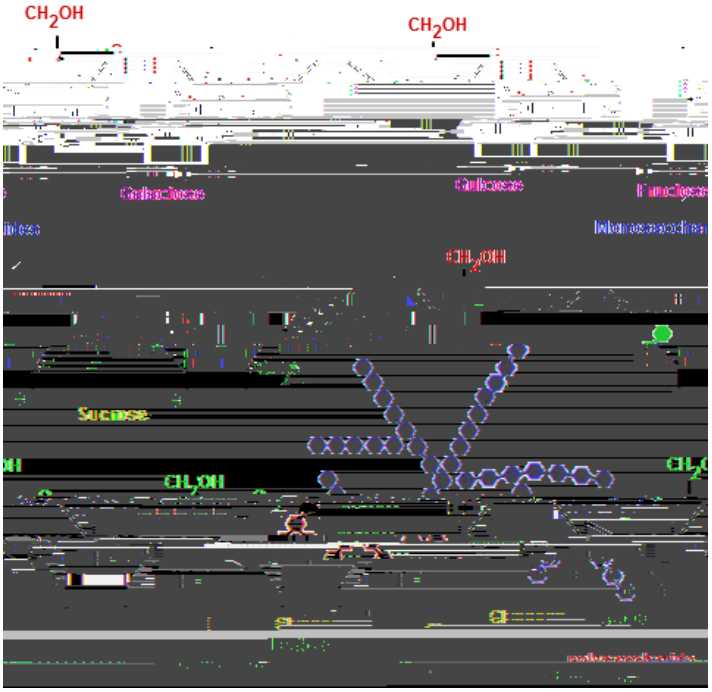
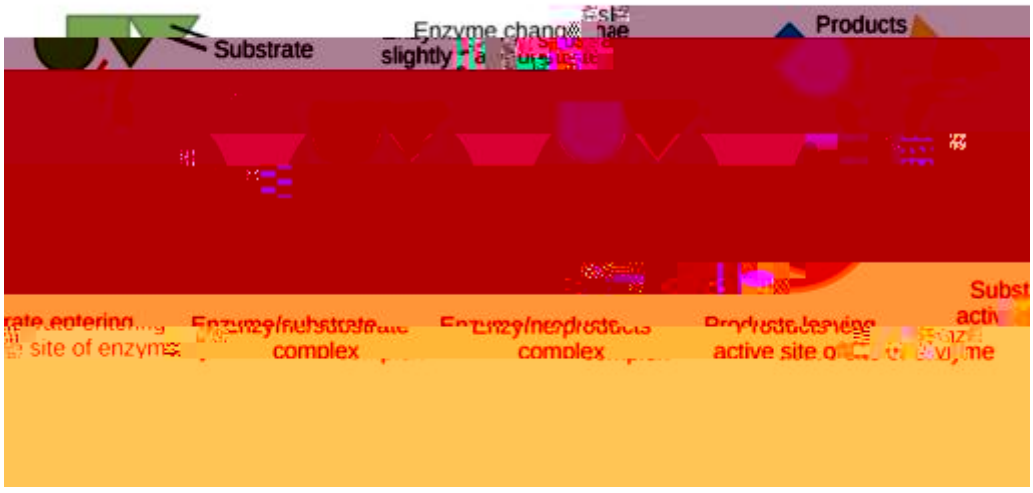
AQA A Level Biology

Summer Independent Learning





A Level Biology Summer Independent Learning Activity.

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

There are 2 things we are expecting of you from your SIL. Teachers will be checking that this has been completed in the first week back in September.

Core Content

1. Complete the questions, and self-mark (mark scheme at the back of the paper)
2. Test yourself on the content, in preparation for an assessment on your return to college

Highly recommended content will assist you in future topics covered in Y12

You can print the booklet, write on the PDF file or answer the questions on paper. The Mark Scheme follows the sections at the end of the document.

Core Content

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.

Can you describe what a condensation reaction is?

Can you describe what a hydrolysis reaction is?

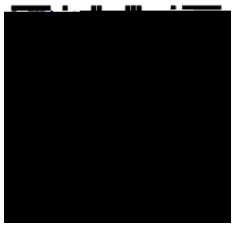
Can you describe how larger carbohydrates are made from monosaccharide monomers?

Can you list some common monosaccharides?

Can you describe how disaccharides are formed?

What are maltose, sucrose and lactose formed from?

Task 3: Protein structure



Watch the videos:

From 7:20 – 10:50

https://www.youtube.com/watch?v=QFq9o72Qal8&list=PL0Mjub5NT755dp8xUfC-yoXlbPTcjVM1i&index=7

What is the general structure of an amino acid?

How do two amino acids form a dipeptide?

Describe the following protein structures:

Primary Structure

Secondary Structure

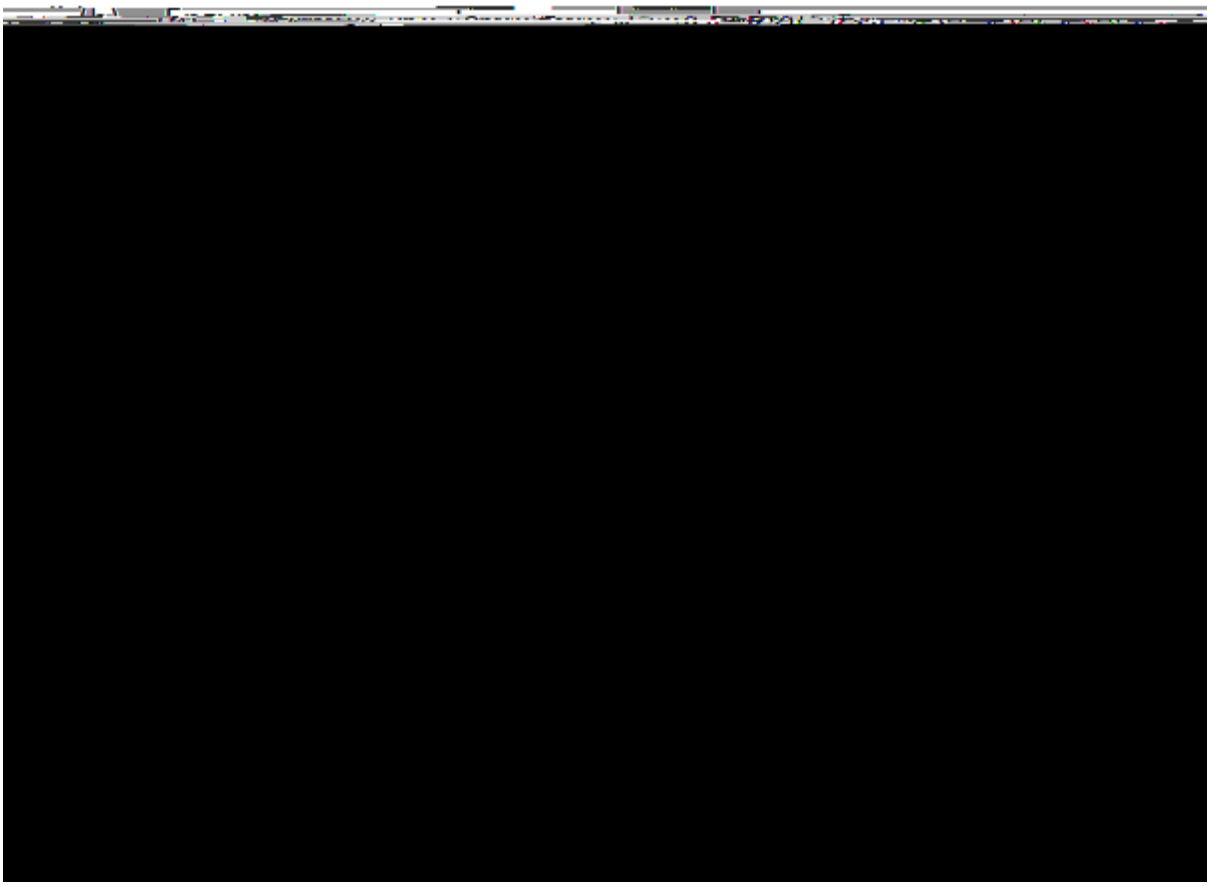
Tertiary Structure

Can you describe the role of hydrogen bonds, ionic bonds and disulfide bridges in the structure of proteins?

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

liver	salivary glands	stomach

(1)

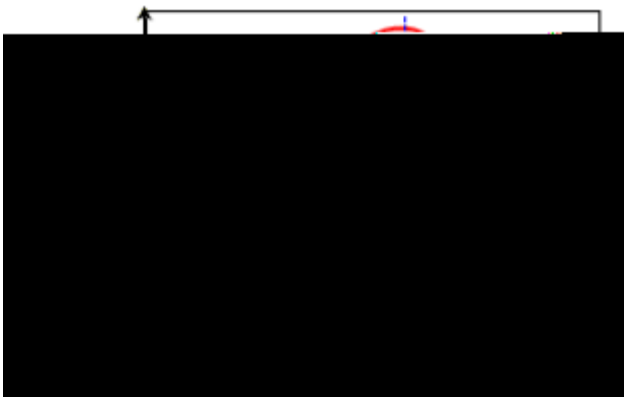


Task 5: Interpreting enzyme graphs.
This section requires you to explain how different conditions affect enzyme activity.

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.

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.

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 b 0 595.32 841.92 reW*5.04 Tf1 0 0 1 36 639.22 Tm0 g0 G[Th)3(e)6(fi)-2(gu)5(re)5(b)-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.

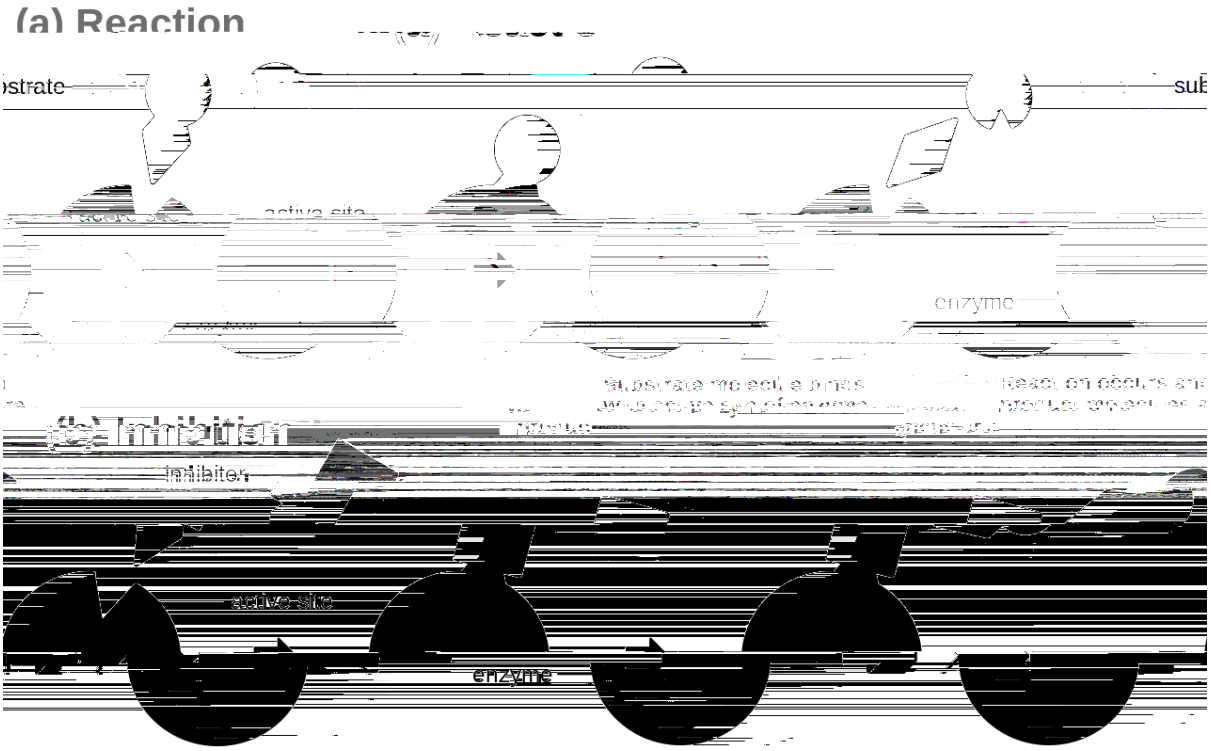
A Level exam questions follow to assess your understanding.

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



Inhibitor molecule prevents the binding of substrate molecule

Inhibitor molecule binds with the active site of enzyme molecule

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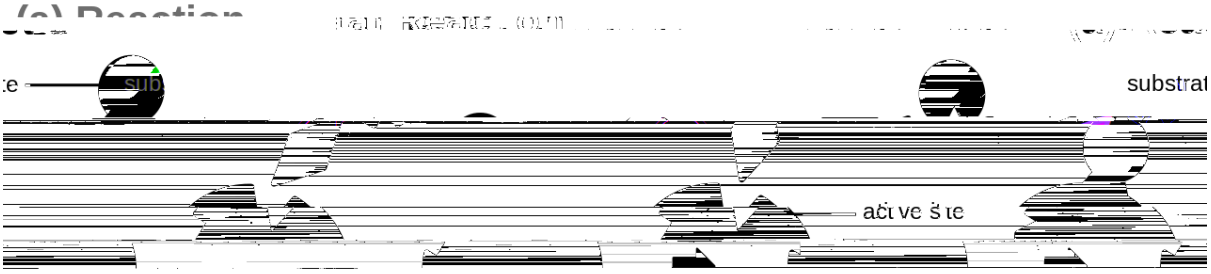
Non-competitive inhibition.



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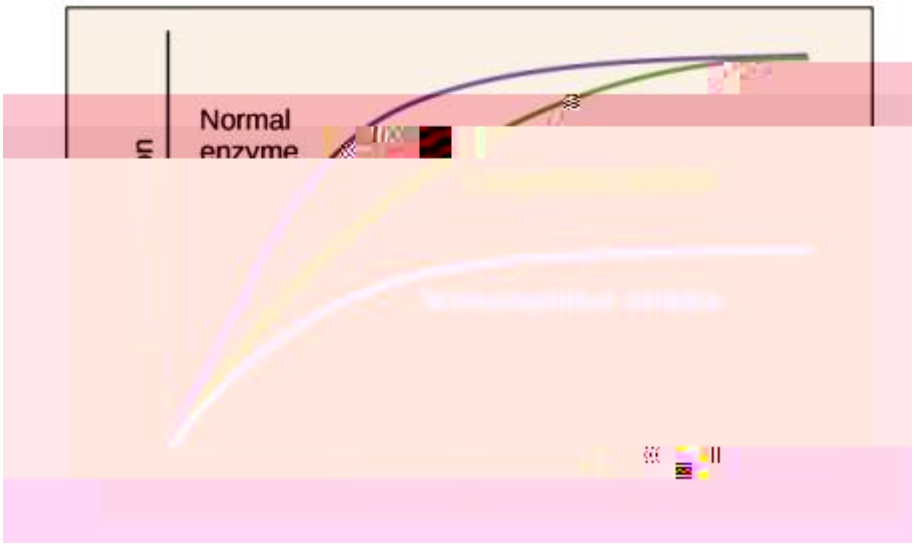
Explain the shape of both inhibitor lines, including how you can identify the type of inhibition.



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-

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

Highly recommended content

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 A Level Biology 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.

Worked example.

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

1.

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

Q3. What is the **percentage change** in the saturation of haemoglobin between 4 and 9 kPa O2?

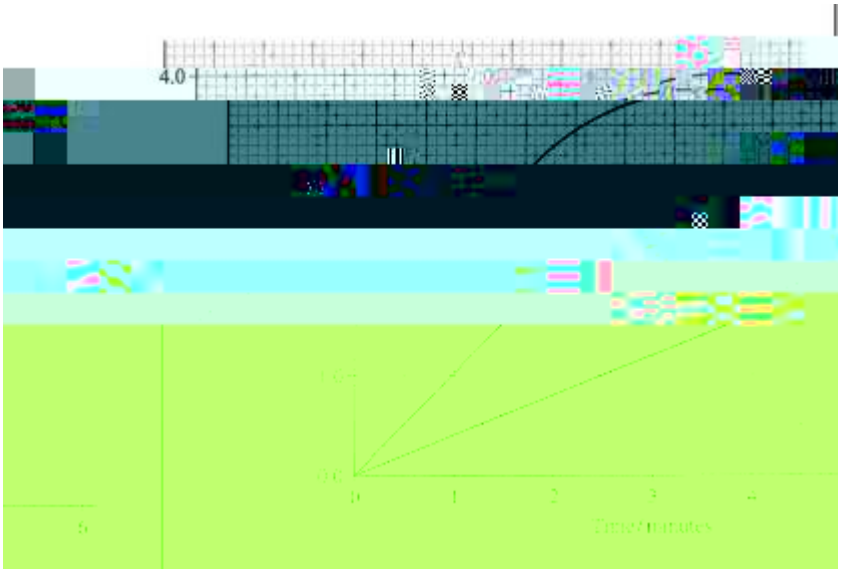
Answer ..... %

Task 8

Calculating the rate when the line is a curve

Sometimes the rate of a reaction changes **over time** eg. as substrate is used up in an enzyme controlled reaction. To calculate rate at a point on a curve we need to draw a tangent to the curve at that point. We can then calculate rate using the tangent line

Practise Questions
Q1.



Calculate the rate of reaction of the enzyme at 4 minutes at
i) 20oC

ii) 30oC

Q3.

Yeast is a single-celled organism. A student investigated respiration in a population of yeast growing in a sealed container. His results are shown in the graph.

(a) Calculate the rate of oxygen uptake in arbitrary units per hour between 2 and 4 hours.

Answer ..... arbitrary units per hour
(1)

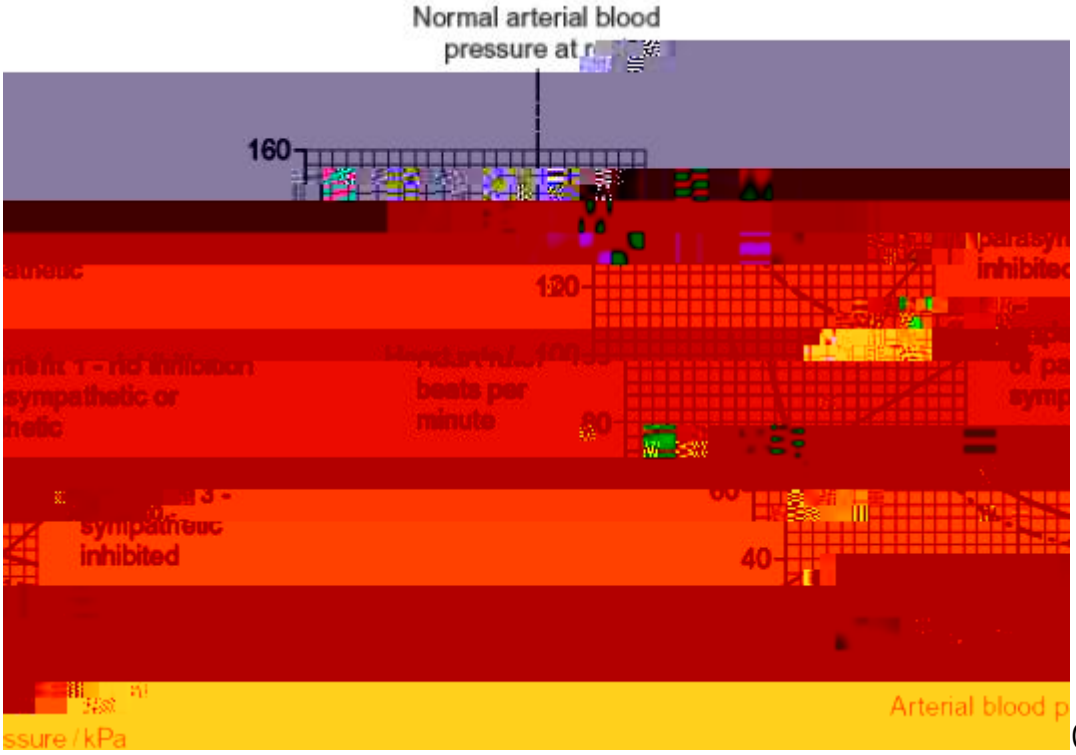
Task 9: Calculating ratios.
This section requires you to understand how to calculate ratios from given data.

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

rvos ofilli5(e)lresults.

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

Task 10: 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

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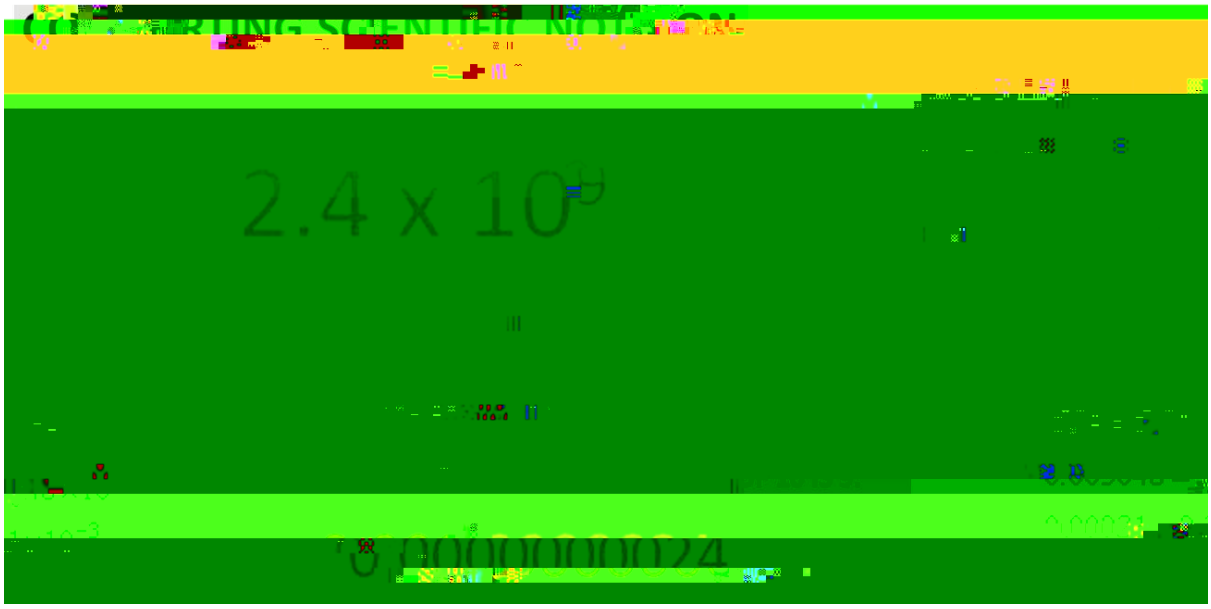
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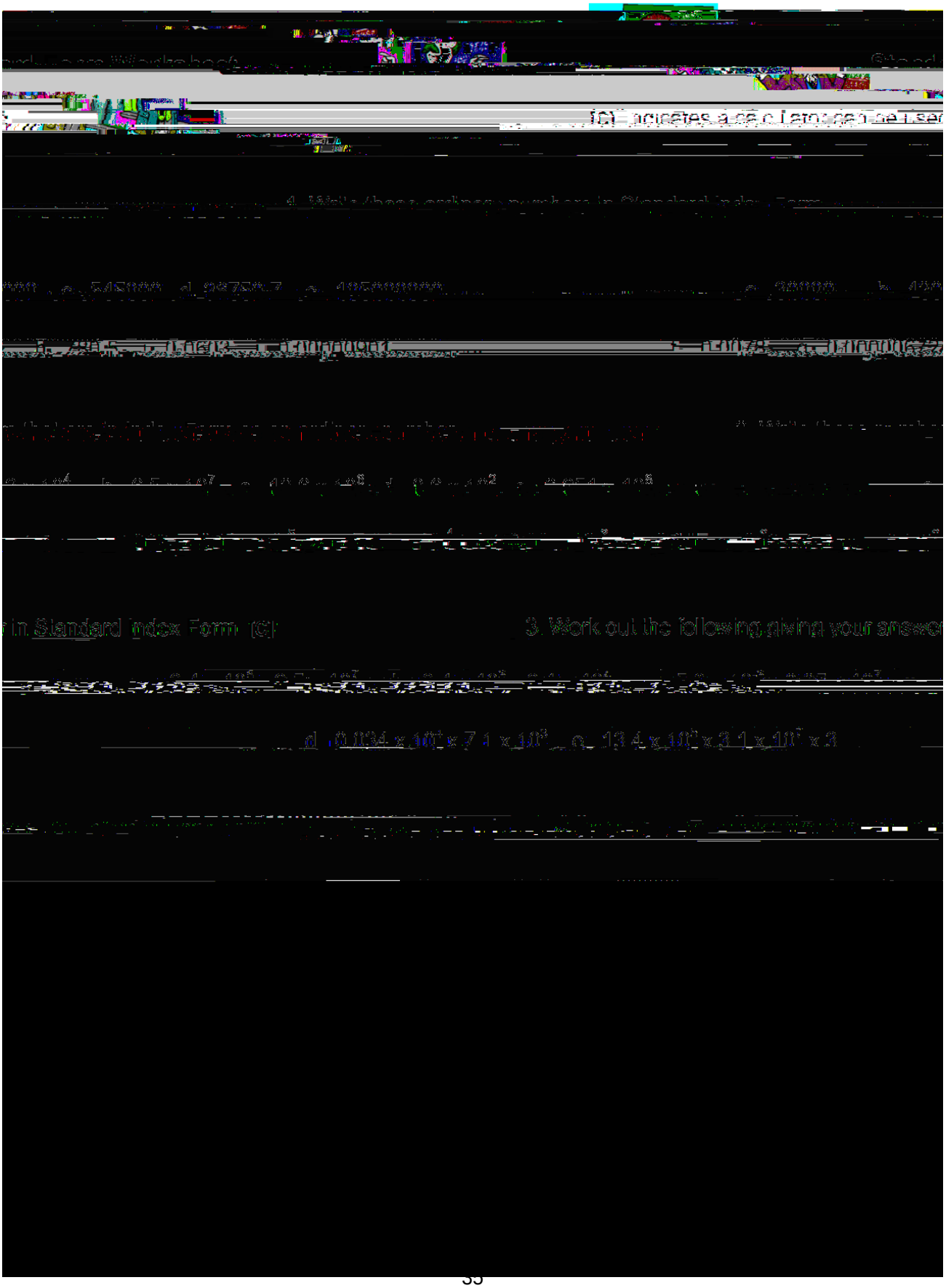


Can you explain that the R-group of a fatty acid may be saturated or unsaturated? What do these terms mean?

Saturated – when there are no C=C bonds in the hydrocarbon chain (i.e. the R group part)

Task 3: Protein structure

What is the general structure of an amino acid?

Can you describe the role of hydrogen bonds, ionic bonds and disulfide bridges in the structure of proteins?

- Hydrogen bonds hold the alpha helix and Beta sheets in place in the secondary structure.
- hydrogen bonds, ionic bonds and disulfide bridges hold the tertiary structure in place (keeps the protein in that shape)

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.

Define these key words.

Enzyme: A protein that acts as a biological catalysts lowering the activation energy of a reaction to alter its speed.

Active site: The shape specific region of an enzyme that is complimentary to the substrate.

Substrate: A substance that is acted on by an enzyme. It is complimentary to the enzymes active site.

Activation energy: The energy required to bring about a reaction.

Denature: Permanent change in a proteins 3D shape due to unravelling of the amino acid chain.

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

(i) What is an enzyme?

Draw a ring around the correct answer.

(1)

(ii)

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)

(b) Enzymes are sometimes used in industry.

Draw one line from each enzyme to the correct industrial use of that enzyme.

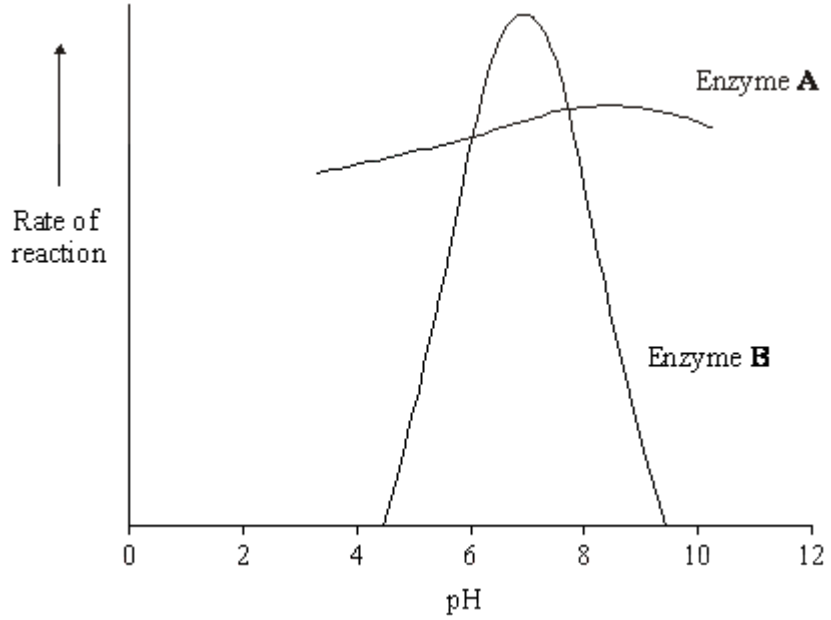
Enzyme	Industrial use
Carbohydrase	Changes starch into sugars
Isomerase	Removes grease stains from clothes
	Pre-digests proteins in some

Task 5: Interpreting enzyme graphs.

Q1. Change in temperature.

As temperature increase the enzyme & substrate gain more kinetic energy. There

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.

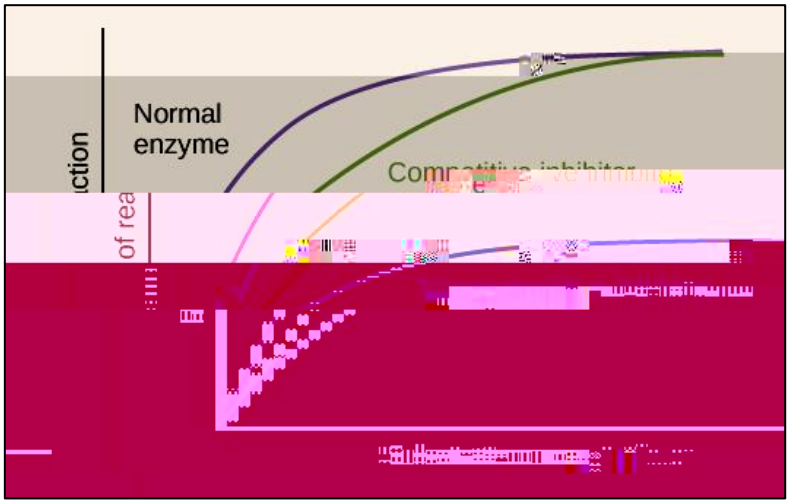
(change in pH) leads to breaking of bonds holding tertiary structure / changes charge on amino acids; enzyme / protein / active site loses shape / denatured; substrate will not bind with / fit active site / fewer / no ES complexes formed;

(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.

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

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 competitive inhibitor not a8871loqw32 84 t e reac

(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;

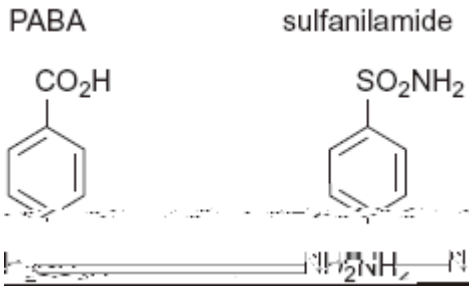
(Non-competitive inhibition),

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

6. Prevents formation of active site / changes (shae other than active site;re oe

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.

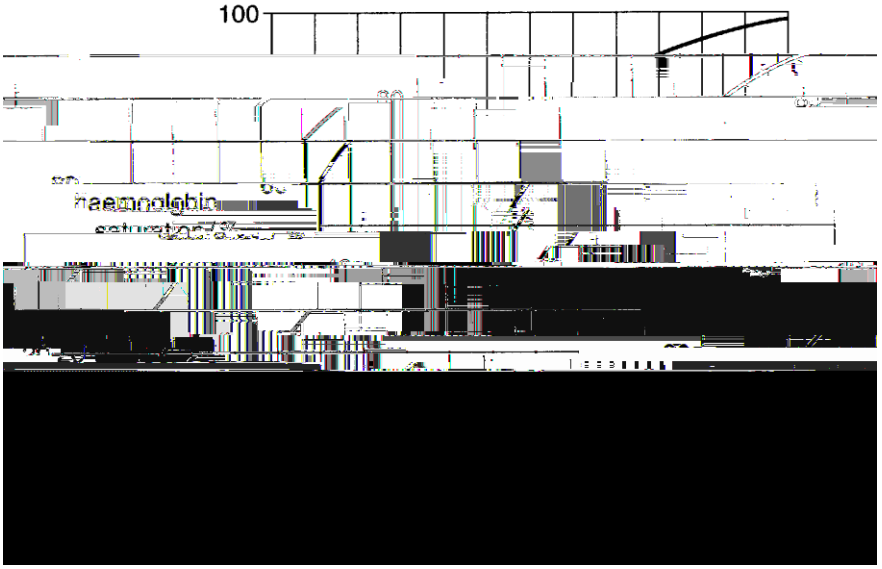
This section requires you to understand how to calculate percentage change from given data. This is a common skill required in A Level Biology exams. Read the worked examples and complete the questions.

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.

Worked example.

Q3. What is the percentage change



Task 8: Calculating Rate

This section requires you to understand how to calculate rates 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.

Worked Examples:

A. A heart beats 3240 times in 45 minutes. Calculate the heart rate in beats/min.

Heart rate = $\frac{3240}{45}$ = 72 beats/min

B. In an experiment to demonstrate water uptake by a leaf, volume of water taken up over a 12 hour period was measured over 5 days. The results were: 24 cm^3; 21 cm^3; 30 cm^3; 28 cm^3 and 26 cm^3. Calculate the mean rate of water uptake per hour.

Mean rate of water uptake = $\frac{\text{total volume taken up}}{\text{Time}}$ = $\frac{24 + 21 + 30 + 28 + 26}{5x12}$

= 21.5 cm^3

Calculating the rate when the line is a curve

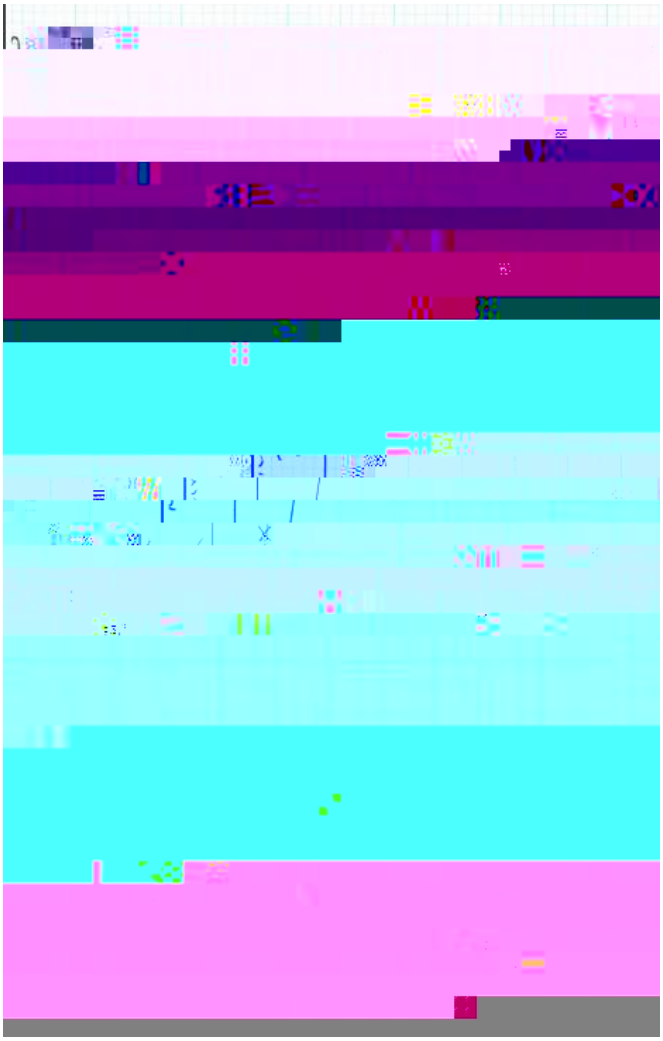
(1)

ii) Calculate the rate of uptake of potassium ions without inhibitor at 60 minutes.

$$\frac{3-0}{156} =$$

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.

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