St Dominic's is a Roman Catholic Sixth Form College committed to the personal and spiritual growth of all its members based on Christian values, academic excellence and high-quality pastoral care

Name:- .....

Year 1 Biology

Summer Transition Work

OCR Module 2

Welcome to Biology at St. Dominic's Sixth Form College! We look forward to you joining us in September.

A Level Biology is a much more detailed look at the concepts you studied at GCSE. It is a very rigorous and demanding course that involves learning content and applying it to unfamiliar contexts, in addition to analysing and evaluating data. The A level is much more strict and specific about the use of keywords.

Many students in the past have found the jump from GCSE to A level difficult and daunting. We hope the process of completing this booklet will be useful in preparing you for that transition,and give you a taste of the level of work to be successful.

Please bring this completed booklet with you to your first Biology lesson in September.

The Biology summer work consists of the following tasks:
Task 1: Maths (this will be 10% of yourA Level exam)
Task 2:Cell Structure
Task 3: Water
Task 4: Carbohydrates
Task 5: Enzymes
Task 6: University courses and careers

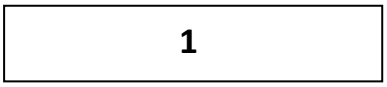
Task 1: Maths in Biology

Mathematical requirements at A level Biology are very high. The assessment will include least 10% Level 2 (GCSE) **or above** mathematical skills. These skills will be applied in the context of the relevant Biology.

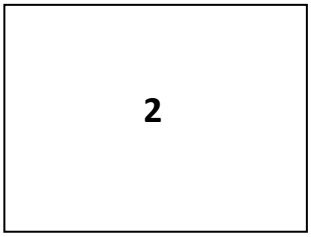
Unit	Symbol	Equivalent in metres	Fraction of a metre
Metre	m	1	One
Decimetre	dm	0.1	One tenth
Centimetre	cm	0.01	One hundredth
Millimetre	mm	0.001	One thousandth
Micrometre	µm	0.000 001	One millionth
Nanometre	nm	0.000 000 001	One thousand millionth

Unit Conversion

Measure these objects in mm then convert as necessary.



Length = ……mm



Length = ……µm

Length = ……nm

What is the relationship between km, m, mm, µm and nm? (Why does cm not fit the pattern?)
……

Convert values from one unit to another unit

2km = …… m

5cm = …… mm

6µm = …… nm

7mm = …… µm

10nm = …… µm

2mm = …… nm

Here are some more questions to practice conversions.

a. How many micrometres are in a millimetre?	d. How many nanometres are in a micrometre?
b. How many nanometres are in a millimetre?	e Which is bigger? 35000 nm or 34 μm.
c. Which is bigger? 7.3 mm or 34μm.	f Which is bigger 250000nm or 25mm

Calculation of linear magnification

There is a relationship between the actual size, the magnification and the image size of a drawing or micrograph where:

$$\textbf{Actual size} = \frac{\textbf{Image size}}{\textbf{Magnification}}$$

Now have a go at the following calculations

Q1. Answer the following questions.

a) If the image of a specimen is 80mm long and it has been magnified 5000 times (x5000) what is the actual length of the specimen? Give your answer in micrometres.

b) If a specimen is 20μm long and it has been magnified 10,000 times (x10, 000) how long is the length of the specimen in the image? Give your answer in millimetres.

c) A 30nm specimen was photographed. In the text book the image of the specimen was 50mm long. How much has it been magnified?

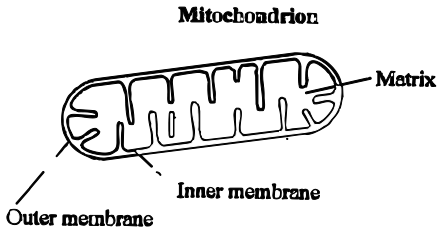
Q2. Use a ruler to find the size of the image of specimen A shown below. The actual size of specimen A is 15 micrometres long. What is the magnification?

Specimen A

Q3. Use a ruler to find the size of the image of specimen B shown below. The specimen has been magnified 30,000 times. What is the actual size of specimen B.?

Specimen B

Q4. Use a ruler to find the magnified size of the mitochondrion shown below. The actual size of the mitochondrion is 2.5 micrometres long. What is the magnification?



Task 1: Cell Structure

This is a section of the OCR specification for 2.1.1 Cell Structure which shows what students will need to know.

d)	the representation of cell structure as seen under the light microscope using drawings and annotated diagrams of whole cells or cells in sections of tissue
e)	the use and manipulation of the magnification formula
g)	the ultrastructure of eukaryotic cells and the functions of the different cellular components To include the following cellular components and an outline of their functions: nucleus, nucleolus, nuclear envelope, rough and smooth endoplasmic reticulum (ER), Golgi apparatus, ribosomes, mitochondria, lysosomes, chloroplasts, plasma membrane, centrioles, cell wall and cilia.
k)	the similarities and differences in the structure and ultrastructure of prokaryotic and eukaryotic cells.

Use the provided textbook pages or pmt revision notes to fill in the missing words

Nucleus

The nucleus is composed of the nucleolus and the …… envelope.
mRNA and rRNA can enter and leave the nucleus moving through the …….. …….
Sections of DNA that codes for a polypeptide is called a ……..

Rough endoplasmic reticulum (RER)

The rough endoplasmic reticulum membrane is continuous with the …… ……
The rough endoplasmic reticulum is made up of flattened sacs called ……..
The rough endoplasmic reticulum is studded with ……., which are responsible for
…… ……

Smooth endoplasmic reticulum (SER)

The smooth endoplasmic reticulum is responsible for …… synthesis.

Golgi apparatus

The Golgi apparatus is responsible for …… and …… proteins

Ribosomes
Ribosomes are made up of …….. and ……
They are the site of the process of …….. …… They can be free in the cytoplasm or attached to ……..

Cytoskeleton
The cytoskeleton is composed of …… and …….

Vacuole
The vacuole is surrounded by a membrane called the ……
Only plant cells have a …….. vacuole.

Lysosomes
Lysosomes are vesicles filled with …….. enzymes used to …… unwanted material.

Cilia
Cilia are found outside the cell and are made of …….

Mitochondria
The mitochondria have a double …….
The inner mitochondrial membrane folds to make structures called ……., these increase the surface area for …….. respiration to occur.

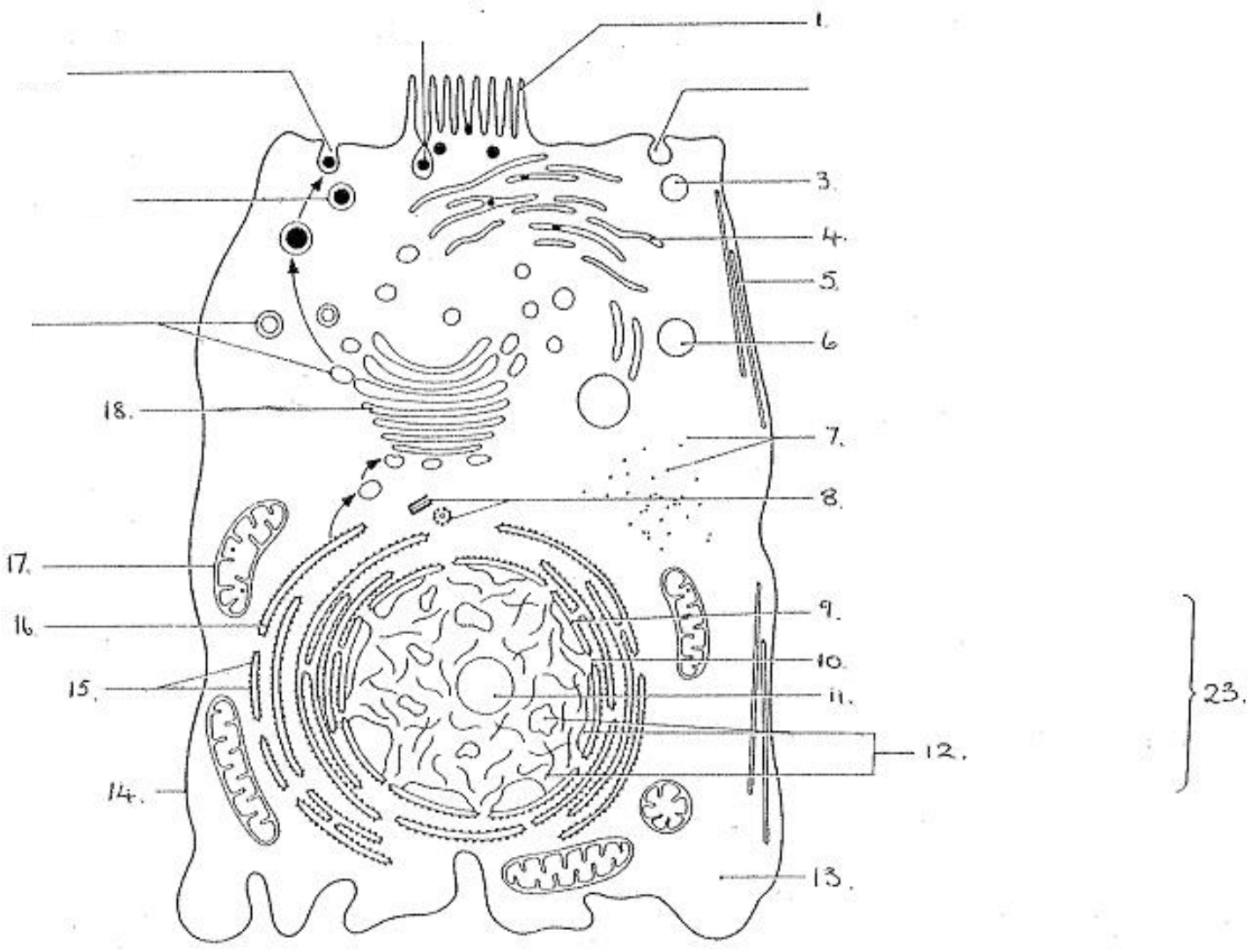
Chloroplast
The chloroplast function is ……
It has a double membrane and a fluid filled interior called the ……

Centrioles
These are located next to the nucleus, they are made of …….. and move the …….. during cell division

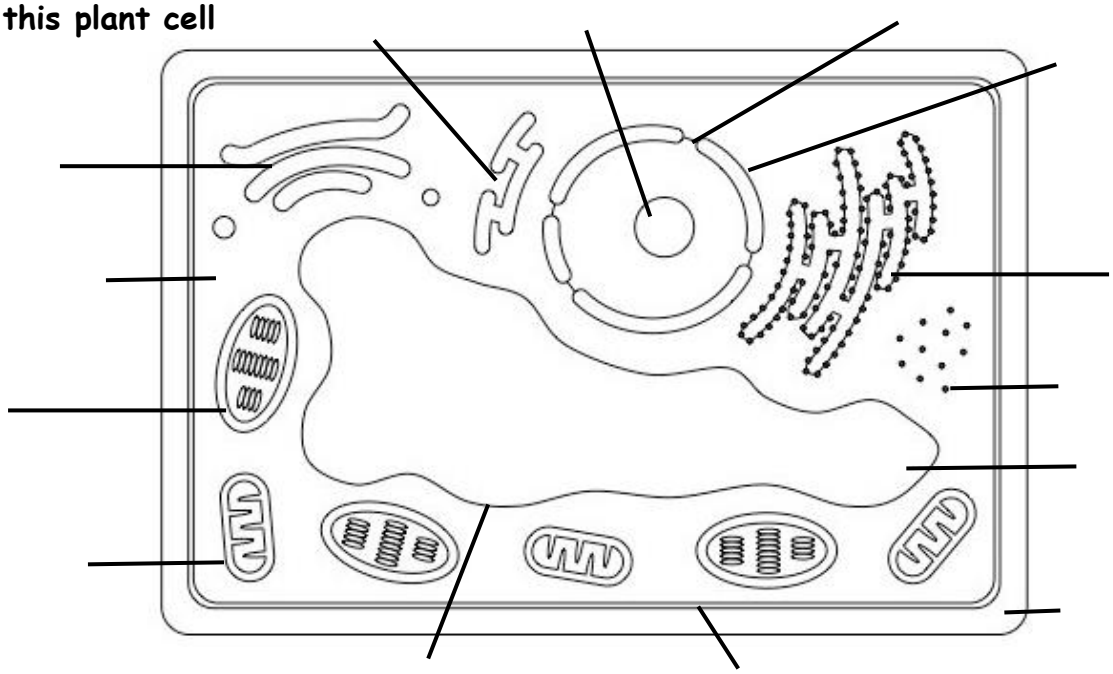
Label the numbered organelles in the animal cell below:-

This is a very detailed image of an animal cell, not all of the labels you need to know, please **only** label the numbered lines

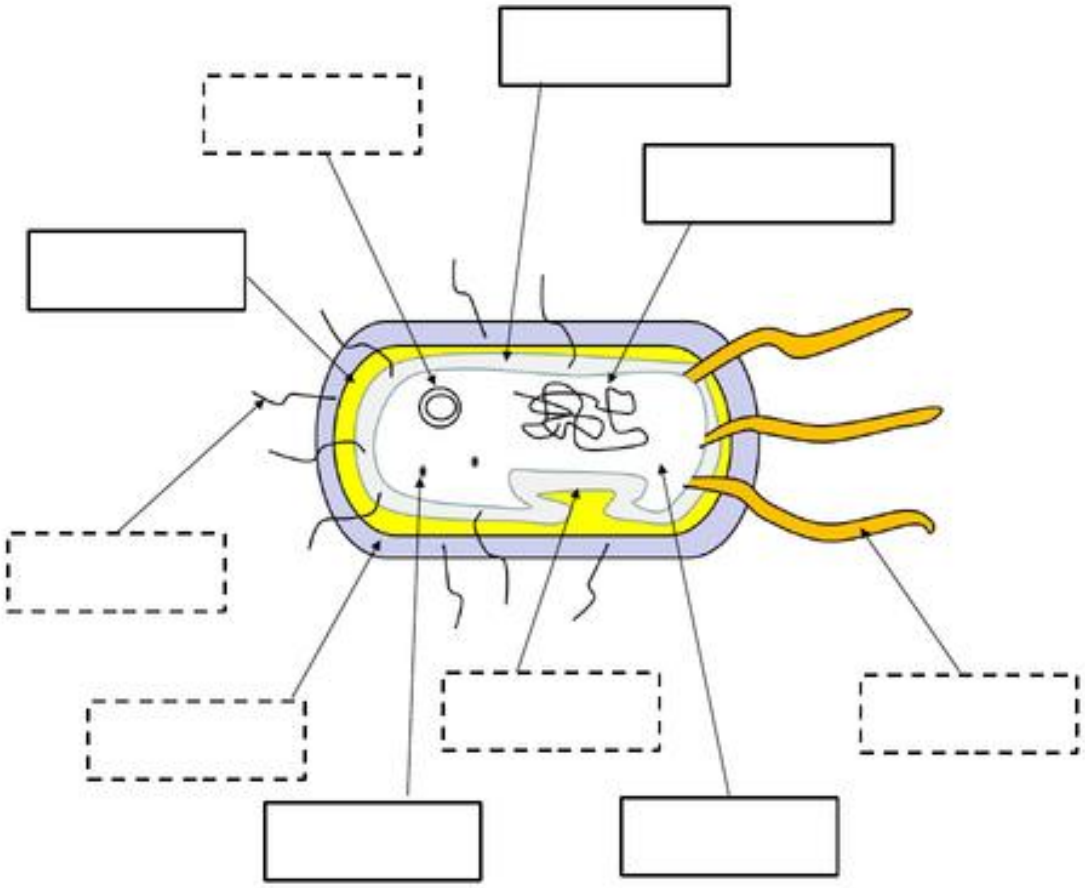
Generalised animal cell as seen with an Electron Microscope (Ultra- Structure)



Label this plant cell



Label this bacteria cell& highlight the structures it has in common with eukaryotic cells



Exam Question – Apply your knowledge

Fig. 1.1 is a diagram of an animal cell as seen using a transmission electron microscope.

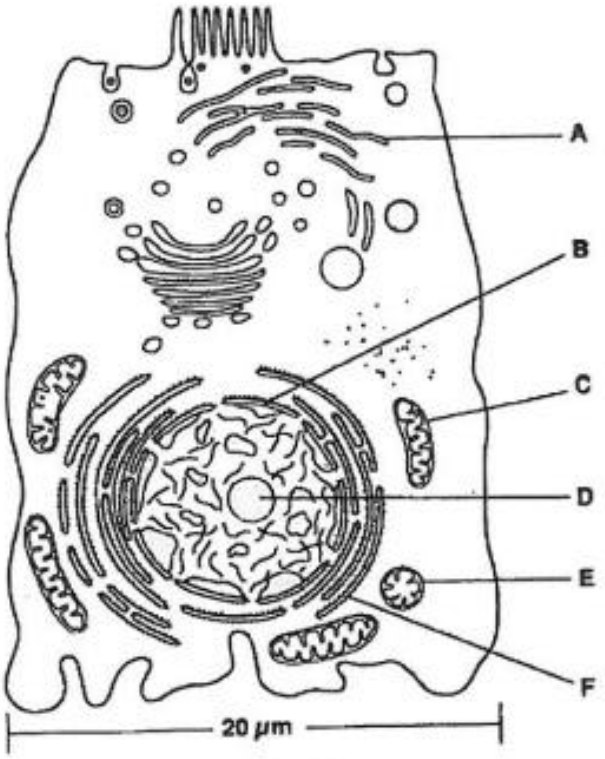


Fig. 1.1

(a) (i) Name the structures of the cell labelled **A**, **B**, **C** and **D**.

A .....

B .....

C .....

D ..... [4]

(ii) Structures **C** and **E** are examples of the same organelle.

Suggest why **E** looks so different to **C**.

.....

.....

.....

..... [2]

(iii) Calculate the actual length of structure **C**.

Show your working and give your answer in micrometres (μm).

Answer = ... μm [2]

In an investigation, cells were broken up (homogenised) and the component organelles were separated into tubes.

Each tube was then tested to determine the identity of the component organelle(s).

The observations are shown in Table 5.2.

Test for the...	Tube			
	1	2		
ability to make ATP	no ATP produced	ATP produced	no ATP produced	no ATP produced
presence of DNA	DNA present	trace amount	no DNA present	no DNA present
ability to produce proteins	no proteins made	no proteins made	no proteins made	proteins made
ability to digest bacteria	none	some ability	none	none

Table 5.2

(i) Identify the tube that contains the following organelles:

nuclei .....

ribosomes .....

mitochondria .....

lysosomes ..... **[4]**

(ii) Which of the organelles listed in **(i)** is the smallest in size?

..... **[1]**

Task 3: Water

This is a section of the OCR specification for 2.1.2 Biological Molecules which shows what students will need to know.

a) how hydrogen bonding occurs between water molecules, and relate this, and other properties of water, to the roles of water for living organisms.
To include roles that relate to the properties of water; solvent, transport medium, coolant and as a habitat AND roles illustrated using examples of prokaryotes and eukaryotes.
Learners should be able to apply their knowledge and understanding in the context of prokaryotes and Eukaryotes

Part 1: Biochemistry and Water

***State** the **appropriate term** for the definitions below:*

1. A reaction that occurs when two molecules are joined together, with the removal of a water molecule **(1)**

……

2. A reaction that occurs when a molecule is split into two smaller molecules, with the addition of water **(1)**

……

3. A small molecule which binds to many other identical molecules to form a polymer **(1)**

……

4. A strong bond due to atoms sharing electrons **(1)**

……

5. A weak interaction which happens wherever molecules contain a slightly negatively charged atom bonded to a slightly positively charged hydrogen atom **(1)**

……

6. The net diffusion of water across a partially permeable membrane **(1)**

……

7. An example of a polar substance that dissolves in cells**(1)**

……

8. The correct biological term for the heat energy required to break water molecules away from each other so they become a gas **(1)**

……

9. The correct biological term for the heat energy required to raise 1 kg of water by $1^{o}C$ (it has a value of 4.2 KJ) **(1)**

……

10. The attraction of water molecules to each other due to hydrogen bonds between them **(1)**

……

11. Draw a diagram of two water molecules bonded by hydrogen bonds (include the polarity on the atoms) **(3)**

Marks: …… / 13

Part 2: Properties of water

Below are some of the properties of water:

Liquid	***Solvent***	***Cohesion***	***Surface tension***
Density	***High specific heat capacity***	***High latent heat of vaporisation***	***Reactant***

From the above list, ***state*** *the most appropriate property and* ***explain*** *its ability to carry out the following functions. Each property can be used more than once.*

1. Dissolve and transport sodium chloride in animal circulation (two properties) (4)

Dissolve:

Property: ……

Explanation:

……

……

Transport:

Property: ……

Explanation:

……

……

2. Cool elephants when they spray themselves (2)

Property:……

Explanation:

……

……

3. Enable pond skaters to walk on water (2)

Property:……

Explanation:

……

……

……

4. Enable fish to survive in a freezing pond (2)

Property:……

Explanation:

……

……

……

5. Create a stable aquatic environment (2)

Property:……

Explanation:

……

……

……

6. To be involved in the process of photosynthesis (2)

Property:……

Explanation:

……

……

Marks: …… / 14

Task 4: Carbohydrates

This is a section of the OCR specification for 2.1.2 Biological Molecules which shows what students will need to know.

d)	the ring structure and properties of glucose as an example of a hexose monosaccharide and the structure of ribose as an example of a pentose monosaccharide To include the structural difference between an α- and a β-glucose molecule AND the difference between a hexose and a pentose monosaccharide.
e)	the synthesis and breakdown of a disaccharide and polysaccharide by the formation and breakage of glycosidic bonds To include the disaccharides sucrose, lactose and maltose.
f)	the structure of starch (amylose and amylopectin), glycogen and cellulose molecules
g)	how the structures and properties of glucose, starch, glycogen and cellulose molecules relate to their functions in living organisms

1. Research and draw the structure of an alpha glucose and a beta glucose, highlighting the difference.

2. Research and draw the structure of a ribose sugar

3. Single sugars (called monosaccharides) can join to create a disaccharide (two sugars joined together). Research which sugars join with glucose to form the following 3 disaccharides.

monosaccharides	disaccharide
Glucose +	maltose
Glucose +	sucrose
Glucose +	lactose

4. When two monosaccharides join together this is a …… reaction because water is formed. The general name for the bond formed between the two sugars is a …… bond. To break this bond and reform the two original monosaccharides water is needed, this is a ……. Reaction.

5. If a third sugar (or more) joins to the disaccharide it is now a polysaccharide. There are three polysaccharides that you must know. Complete the table below.

polysaccharide	structure	function
starch	Made of alpha glucose joined with 1-4 glycosidic bonds to form amylose and 1-6 glycosidic bonds to form amylopectin	
glycogen		Energy store in animals
cellulose		

Task 5: Enzymes

This is a section of the OCR specification for 2.1.4 Enzymes which shows what students will need to know.

a) the role of enzymes in catalysing reactions that affect metabolism at a cellular and whole organism level To include the idea that enzymes affect both structure and function.
b) the role of enzymes in catalysing both intracellular and extracellular reactions
c) the mechanism of enzyme action To include the tertiary structure, specificity, active site, lock and key hypothesis, induced-fit hypothesis, enzyme-substrate complex, enzyme product complex, product formation and lowering of activation energy.
d) the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme activity

Fill in the blanks using the following words (some may be used more than once, or not at all):

Word Bank:
active site, tertiary structure, substrate, specificity, induced-fit, enzyme-substrate complex, enzyme-product complex, activation energy, temperature, pH, concentration, intracellular, extracellular, metabolism, catalyse, product, lock and key

1. Enzymes are biological catalysts that _____ metabolic reactions at both the cellular and whole organism level.
2. Enzymes function in two types of reactions: _____ reactions that occur inside cells, and _____ reactions that occur outside cells.
3. The region of the enzyme where the substrate binds is known as the _____.
4. The shape of this region is determined by the enzyme's _____, which is maintained by interactions such as hydrogen bonds and disulphide bridges.
5. Enzymes are highly specific; this is known as _____. Each enzyme typically acts on one type of _____.
6. In the _____ hypothesis, the substrate fits perfectly into the active site
7. The _____ hypothesis suggests the enzyme changes shape slightly to fit more closely around the substrate.

8. When the substrate binds to the active site, it forms an _____.
9. This intermediate then changes into the _____ as the reaction proceeds.
10. Enzymes increase the rate of reactions by lowering the _____ required to start the reaction.
11. Enzyme activity is affected by several factors including _____, _____, enzyme _____ and substrate _____.
12. If the temperature is too high, the enzyme's _____ structure may become disrupted, leading to a change in the shape of the _____, this is denaturation.
13. Changes in _____ can also affect the charges on amino acid residues in the active site, impacting substrate binding.

Exam Question – Apply your knowledge

Respiration is an important metabolic process that takes place in all living cells.

The black widow spider, Latrodectus hesperus, paralyses and kills its prey with venom. The venom contains a toxin known as latrotoxin. If a human is bitten, this toxin can cause serious harm by damaging heart tissue. Latrotoxin causes influx of Ca2+ ions, which disrupts normal cell function, including respiration.

An investigation was carried out into the effect of latrotoxin on aerobic respiration in humans. The rate of activity of malate dehydrogenase, a mitochondrial enzyme involved in aerobic respiration, was analysed at different substrate concentrations. The substrate concentrations used were within the normal range for a living cell.

The data is shown in Table 19.1.

Concentration of malate (mmol dm^{-3})	Rate of reaction of malate dehydrogenase (mmol dm^{-3} s^{-1})
0.0	0.0
1.0	37.7
2.0	55.2
3.0	66.0
4.0	74.8
6.0	83.1
8.0	88.9
10.0	92.3
14.0	96.9
18.0	99.0

Use the space provided to plot a suitable graph of these data.

Calculate the mean increase in malate dehydrogenase activity for every 1 mmol dm^{-3} increase in malate concentration between 1.0 and 10.0 mmol dm^{-3}. Give your answer to two significant figures. Show your working.

Answer = ... [3]

Task 6: University Courses & Careers

1. Research one or more university courses that you are considering doing after you complete yourA Levels at St Dominic's. If you are unsure, use this as an opportunity to begin looking into different courses.
   If you do not want to study at university, research the courses or apprenticeships you would like to do in order to support the career you want to pursue.

   You could use the UCAS website to look up courses (or look on each university website, or employers websites):
   https://www.ucas.com/
   https://www.ucas.com/explore/search/apprenticeships?query=

2. For each course list

a) the title of the course

b) the universities you could apply to in order to study this course

c) the entry requirements for this course at each university

d) if you will have to do any post graduate or further training to support your career when you complete your course

e) what work experience would support your application to study this course

3.Write a short paragraph on why you have chosen this course and career path. If you have chosen more than one possible path, write a paragraph for each one.

- Why does this course/apprenticeship interest you?
- What will the career entail and why do you want to pursue it?
- What skills will you have that will help you on this course?
- What skills would you like to develop further to help you on this course and how will you do this?