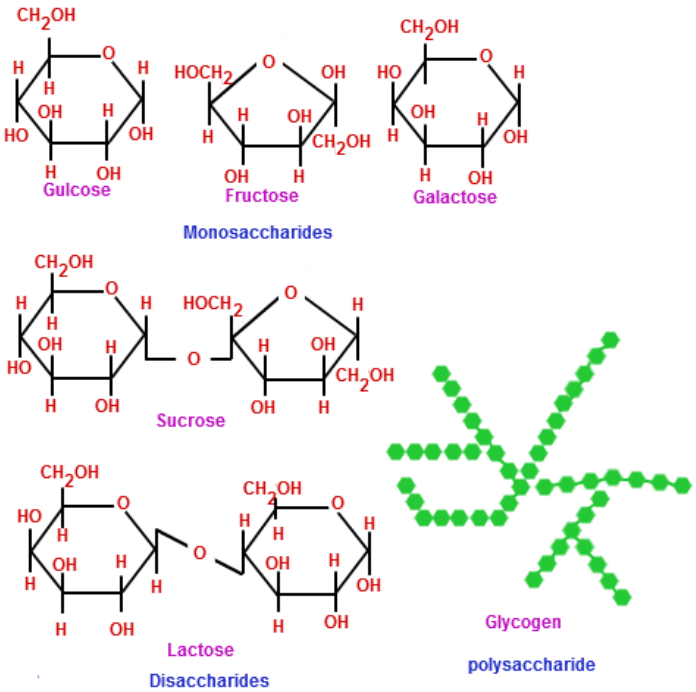
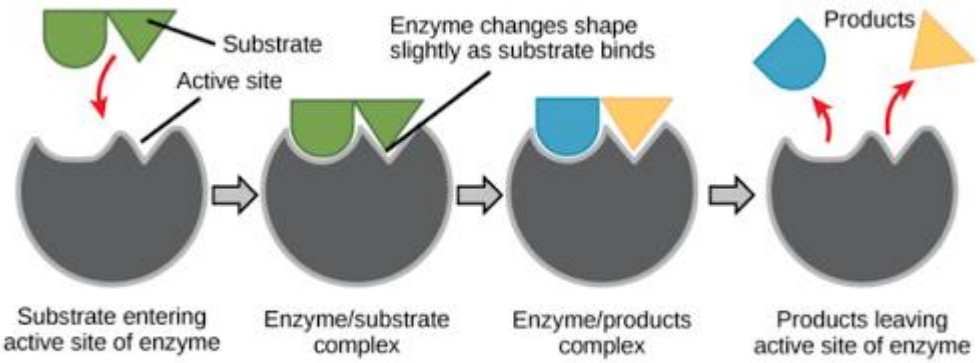
AQA A Level Biology

Summer Independent Learning





A Level Biology Summer Independent Learning Activity.

Welcome to A Level Biology, please complete **ALL** 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. Your teacher will check that this has been completed in the first week back in September.

The SIL is split into 2 sections:

Core Content

1. Complete all the questions.
2. Test yourself on the definitions and content, in preparation for an assessment on your return to college.

Highly recommended

This content will assist you in future topics covered in Y12

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.

Highly recommended

Part 3: Maths

Task 7: Calculating percentage change.

Task 8: Calculating rates.

Task 9: Calculating ratios

Task 10: Standard form

Task 11: Drawing graphs

Core Content

Part 1

Task 1: Structure of carbohydrates

Use the following video links to support with your answers:

https://www.youtube.com/watch?v=dSJGCGQ_9vA&list=PL0Mjub5NT755dp8xUfC-yoXlbPTcjVM1i&index=7&t=0s

https://www.youtube.com/watch?v=wuDxoneoPnY&list=PL0Mjub5NT755dp8xUfC-yoXlbPTcjVM1i&index=5

What is a monomer?

What is a polymer?

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?

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

Can you explain how glycogen and starch are formed?

Task 2: Lipid Structure

https://www.youtube.com/watch?v=TOFjqpzbMZU&list=PL0Mjub5NT755dp8xUfC-yoXlbPTcjVM1i&index=3

Video from 10:50 to 12:50

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

Can you explain how triglycerides are formed? Draw a diagram to show this happening. Label the molecules involved, the type of reaction and the types of bonds formed.

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

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?

Part 2: Enzymes

Task 4: Enzyme definitions.

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)

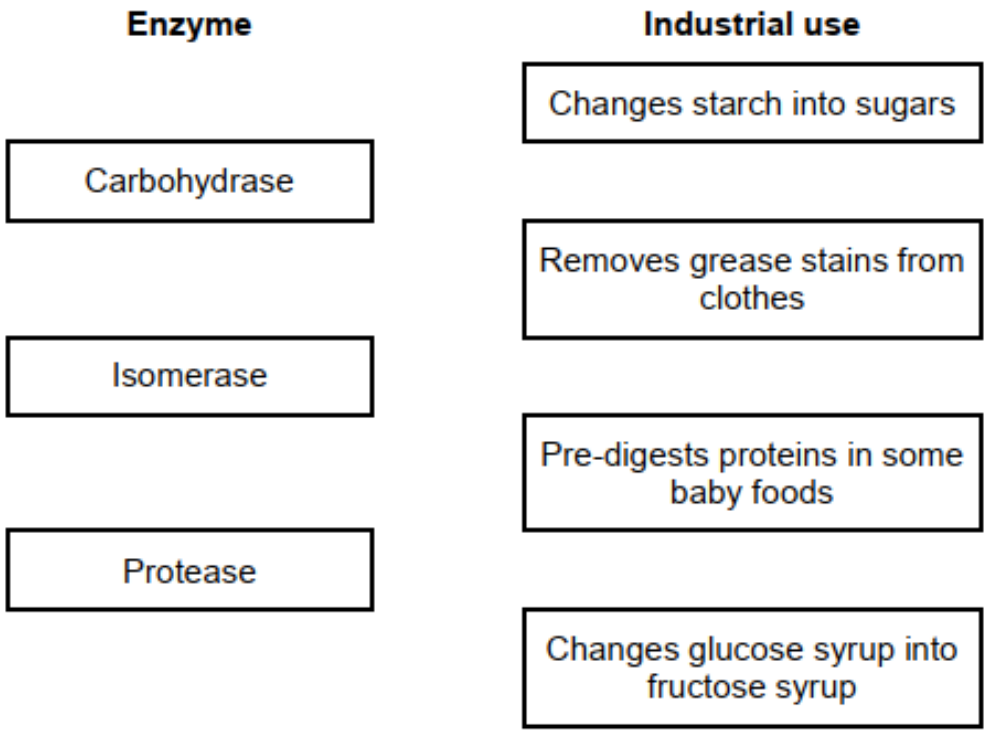
(iii) Where is the enzyme amylase produced in the human body? Draw a ring around the correct answer.

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

(1)

(b) Enzymes are sometimes used in industry.

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



Task 5: Interpreting enzyme graphs.

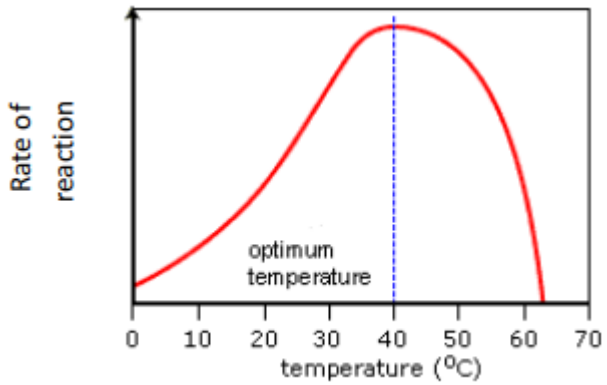
This section requires you to explain how different conditions affect enzyme activity.

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

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

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

Q1. Change in temperature.



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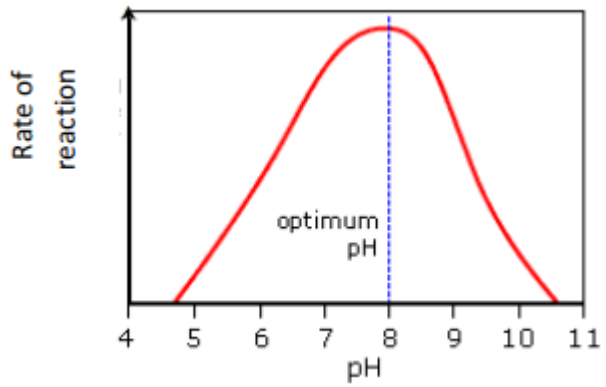
Q2. Change in pH.



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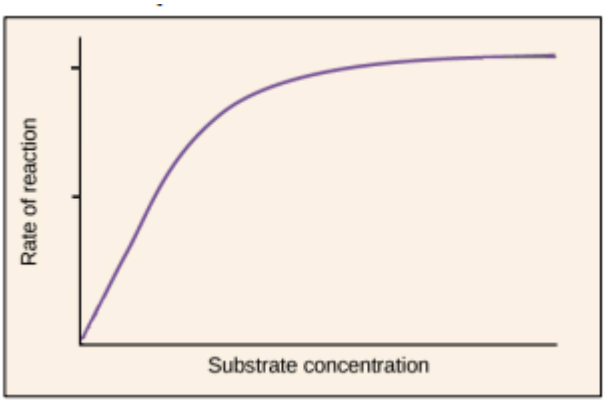
Q3. Change substrate concentration.



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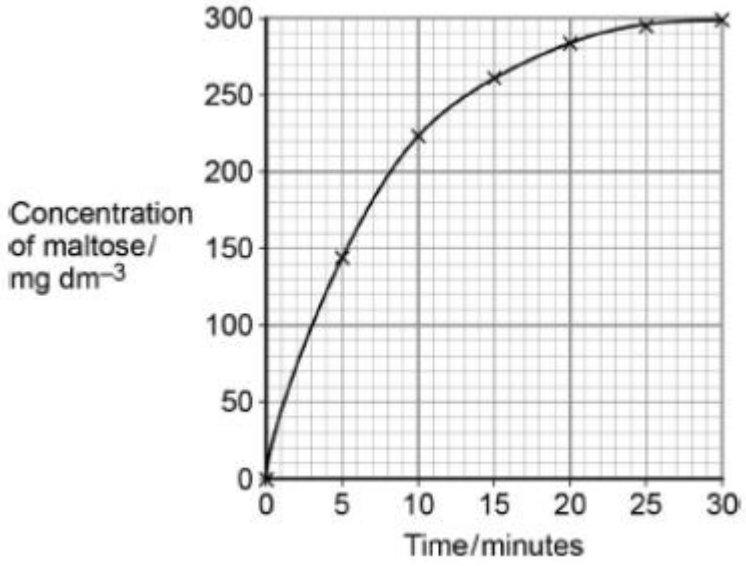
Q4. A scientist investigated the hydrolysis of starch. He added amylase to a suspension of starch and measured the concentration of maltose in the reaction mixture at regular intervals. His results are shown in the graph below.



Explain the results shown in the graph.

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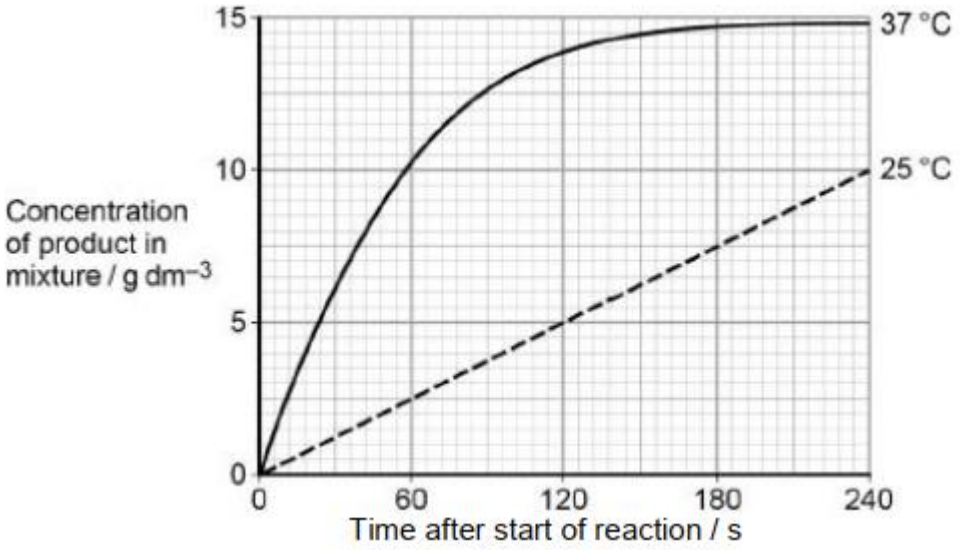
Q2. A technician investigated the effect of temperature on the rate of an enzyme-controlled reaction. At each temperature, he started the reaction using the same volume of substrate solution and the same volume of enzyme solution.

The figure below shows his results.



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

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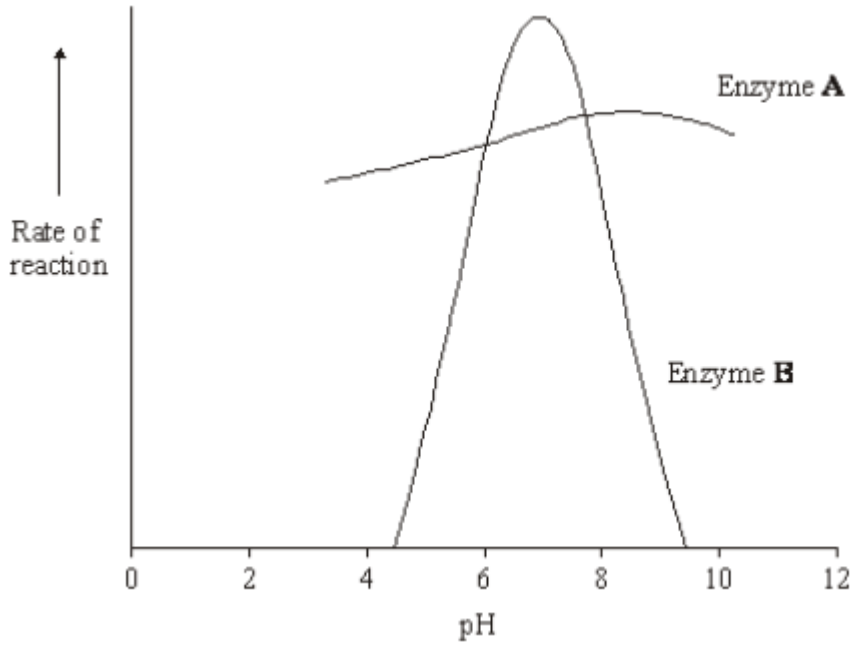
Q3. Enzymes **A** and **B** digest protein. The graph shows the effect of pH on the rates of reaction of these enzymes.



(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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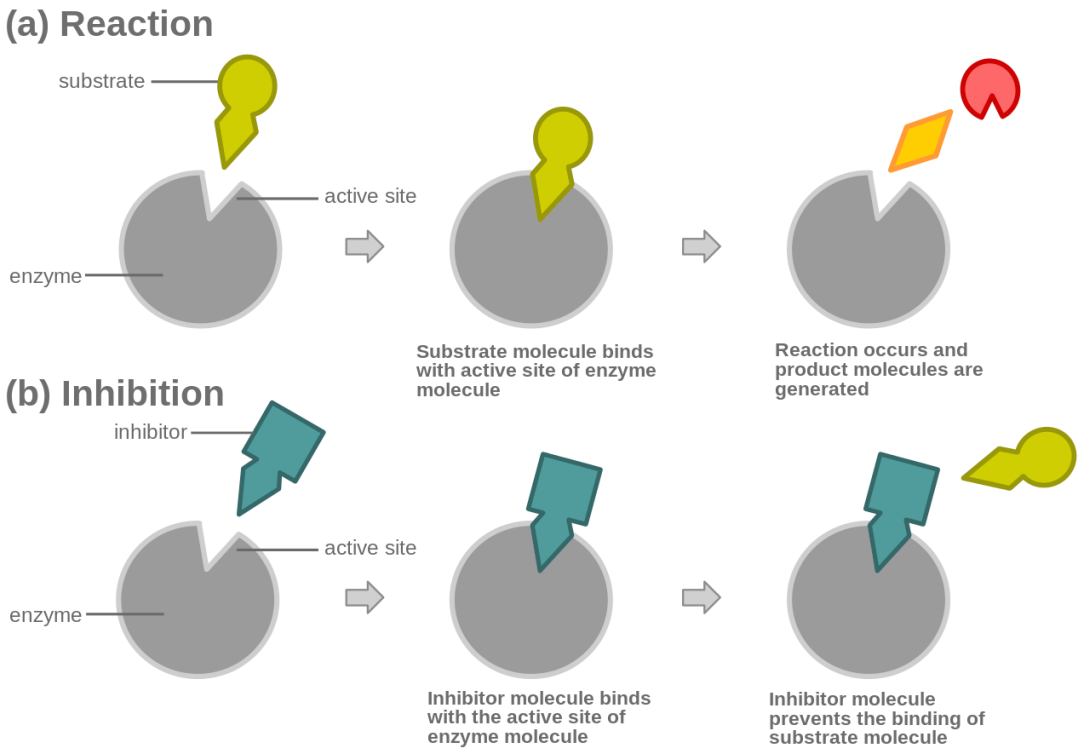
Task 6: Enzyme inhibition.

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. 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



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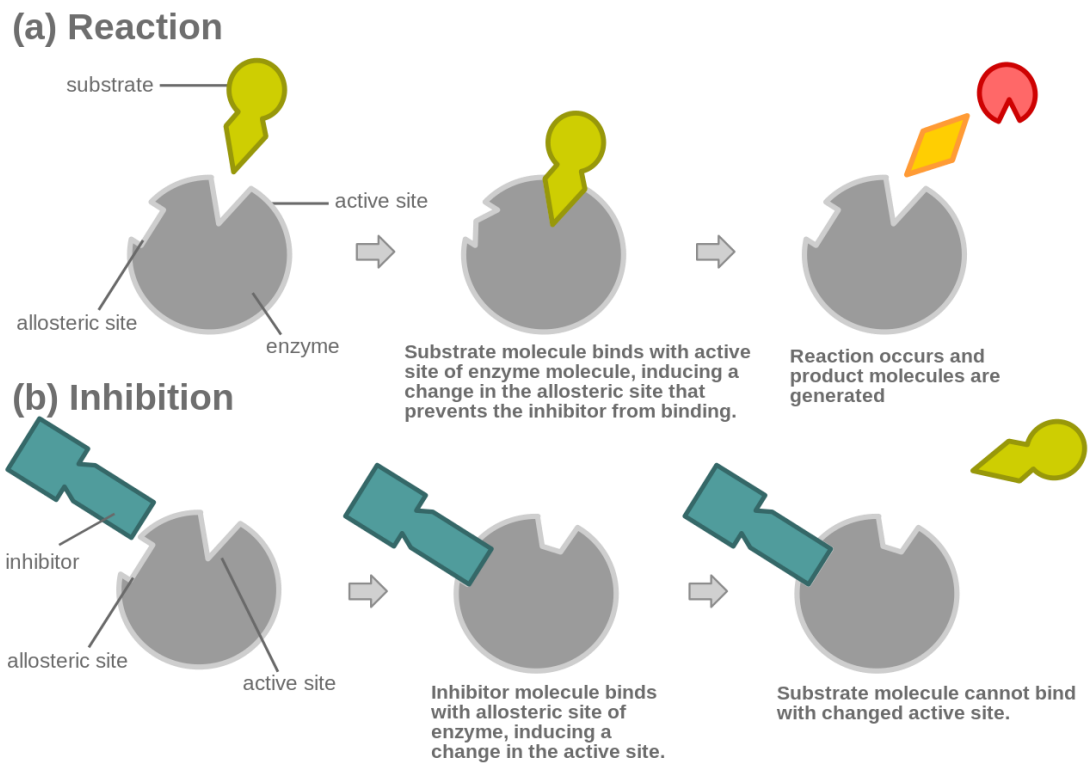
Non-competitive inhibition.



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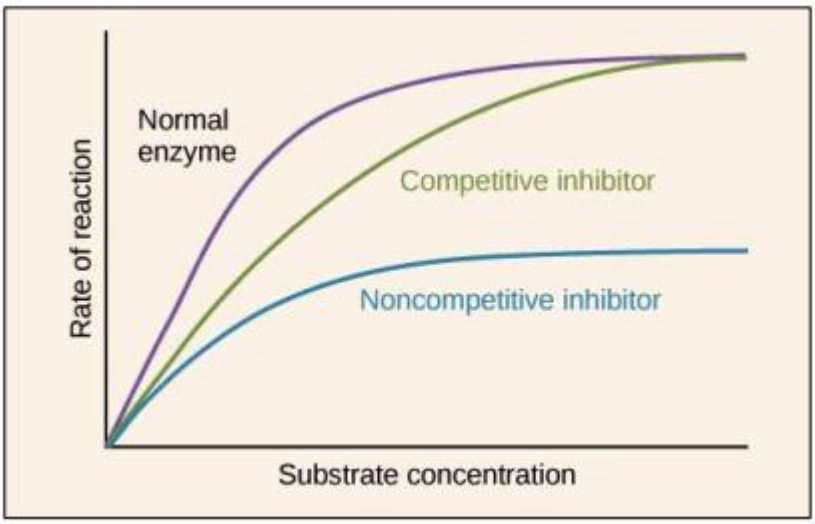
Explain the shape of both inhibitor lines, including how you can identify the type of inhibition.



Competitive inhibitor:

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Non-competitive inhibitor:

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

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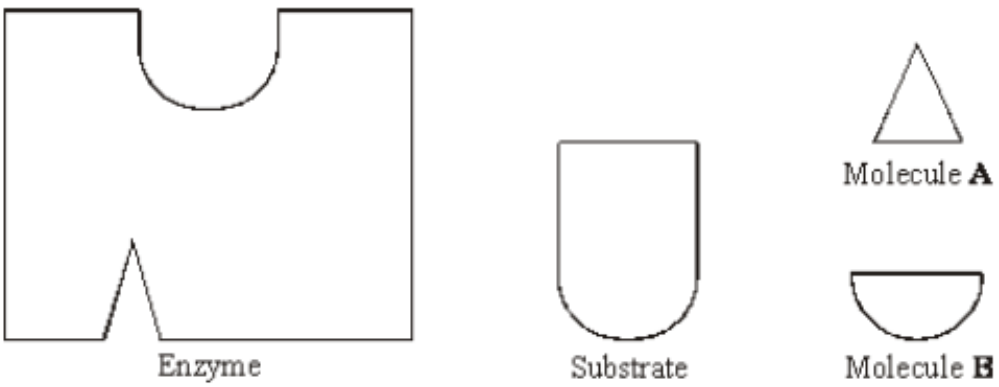
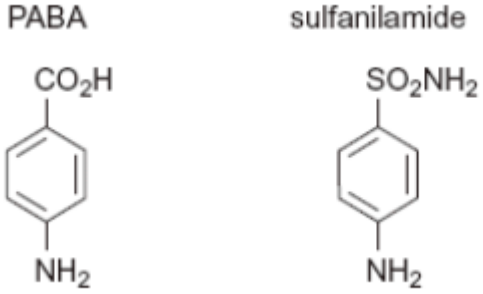
Q2. The diagrams represent an enzyme, its substrate and two other molecules, **A** and **B**.



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.



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

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(Total 3 marks)

Highly recommended content

Part 3: Maths

Task 7: Calculating percentage change.

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** 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?

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

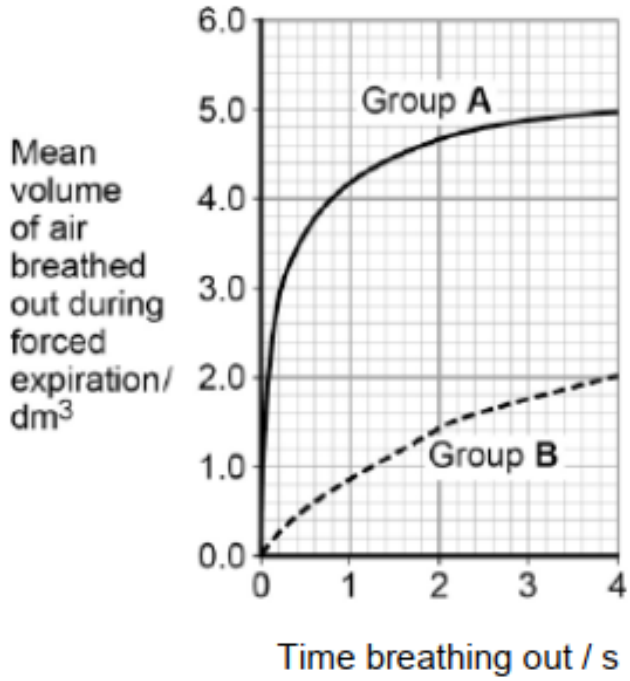
1. The table shows how environmental temperature affects the food intake, water intake and milk production of cows in a fixed period of time.

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

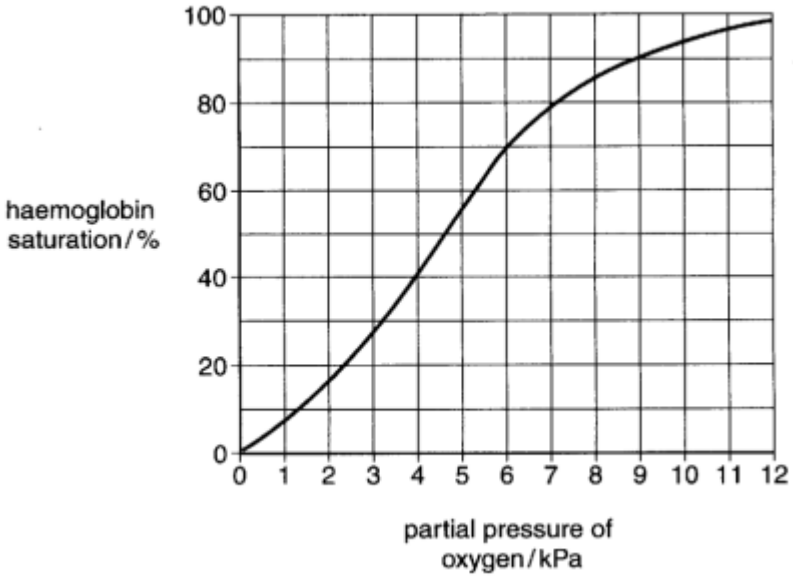
..... %

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 decrease in the FEV for group **B** compared with group **A**.



..... %

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



Answer ..... %

Task 8: Calculating Rate

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 3:55** in order to help you with the follow section.

Rate just means 'change per unit time'. To calculate rate, you divide by time.

Worked Examples:

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

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

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 cm3; 21 cm3; 30 cm3; 28 cm3 and 26 cm3. Calculate the mean rate of water uptake per hour.

Mean rate of water uptake = total volume taken up / time

= (24 + 21 + 30 + 28 + 26) / (5x12) = 21.5 cm^3

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

Draw a tangent to the curve. To calculate the gradient, change in Y axis divided by change in time (shown on the X axis).

https://www.youtube.com/watch?v=CbfxFBfB7kk&list=PL0Mjub5NT756MyHewhXhdRSIygaF_woF3&index=4&t=0s **from 19:30**

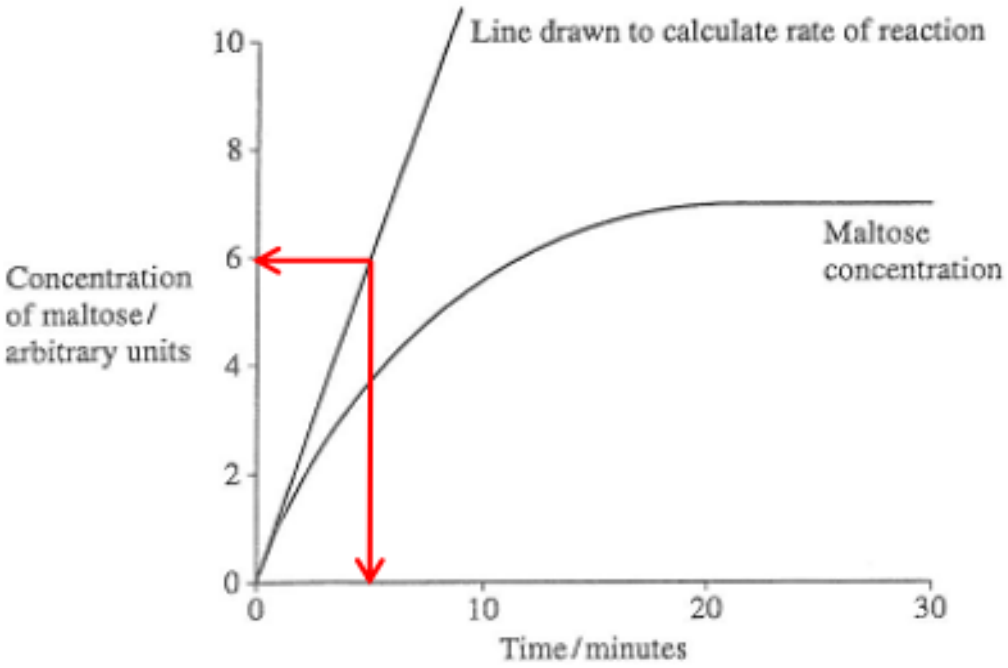
Example

8 Amylase is an enzyme. It catalyses the reaction

$$\text{starch} \xrightarrow{\text{amylase}} \text{maltose}$$

Students mixed a starch solution with amylase. They recorded the concentration of maltose at intervals for 30 minutes. **Figure 1** shows their results.

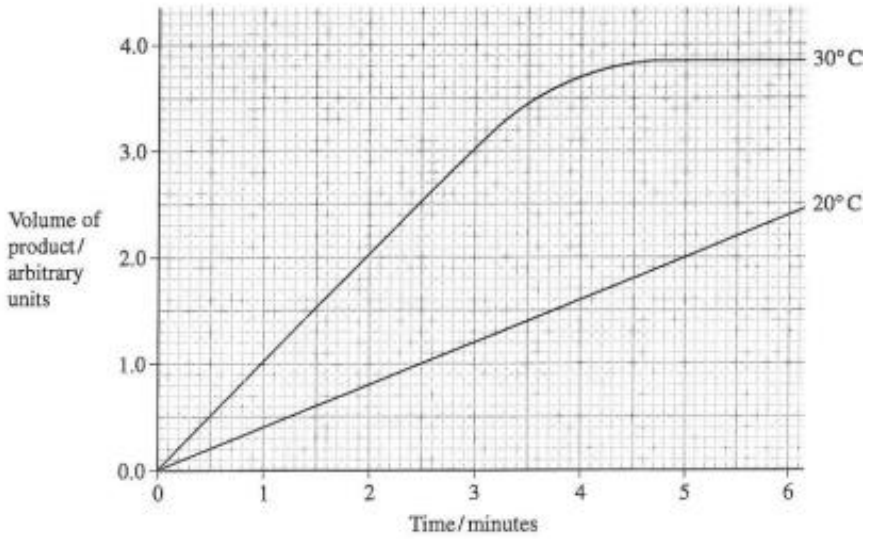
Figure 1



$$\text{Rate} = \frac{\text{value on y axis}}{\text{time on x axis}} = \frac{6 \text{ AU}}{5 \text{ mins}} = 1.2 \text{ AUmin}^{-1}$$

Practise Questions

Q1.

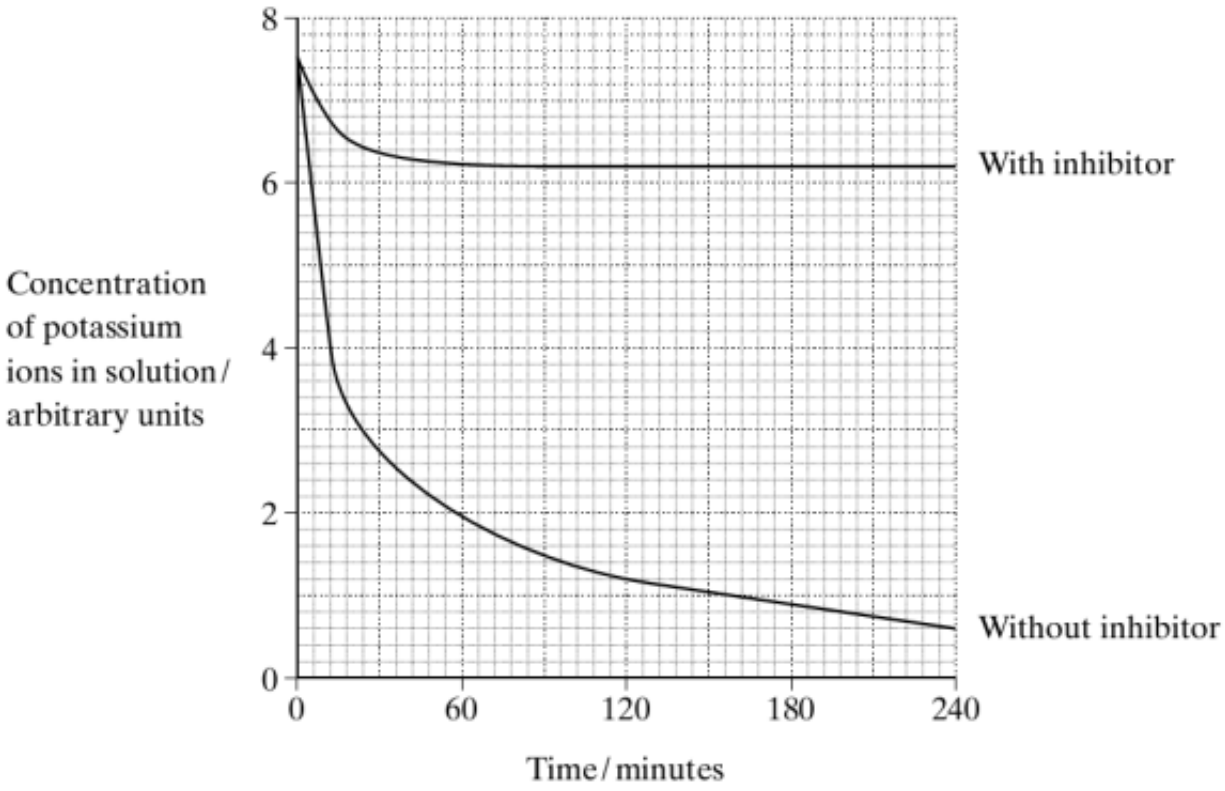


Calculate the rate of reaction of the enzyme at 4 minutes at
i) 20°C

ii) 30°C

Q2.

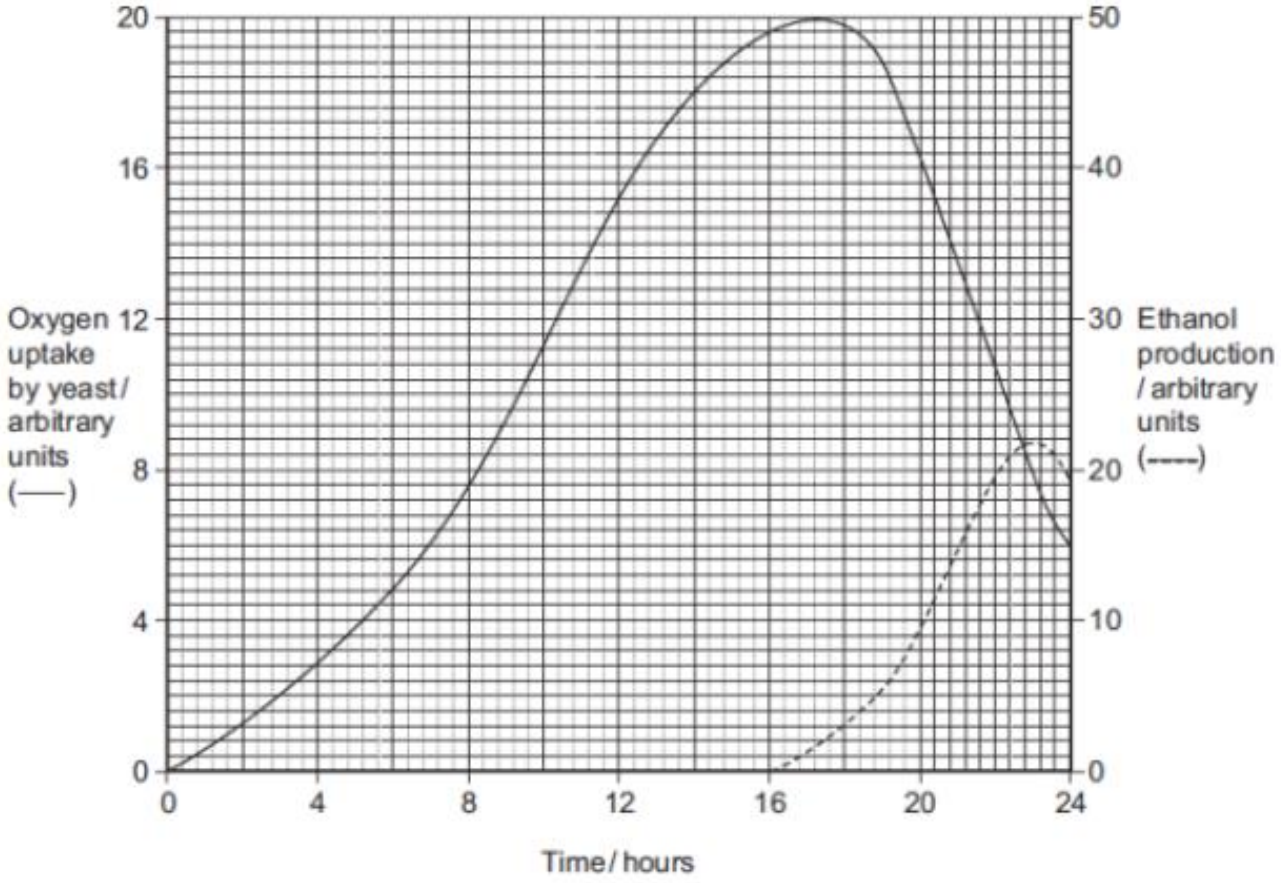
Two samples of the roots of pea plants were placed in solutions containing potassium ions. An inhibitor to prevent respiration was added to one solution. The concentrations of potassium ions in the two solutions were measured at regular intervals. The graph shows the results.



i) Calculate the initial rate of uptake of potassium ions without inhibitor. (1)

ii) Calculate the rate of uptake of potassium ions without inhibitor at 60 minutes. (1)

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.

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** 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.

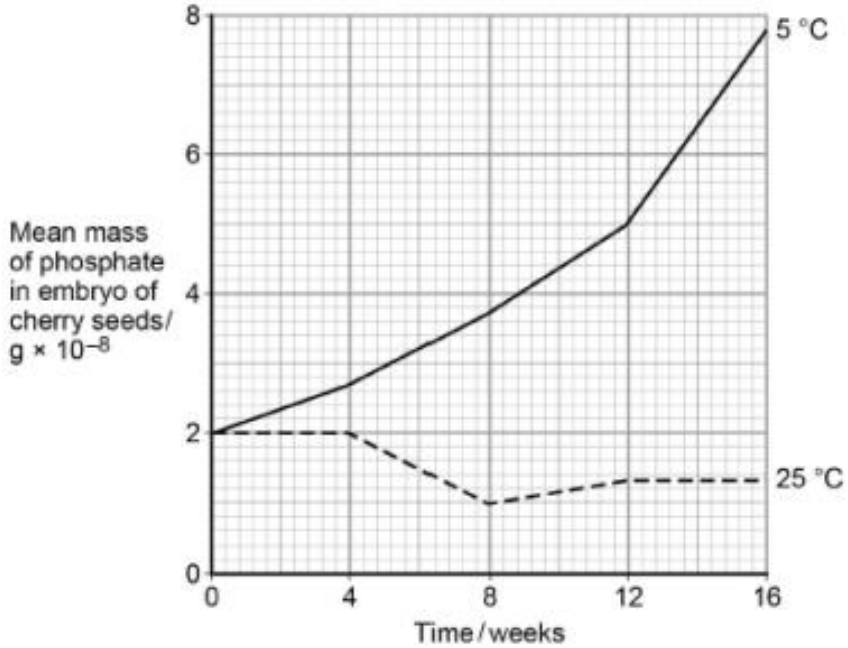
Worked example.

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.

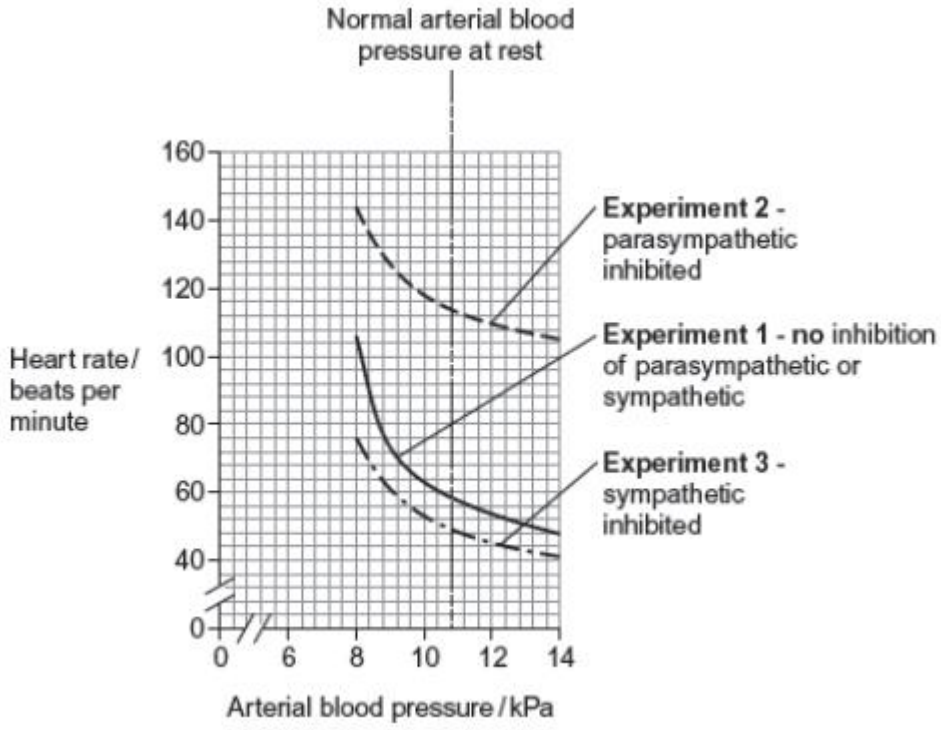
Q1. The seeds of some plant species require chilling (exposure to low temperatures) before the embryos they contain grow into plants. During chilling, storage molecules in the seed that contain phosphate are broken down and phosphates are transported to the embryo. Scientists investigated the change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

Ratio = ...**(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.

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 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

- 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 A level Biology 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. $p^2 \div q$

Task 11: Graph drawing

The enzyme catalase reacts with hydrogen peroxide to produce oxygen.

a) Calculate the rate of reaction and fill in the table.
b) Plot a graph of concentration against rate.
c) Describe your results

Concentration of Enzyme / mol dm^{-3}	Volume of oxygen produced in 5 minutes / cm^3	Rate of reaction / cm^3 min^{-1}
0.00	0.00	
0.05	2.00	
0.10	4.00	
0.20	8.00	
0.50	10.00	
1.00	10.00